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FORM OF ENTRY

All entries in *Physics Abstracts* follow the same basic pattern. The following example identifies the individual parts of a typical entry for an article from a journal.

Entry No. in PA ↓ **Title of paper** ↓

87093 PAC study of molecular rotational motions in dilute solutions.

Authors → A.Baudry, P.Boyer, J.D.Fabris, P.Vulliet (Lab. d'Interactions Hyperfines, CENG, Grenoble, France). ← **Author's affiliation**

Source of paper → *Hyperfine Interactions (Netherlands)*, vol.10, no.1-4, p.1057-62 (June 1981). (Proceedings of the Fifth International Conference on Hyperfine Interactions, Berlin, Germany, 21-25 July 1980).

The rotational tumbling of neutral chelates of hafnium dissolved in several organic solvents was studied via ^{181}Ta DPAC experiments. The results are compared with the predictions of a hydrodynamic model with partial slip boundary conditions. The influence of solute-solvent interactions and/or associations on the quadrupole relaxation is discussed. (16 refs.) } **Abstract**

Entries for other types of material differ mainly in the reference to the source, e.g., a report will refer to the report series and the number of the individual report. A conference paper on the other hand will normally refer to the title, place and date of the conference at which the paper was given.

SUBJECT ARRANGEMENT & SUBJECT GUIDE

The abstracts are arranged by subject in accordance with the scheme in the CLASSIFICATION and CONTENTS which appears opposite. The page number for the start of each subject section is given. An alphabetical index to the scheme—the SUBJECT GUIDE—follows the CLASSIFICATION and CONTENTS.

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Detailed twice-yearly subject indexes to the individual entries are provided separately, covering the periods January-June and July-December. In these SUBJECT INDEXES each major concept occurring in each paper abstracted is indexed under headings drawn from the INSPEC Thesaurus.

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At the end of each issue, an alphabetical index of authors is provided showing the entry number of the items written by them. These indexes are cumulated every six months and, with the addition of the title of the individual papers, are published separately to cover the periods January-June and July-December of each year.

SUBSIDIARY INDEXES

Where appropriate, the following subsidiary indexes are included for the convenience of users:

Bibliography index of articles where a significant list of references or bibliography is contained.

Book index of books received and abstracted.

Corporate Author index where a corporate organisation rather than an individual is responsible for publication. This index includes all reports.

Conference index with reference to individual papers.

Subscription prices and ordering procedure are shown on the inside back cover.

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CLASSIFICATION AND CONTENTS

The abstracts are arranged by subject in accordance with the following scheme. The page number for each section is given. The CLASSIFICATION AND CONTENTS is followed by an alphabetical guide to the scheme, the SUBJECT GUIDE.

The classification scheme is the result of cooperation between INSPEC, the American Institute of Physics, the European Physical Society and the Physics Working Group of the ICSU-AB.

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Physics Abstracts

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00.00 GENERAL

01.00 COMMUNICATION, EDUCATION, HISTORY, AND PHILOSOPHY

01.30 PHYSICS LITERATURE AND PUBLICATIONS

01.30B Publications of lectures (advanced institutes, summer schools, etc.)

105007 Lecture to American College of Radiology [medical image processing]. C.C.Jaffe (Dept. of Diagnostic Radiology, Yale Univ. of School of Medicine, New Haven, CT, USA).
IEEE Trans. Med. Imaging (USA), vol.MI-1, no.4, p.226-9 (Dec. 1982). [received: Sept. 1983]
Image processing applied to medicine is more constrained than in other fields. Lacking means of verification, as is often the case, it is difficult to judge what constitutes a success or how the ideal image should look. Most successful processing efforts to date have been directed at correcting distortions introduced by shortcomings in the imaging equipment itself or methods for filling in missing data sets. Some important headway has been made in processing which is directed at providing a better match to human visual psychophysics particularly in matrix images. The greatest future opportunities appear to lie in image integration of several different imaging modalities of the same body part and utilization of a priori information as a factor in image formation. (no refs.)

105008 Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions.
Prog. Theor. Phys. Suppl. (Japan), no.74-75 (1983).
Conference held at: Kyoto, Japan. Date 12-16 July 1982. Sponsors: Yukawa Found.; Yamada Sci. Found. The Summer Institute is devoted to recent developments of microscopic theories for collective states of transitional nuclei and giant resonance states, covering the topics such as algebraic approach, boson-fermion expansion, mode-mode coupling theory, nuclear field theory, nuclear response theory, sum rule approach, TDHF and its extension. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

01.30C Conference proceedings

105009 4th Italian National Meeting on Applied Electromagnetics.
Alta Freq. (Italy), vol.52, no.3 (May-June 1983).
Conference held at: Florence, Italy. Date 4-6 Oct. 1982. The following topics were dealt with: scattering and inverse problems; antennas; MM waves; nonlinear EM problems; bioelectromagnetics; microwave circuits and components; optical fibres; integrated and micro-optics; propagation in natural media; remote sensing. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

105010 3rd Tri-Service Cathode Workshop.
Appl. Surf. Sci. (Netherlands), vol.16, no.1-2 (May-June 1983).
Conference held at: Fort Monmouth, NJ, USA. Date 23-26 March 1982. The following topics were dealt with: tungsten based dispenser cathodes; M-type cathode activation; impregnated cathodes; Ba thin films; $BaO-CaO-Al_2O_3$ dispenser cathode impregnants; Ba-O-W cathode characterization; diode characteristics and cathode emission capability; work function distribution; laser excited high emission cathodes; high current photocathodes; field emission cathode arrays; Spindt-type field emitting cathodes; and secondary emission properties. 20 papers are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

105011 Proceedings of the British Institute of Radiology, Radiobiology Work-in-Progress Meeting (papers in summary form only received).
Br. J. Radiol. (GB), vol.56, no.669 (Sept. 1983).
Conference held at: London, England. Date 18 Feb. 1983. Papers in summary form only received. The topics dealt with included: the radiation response of V79 and human tumour multicellular spheroids; the relation of clonogenic cell survival to functional impairment by irradiation of self-renewing normal tissues; some early effects of thoracic irradiation in mice; fractionated response of mouse kidneys to irradiation; nonstochastic effects of beta-irradiation of mouse skin; the interaction of neutrons and X-rays on mouse skin; life shortening in mice following inhalation of sized aerosols of $^{239}PuO_2$. 11 papers were presented.

105012 162nd Meeting of the American Astronomical Society (papers in summary form only received).
Bull. Am. Astron. Soc. (USA), vol.15, no.2 (1983).
Conference held at: St. Paul, MN, USA. Date 19-22 June 1983. The following topics were dealt with: supernovae, variable stars, planets, interstellar matter, Sun, instruments, stars, active galaxies, quasars, Solar System, dust, stellar atmospheres, white dwarf, galaxies, binary stars, massive stars, pulsars, X-ray sources and galactic structure.

105013 Annual Meeting of the Division on Solar Physics of the American Astronomical Society.
Bull. Am. Astron. Soc. (USA), vol.15, no.2 (1983).
Conference held at: Pasadena, CA, USA. Date 22-24 June 1983. The following topics were dealt with: flare observations and spectral line effects, rotation, activity cycle, heliosphere, heating, magnetic reconnection, magnetic fields, chromosphere, corona, waves, oscillations, loops, transients, beams, evaporation, NASA programs, Solar Optical Telescope, interior, convection, active regions, prominences, quiet radio Sun, instrumentation, and velocity fields.

105014 Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1 (15 July 1983).
Conference held at: Jerusalem, Israel. Date 6-8 June 1982. The following topics were dealt with: HgI_2 crystal growth and detector fabrication; HgI_2 detector characterisation and applications. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

105015 Proceedings of Symposium 2 of the COSPAR Twenty-Fourth Plenary Meeting.
Adv. Space Res. (GB), vol.3, no.4 (1983).
Conference held at: Ottawa, Canada. Date 16 May-2 June 1982. Sponsors: COSPAR; IAU. This symposium reviews the current observational status of gamma ray astronomy, emphasizing the objectives to be obtained by future instrumentation, and reviews the instruments currently being developed, as well as the future directions which new instrumentation might take. The four traditional domains of gamma ray astronomy gave rise to four sessions: (1) The first session was devoted to high energy gamma ray astronomy, with a review of the SAS 2 and COS B results on the diffuse galactic and extragalactic component, and on sources. It is clear that for the study of sources, future detectors must not only be more sensitive, but also have better resolution for localizing the emission. (2) The second session, on medium energy gamma ray astronomy, treated the observational results which, although scarce, are very interesting. One result of this session was the proposal to use coded aperture imaging to help identify the sources and associate them with objects known at other wavelengths. (3) The third session was on gamma ray spectroscopy. For studying the fine structure of energy spectra future instruments will still rely on the use of germanium detectors, whose performance and characteristics are improving continually. (4) The fourth session treated gamma ray bursts. 32 papers were presented which are published in full in the present proceedings.

105016 Biostereometrics '82.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361 (1983).
Conference held at: San Diego, CA, USA. Date 24-27 Aug. 1982. The following topics were dealt with: stereometric data acquisition; photogrammetry and moire interferometry techniques; stereometric analysis and display; stereometric radiography; biomechanics including human locomotion; and the eye and the brain. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

105017 10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3 (July-Sept. 1983).
Conference held at: Santa Fe, NM, USA. Date 25-27 Jan. 1983. The following topics were dealt with: Schottky barriers; heterojunctions; semiconductor surface studies and techniques; chemisorption and oxidation at semiconductor surfaces and interfaces. The main semiconductor materials studied are Si, Ge, GaAs, GaP, InP, GaAlAs and InGaAs. 72 papers were presented, of which 64 are published in full in the present proceedings, and 8 as abstracts only. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

105018 Application of Nuclear Techniques in Geothermal Investigations Consultants Meeting.
Geothermics (GB), vol.12, no.2-3 (1983).
Conference held at: Vienna, Austria. Date 3-6 Nov. 1981. The papers presented at this conference describe how radioactive and nuclear techniques may be employed to study geothermal systems. Some of the papers describe the nuclear techniques and others describe studies of geothermal areas performed using the nuclear techniques. 15 papers are presented.

105019 Applied Radionuclide Metrology.
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8 (1983).
Conference held at: Geel, Belgium. Date 16-17 May 1983. The topics dealt with included: needs for radioactivity standards and measurement; multi-gamma-ray calibration sources; the variation of Ge-detector efficiency with source diameter and radial source position; the development of radioactive gas standards at IMRI; standardisation of ^{137}Cs; standardisation of ^{18}F for use in positron emission tomography; half-life measurements at the PTB; standardisation and decay rate of ^{169}Yb; the measurement of the beta-ray spectra of ^{90}Sr-^{90}Y; assay of radionuclide sources by energetic ion beams; a versatile solid-state detector spectrometer. 33 papers were presented, all of which are published in full in the present proceedings.

105020 Yamada Conference VI on Neutron Scattering in Condensed Matter.
Physica B & C (Netherlands), vol.120B+C, no.1-3 (May 1983).
Conference held at: Hakone, Japan. Date 1-4 Sept. 1982. The following topics were dealt with: pulsed neutron sources; neutron spin echo and spin modulation techniques; optical devices; neutron spectrometers; magnetic structure and magnetic excitations; spin density distributions; solitons; phase transitions; and lattice dynamics; nonperiodic and nonequilibrium systems; polymers and biological systems. 95 papers were presented, of which 85 are published in full in the present proceedings, and 8 as abstracts only. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

105021 Institute of Statisticians International Conference on Practical Bayesian Statistics.
Statistician (GB), vol.32, no.1-2 (March-June 1983).
Conference held at: Cambridge, England. Date 21-24 July 1982. The following topics were dealt with: Bayesian statistics, theory, practice and applications to economics, medicine, education, insurance, law, industrial research, auditing, software engineering, road safety, inventory problems, advertising, system reliability, and hydrology. 39 papers were presented, of which 36 are

published in full in the present proceedings, and three as extended abstracts only. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

105022 11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s'.
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1 (1983).
Conference held at: Scottsdale, AZ, USA. Date 1-3 Aug. 1983. The following topics were dealt with: training, research and test reactors; radioactive materials management; plant startup experiences; computer applications; personnel training; emergency planning; reactor operations; human factors. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

105023 1982 Meeting of the European Geophysical Society Symposium on Palaeomagnetism of Orogenic Belts.
Tectonophysics (Netherlands), vol.98, no.1-2 (1983).
Conference held at: Leeds, England. Date 1982. The following topics were dealt with: the rotation of both small and large scale tectonic blocks, the effects of strain and deformation on magnetization directions, the relationships between magnetic anisotropy and strain and how apparent polar wander can indicate relative continental movements.

105024 Surface Imaging and Analysis with High Spatial Resolution.
Ultramicroscopy (Netherlands), vol.11, no.2-3 (1983).
Conference held at: Wickenburg Inn, AZ, USA. Date 12-15 Jan. 1983. The following topics were dealt with: Si surface phase transitions studied by reflection electron microscopy; analysis of surface structural defects using LEED and RHEED; surface studies with supported metal particles and clusters; high energy transmission electron diffraction and imaging of Si surface structure; TEM imaging of atomic steps on ultrathin Au films; STEM imaging and analysis of surfaces; surface reactions and excitations; UHV-SEM studies of surface processes; surface imaging by scanning tunnelling microscopy; unstained DNA on a metal substrate; reflection electron microscopy of vicinal surfaces of FCC metals; surface step height measurement by STEM low-loss imaging; surface excitations and EELS; electron- and photon-stimulated desorption; work function measurements; photoelectron emission microscopy; and glancing reflection EELS from bulk crystals. 17 papers were presented, all of which are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

105025 Otto-Schott-Colloquium on the State of Optical Glass Research 1982.
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.2-3 (1983).
Conference held at: Jena, Germany. Date 1982. The following topics were dealt with: influence of elementary structure defects on the optical properties of glasses; gradient index optical materials; recent advances in optical fibre materials; oxide and halide laser glasses; glass-forming in ternary telluride systems; reacting and optical properties of silicate glass surfaces; solid electrolyte batteries and fast ion conducting glasses; fundamental models of electronic transport in amorphous semiconductors; diffusion processes in glasses and glass melts; crystallisation behaviour of rapidly quenched iron oxide containing glasses with regard to thermal and magnetic properties; relaxation properties in inorganic glasses; NMR studies of structure and ion motion in glasses; structure and intrinsic disorder of glassforming compounds; structure of one phase glasses and melts; crack resistance a sensitive parameter for characterisation of the mechanical strength of glasses in the surface region; phase separation and crystallisation of zirconium and titanium containing lithium-aluminosilicate glasses; structure-property relations of optical glasses with abnormal partial dispersion; development of optical fluorophosphate glasses; bioactive implantates based on glass ceramic materials and machinable bioactive glass-ceramics. 29 papers were presented, all of which are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

105026 Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings.
Geneva, Switzerland: CERN (1983), xi+584 pp.
Conference held at: Rome, Italy. Date 12-14 Jan. 1983. Sponsors: Istituto Nazionale di Fisica Nucl.; Univ. Rome. The following topics were dealt with: CERN collider with minimum bias trigger; search for fractionally charged relativistic particles at CERN $\bar{p}p$ collider; UA5 results; multiplicity correlations in $\bar{p}p$; hadron jets and large transverse momentum electrons at SPS; elastic and total cross sections; small angle pp and $\bar{p}p$ elastic scattering; fermilab $p\bar{p}$ collider; QCD in $p\bar{p}$ collider physics; hadron versus e^+e^- colliders; intermediate vector boson parameters; very heavy flavours; transverse energy production; QCD radiation; weak interactions in the fermi scale region; limitations in usable collider luminosity. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

105027 Planetary Nebulae. International Astronomical Union Symposium No.103.
Dordrecht, Netherlands: Reidel (1983), xxi+557 pp. [90 277 1558 0]
Conference held at: London, England. Date 9-13 Aug. 1982. Discusses planetary nebulae observations, kinematics, morphology, bipolar nebulae, NGC 2346, radio observations, IR emission lines, molecules, dust, UV, atomic parameters, ionisation equilibrium, plasma, recombination, radiative transfer, spectra, abundances, S, red giants, evolution, long period variable stars, mass loss, winds, symbiotic star, model atmosphere, Magellanic Clouds, HR diagram, distances, metallicity and mass.

105028 Heavy-Ion Collisions. Proceedings of the International Summer School.
Berlin, Germany: Springer-Verlag (1982), vi+429 pp. [3 540 11945 0]
Conference held at: La Rabida, Spain. Date 7-18 June 1982. The following topics were dealt with: heavy ion collisions; effective interactions; potential model descriptions; folding models; elastic scattering; inelastic scattering; polarisation; transfer reactions; charge and matter distributions; selfconsistent models; dissipative collisions; deep inelastic peripheral collisions; fission; preequilibrium processes; nuclear far from stability; proton decay; high spin states; nuclear shape; moment of inertia; fusion; compound nuclei; nuclear molecular states; quasimolecules; quasiatoms. 24 papers were presented, of which 23 are published in full in the present proceedings, and 1 as abstract only. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

105029 Internal Kinematics and Dynamics of Galaxies. International Astronomical Union Symposium No.100.
Dordrecht, Netherlands: Reidel (1983), xvi+432 pp. [90 277 1547 5]
Conference held at: Besancon, France. Date 9-13 Aug. 1982. Discusses H II rotation curves, H I velocity fields, TAURUS, spectrometer, galaxy, molecular clouds, CO, Milky Way, galactic nuclei, mass model, warp, disc thickness, dark haloes, missing mass, spiral structure, instabilities, disc heating, star formation, cloud-particle dynamics, ballistic particle model, bubbles, angular momentum, shocks, corotation, Virgo cluster, magnetic fields, density waves, periodic orbits, stellar kinematics, dynamics, stochasticity, gas flow, bar forcing, hydrodynamics, rings, lenses, bulges, interstellar matter, gaseous emission, radiogalaxies, mergers, velocity field, shells, collisions, tidal encounters, globular clusters, Hubble type and superclusters.

105030 Highlights of Astronomy as Presented at the XVIII General Assembly of the IAU. Vol.6.
Dordrecht, Netherlands: Reidel (1983), viii+817 pp. [90 277 1565 3]
Conference held at: Patras, Greece. Date 17-26 Aug. 1982. Discusses ancient Greek astronomy, Sun and planetary system origin and early history, stellar evolution, cosmology, solar flares, solar luminosity variations, stellar populations, globular cluster abundances, ages, halo field star composition, spiral galaxies nuclei, elliptical galaxies, star formation, Hubble type, distance scale, Magellanic Clouds, Cepheids, Virgo Cluster, Universe, Tully-Fisher relation, Hubble constant, comets, ices, grains, Oort cloud, asteroids, meteorite, meteors, zodiacal light, dust, Saturn, active galactic nuclei, X-ray source, mass loss, stellar wind, interstellar matter, novae, supernovae, quasars, H II regions, X-ray binaries, close binaries, background radiation, molecular clouds, beams, jets, supercluster, stellar spectra and plasma.

105031 Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute.
New York, USA: Plenum (1983), xi+538 pp. [0 306 41105 9]
Conference held at: Baddeck, NS, Canada. Date 13-26 Sept. 1981. The following topics in collision processes were dealt with: electron-impact excitation of ions; electron-impact ionisation of ions; electron-ion recombination; ion-ion charge exchange; ion confinement; ion-ion recombination; dissociative recombination. The relevance of the work to laboratory plasmas, astrophysics and thermonuclear fusion is also discussed. 12 papers were presented, all of which are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

105032 Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191).
Paris, France: ESA (1983), viii+440 pp.
Conference held at: Madrid, Spain. Date 5-8 April 1983. Sponsors: ESA; UPM; ELGRA; COSPAR. The following topics were dealt with: fluid physics under reduced gravity; composites and heterogeneous phases; experimental facilities and programmes; transport phenomena; combustion; gas/liquid interfaces; liquid/solid interfaces and critical-point phenomena. 66 papers were presented, of which 54 are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or future issues.

105033 Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium.
Paris, France: ESA (1983), xiv+493 pp.
Conference held at: Louvain-la-Neuve, Belgium. Date 9-15 June 1983. Sponsors: ESA; CEC. The following topics were dealt with: clear air refractivity and turbulence, rain and dust characteristics, attenuation and crosspolarisation of microwaves, radar and radiometer measurements, surface and volume scattering, multipath effects, applications to remote sensing and inversion methods. 64 papers were presented, all of which are published in full in the present proceedings.

105034 Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School.
Amsterdam, Netherlands: North-Holland (1983), xxv+510 pp. [0 444 86560 8]
Conference held at: France. Date 2-21 June 1982. Discusses gravitational radiation theory, the motion of compact bodies, positivity of total gravitational energy at retarded times, initial value problems and dynamics, numerical relativity, sources, extragalactic origins, interferometric detectors, resonant bar detectors, Weber-type gravitational antennae, asymptotically flat empty spaces, motion equations, gauge conditions, rotating stars general relativistic collapse, low temperature wave detector, optical detectors, EM tracked free mass antennas and linear models for detector analysis.

105035 Proceedings 1983 International Symposium on Urban Hydrology, Hydraulics and Sediment Control.
Lexington, KY, USA: OES Publications (1983), 531 pp. [0 89779 056 1]
Conference held at: Lexington, KY, USA. Date 25-28 July 1983. Sponsors: Univ. Kentucky; Coll. Engng; et al. The following topics were dealt with: hydrology; stormwater management—planning and analysis; stormwater quality; water distribution systems; hydraulics of sewers; flood plain considerations; erosion and sediment transport; detention facilities; and economic, legal and institutional aspects. 58 papers were presented, all of which are published in full in the present proceedings.

105036 Third Joint Conference on Applications of Air Pollution Meteorology.
Boston, MA, USA: American Meteorological Soc. (1983), 311 pp.
Conference held at: San Antonio, TX, USA. Date 12-15 Jan. 1982. Sponsors: American Meteorological Soc.; Air Pollution Control Assoc. The following topics were dealt with: ozone and long-range transport; long-range transport and photochemistry; acid rain and visibility; source and input data; regulatory aspects; new model development; accident and emergency applications; remote sensing and instrumentation; complex terrain; power plants; major studies; RAPS and physical modelling; model comparisons; and model evaluation. All papers were presented as abstracts only.

105037 Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V.
Amsterdam, Netherlands: North-Holland (1982), xx+991 pp. [0 444 86529 2]
Conference held at: Kyoto, Japan. Date 16-20 Nov. 1981. The following topics were dealt with: advances in techniques; electronic theory of atomic defects; self-interstitials; interstitials and vacancies solutes in metals, point defect solute interactions diffusion; high-concentration alloys; defect clusters; interaction with dislocation and grain bonding; radiation damage. Abstracts of individual papers can be found under relevant classification codes in this or future issues.

Proceedings of Symposium 5 of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 105087

Proceedings of Workshops III and IV and of the Topical Meeting of the COSPAR Interdisciplinary Scientific Commission F (Meeting F2) of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 110195

Proceedings of Workshop VII and of the Topical Meeting of the COSPAR Interdisciplinary Scientific Commission F (Meetings F1 and F4) of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 110196

01.30E Monographs, and collections

105038 Basaltic volcanism on the terrestrial planets. W.M.Kaula, J.W.Head,III, R.B.Merrill, R.O.Pepin, S.C.Solomon, D.Walker, C.A.Wood [Ed.]
New York, USA: Pergamon (1981), 1286 pp.
Discusses terrestrial planets basaltic volcanism, petrology, chemistry, meteorites, lunar rock, tectonics, isotope analysis, radiometric chronology, cratering, thermal histories, planetary bodies evolution.

105039 Constrained dynamics with applications to Yang-Mills theory, general relativity, classical spin, dual string model. K.Sundermeyer.
Berlin, Germany: Springer-Verlag (1982), iv+318 pp. [3 540 11947 7]
The author considers constrained dynamic systems with applications to Yang-Mills theory, general relativity, classical spin, and the dual string model.

01.30K Handbooks, dictionaries, tables and data compilation

105040 Tables of Auger transition amplitudes. I.Chorkendorff (Fysisk Inst., Odense Univ., Odense, Denmark).
J. Electron Spectrosc. & Relat. Phenom. (Netherlands), vol.32, no.1, p.1-57 (Aug. 1983).
A short review of the theory of the Auger transition in a mixed coupling scheme is given, and an expression for the transition probability in terms of transition amplitudes has been derived. The amplitudes for all Auger transitions in systems with initially filled shells have been calculated and are tabulated in terms of D and E radial integrals. (27 refs.)

105041 The solubility of oxygen and ozone in liquids. R.Battino, T.R.Rettich, T.Tominaga (Dept. of Chem., Wright State Univ., Dayton, OH, USA).
J. Phys. & Chem. Ref. Data (USA), vol.12, no.2, p.163-78 (1983).
Reviews the solubility of oxygen and ozone in liquids as a function of temperature and pressure. Solubility data for individual systems were critically evaluated and recommended or tentative values presented in many cases. The trend of solubilities in homologous series or related solvents is discussed. Liquids include water; seawater; aqueous salt solutions; mixed solvents; hydrocarbons; organic compounds containing oxygen, halogen, sulfur, nitrogen, or silicon; olive oil; and human blood. For ozone, only its solubility in water is presented. (106 refs.)

105042 Recommended values for the thermal expansivity of silicon from 0 to 1000K. C.A.Swenson (Dept. of Phys., Iowa State Univ., Ames, IA, USA).
J. Phys. & Chem. Ref. Data (USA), vol.12, no.2, p.179-82 (1983).
Silicon, a high melting point, low expansivity, cubic material which can be obtained readily in high purity form, provides an excellent thermal expansion standard. Various absolute determinations of the thermal expansivity of both single crystal and polycrystalline silicon are used to establish a smooth relationship from 90 to 850K which is believed to be reliable to roughly $10^{-8}K^{-1}$, and which is extrapolated to 1000K. Values also are suggested for temperatures to absolute zero. (18 refs.)

105043 Electrical resistivity of ten selected binary alloy systems. C.Y.Ho, M.W.Ackerman, K.Y.Wu, T.N.Havill, R.H.Bogaard, R.A.Matula, S.G.Oh, H.M.James (Center for Information & Numerical Data Analysis & Synthesis, Purdue Univ., West Lafayette, IN, USA).
J. Phys. & Chem. Ref. Data (USA), vol.12, no.2, p.183-322 (1983).
Compiles, reviews, and discusses the available data and information on the electrical resistivity of ten selected binary alloy systems and presents the recommended values resulting from critical evaluation, correlation, analysis, and synthesis of the available data and information. The ten binary alloy systems selected are the systems of aluminum-copper, aluminum-magnesium, copper-gold, copper-nickel, copper-palladium, copper-zinc, gold-palladium, gold-silver, iron-nickel, and silver-palladium. The recommended values of each of the ten binary alloy systems except three (aluminum-copper, aluminum-magnesium, and copper-zinc) are given for 27 compositions: 0 (pure element), 0.5, 1.3, 5, 10(5)95, 97, 99, 99.5, and 100% (pure element). For aluminum-copper, aluminum-magnesium, and copper-zinc alloy systems, the recommended values are given for 26, 12, and 11 compositions, respectively. For most of the alloy systems the recommended values cover the temperature range from 1K to the solidus temperature of the alloys or to about 1200K. For most of the nine elements constituting the alloy systems, the recommended values cover the temperature range from 1K to above the melting point into the molten state. The estimated uncertainties in most of the recommended values are about $\pm 3\%$ to $\pm 5\%$. (408 refs.)

105044 Energy levels of silicon, Si I through Si XIV. W.C.Martin, R.Zalubas (Center for Radiation Res., Nat. Measurement Lab., NBS, Washington, DC, USA).
J. Phys. & Chem. Ref. Data (USA), vol.12, no.2, p.323-80 (1983).
Energy level data are given for the atom and all positive ions of silicon ($Z=14$). These data have been critically compiled, mainly from published material on measurements and analyses of the optical spectra. The authors have derived or recalculated the levels for a number of the ions. In addition to the level value in cm^{-1} and the parity, the J value and the configuration and term assignments are listed if known. Leading percentages from the calculated eigenvectors are tabulated or quoted wherever available. Ionization energies are given for all spectra. (6 refs.)

105045 Evaluation of binary PTxy vapor-liquid equilibrium data for C_6 hydrocarbons. Benzene+hexane. B.D.Smith, O.Muthu, A.Dewan (Thermodynamics Res. Lab., Washington Univ., St. Louis, MO, USA).
J. Phys. & Chem. Ref. Data (USA), vol.12, no.2, p.381-7 (1983).
The binary *PTxy* vapor-liquid equilibrium data for the benzene+hexane system are evaluated. The needs for new experimental data are defined. (5 refs.)

105046 Evaluation of binary excess enthalpy data for C_6 hydrocarbons. Benzene+hexane. B.D.Smith, O.Muthu, A.Dewan (Thermodynamics Res. Lab., Washington Univ., St. Louis, MO, USA).
J. Phys. & Chem. Ref. Data (USA), vol.12, no.2, p.389-93 (1983).
The excess enthalpy data for the benzene+hexane system are evaluated. The needs for new experimental data are defined. (3 refs.)

105047 Evaluation of binary excess volume data for C_6 hydrocarbons. Benzene+hexane. B.D.Smith, O.Muthu, A.Dewan (Thermodynamics Res. Lab., Washington Univ., St. Louis, MO, USA).
J. Phys. & Chem. Ref. Data (USA), vol.12, no.2, p.395-401 (1983).
The excess volume data for the benzene+hexane system are evaluated. The needs for new experimental data are defined. (4 refs.)

105048 PHAB—an alloy phase diagram bibliographic database: a part of the ASM/NBS data program for alloy phase diagrams. J.R.Cuthill, H.Baker (American Soc. for Metals, Metals Park, OH, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.429-32
PHAB is intended to be a complete bibliographic file of the phase diagram data papers pertaining to the experimental determination, evaluation and calculation of phase diagrams of binary, ternary and higher-order alloy systems. Metastable as well as stable equilibrium data, crystal structure, thermodynamic and high pressure data are included. The database will provide a service to the scientific community as well as serving the ASM/NBS data program for alloy phase diagrams. The PHAB database will serve as a source of data to the other activities and outputs of the program, including alloy system evaluations, the bulletin of alloy phase diagrams and bound volumes of evaluated phase diagrams, as well as other databases. (3 refs.)

01.30M Textbooks for graduates and researchers

105049 Vibrational spectra and structure. A series of advances. Vol.12. J.R.Durig [Ed.]
Amsterdam, Netherlands: Elsevier (1983), xvi+497 pp. [0 444 42197 1]
The author presents papers on: infrared studies of site structure and dynamics of matrix isolated molecules; force fields for large molecules; molecular electronic excited state structure by resonance Raman spectroscopy; vibrational spectra and conformational analysis of three membered ring compounds; vibrational spectra of small matrix isolated molecules; Raman difference spectroscopy.

105050 Atmosphere-ocean dynamics. A.E.Gill.
New York, USA: Academic Press (1982), 662 pp.
The following topics are dealt with: the input of energy from the Sun and the subsequent redistribution of heat by the atmosphere and ocean, the interchanges of properties (mass, heat, and momentum) between atmosphere and ocean, the thermodynamics and motion equations of ocean and atmosphere, gravity waves in non-rotating systems and gravity wave adjustment to geostrophic steady flows in rotating systems, tropical motions, mid-latitude meteorology and oceanography, barotropic and baroclinic instability processes, fronts in the atmosphere and ocean, and the atmospheric general circulation. Appendices list units, constants, properties of moist air and sea water, and atlases and other data sources. (>1500 refs.).

105051 Elastic media with microstructure I. One-dimensional models. I.A.Kunin.
Berlin, Germany: Springer-Verlag (1982), viii+291 pp. [0 387 11145 x]
Crystals and polycrystals, composites and polymers, grids and multibar systems can be considered as examples of media with microstructure. A characteristic feature of all such models is the existence of scale parameters which are connected with microgeometry or long-range interacting forces. As a result the corresponding theory must essentially be a nonlocal one. The book is devoted to a systematic investigation of effects of microstructure, inner degrees of freedom and nonlocality in elastic media. The propagation of linear and nonlinear waves in dispersive media, static problems, and the theory of defects are considered in detail. Much attention is paid to approximate models and limiting transitions to classical elasticity.

01.30P Textbooks for undergraduates

105052 Fundamentals of molecular spectroscopy. Third edition. C.N.Banwell.
Maidenhead, Berks., England: McGraw-Hill (1983), xii+338 pp. [0 07 084139 X]
The author discusses the basic theory of spectroscopy and the elements of practical spectroscopy, including Fourier transform spectroscopy, signal to noise ratios and resolving power, spectrum enhancement and computer averaging, stimulated emission and lasing. He describes microwave, infrared and Raman spectroscopy, electronic spectroscopy of atoms and molecules, electron and nuclear spin resonance spectroscopy and Mossbauer spectroscopy. (12 refs.)

105053 Thunderstorms: A social scientific and technological documentary. Vol. 2. Thunderstorm morphology and dynamics. E.Kessler [Ed.]
Washington, DC, USA: U.S. Government Printing Office (1982), 603 pp.
Discusses thunderstorm morphology and dynamics, cumulus convection, climatology, weather modification, energetics, gust fronts, tornadoes, hail, electrical phenomena, mesoscale processes and sea thunderstorms.

105054 Geoelectromagnetic investigation of the Earth's crust and mantle. I.I.Rokityansky.
Berlin, Germany: Springer-Verlag (1982), xiii+381 pp. [3 540 10630 8]
Discusses geoelectromagnetic fields, elements of the theory of electromagnetic fields, the inverse problem, global and regional geomagnetic deep sounding, magnetotelluric sounding, magnetic variation profiling (MVP), electrical conductivity anomalies, geomagnetic observatories of world-wide network.

01.30R Surveys and tutorial papers; resource letters

105055 Hydromagnetic waves in the magnetosphere. W.J.Hughes (Dept. of Astron., Boston Univ., Boston, MA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.508-20 (March 1983).
The review is divided into three main sections, dealing in turn with waves at or around the ion gyrofrequency, waves with frequencies much below the ion gyrofrequency and waves associated with magnetospheric substorms. The author concludes with two smaller sections, one describing attempts to artificially generate hydromagnetic waves (or the inadvertent generation or stimulation by man) and the other on the recent application of data analysis techniques which may well have a large impact on the field. The review covers a wide subject in which over 300 papers have been published during the 1979-82 period. (338 refs.)

Lecture to American College of Radiology [medical image processing] .... See Entry 105007
Tables of Auger transition amplitudes .... See Entry 105040
The solubility of oxygen and ozone in liquids .... See Entry 105041
Electrical resistivity of ten selected binary alloy systems .... See Entry 105043
Coupled fields and nonclassical continuous media .... See Entry 105110
Thermoelasticity problems .... See Entry 105112
Electromagnetic stirred mode cavities (SMCs) .... See Entry 105340
Non-biological aspects of phosphorus-31 NMR spectroscopy .... See Entry 105354
Zeeman atomic absorption spectroscopy .... See Entry 105384

A review of the application of UV-absorbers in colour recording materials ... See Entry 105401

Baryon spectroscopy ... See Entry 105595

The residual interaction of bound nucleons—two-nucleon matrix elements deduced from transfer experiments ... See Entry 105755

Current viewpoints concerning the algebraic approach to nuclear collective motion ... See Entry 105767

The generalized density matrix method in the theory of nuclear collective motion ... See Entry 105768

Microscopic aspects of the interacting boson model ... See Entry 105770

A microscopic theory of collective and independent-particle motions; time-dependent Hartree-Fock method and its extension ... See Entry 105775

Widths of giant resonances ... See Entry 105813

Recent developments in the description of electric giant resonances ... See Entry 105816

Fragmentation processes in nucleus-nucleus collisions ... See Entry 105924

Neutron-proton asymmetry and fast fission: two extreme time evolutions in dissipative heavy ion reactions ... See Entry 105930

BENCHMARK. Reference data on post irradiation analysis of light water reactor fuel samples ... See Entry 105980

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Thermal shock in nuclear reactors ... See Entry 106115

Progress in energy resolution of mercuric iodide (HgI_2) X-ray spectrometers ... See Entry 106201

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Influence of temperature upon dislocation mobility and elastic limit of single crystal HgI_2 ... See Entry 106226

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Atomic and molecular physics near ionization thresholds in high fields ... See Entry 106621

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Plastics for high-power laser applications: a review ... See Entry 106792

New light on fiber fabrication and materials ... See Entry 106905

Recent developments of experimental fracture mechanics in Greece ... See Entry 107056

The behaviour of fatigue cracks subject to applied biaxial stress: a review of experimental evidence ... See Entry 107058

Mean flow in round bubble plumes ... See Entry 107217

Estimation of liquid film mass transfer coefficients for randomly packed absorption columns ... See Entry 107237

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Transient annealing of ion implanted gallium arsenide ... See Entry 107757

Vibrational spectra of hydrogen in silicon and germanium ... See Entry 107853

Diffusion-induced changes in the defect structure of solids (review) ... See Entry 108012

Disorder phenomena in β-alumina ... See Entry 108034

Hydrodynamics and heat transfer in superfluid helium ... See Entry 108091

Energetics of solid/liquid interfaces of metals and alloys ... See Entry 108114

Achievements and perspectives in positron physics ... See Entry 109041

Application of synchrotron radiation to EXAFS and SEXAFS ... See Entry 109049

Atomic beam scattering from single crystal surfaces ... See Entry 109089

Recent developments in the field of bremsstrahlung isochromatic spectroscopy ... See Entry 109095

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Phase equilibria in iron ternary alloys. X. Critical evaluation of constitution of cobalt-iron-vanadium system ... See Entry 109218

Toughening of structural ceramics ... See Entry 109319

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The solution composition and electrode potential in pits, crevices and cracks ... See Entry 109559

High strain fatigue testing at elevated temperature ... See Entry 109607

Recent developments in quantitative fractography ... See Entry 109633

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The free-electron laser: medicine's rising star ... See Entry 110116

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Imaging system using gradient index fibers: a tutorial. [Medical imaging] ... See Entry 110144

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Interpretation methods for magnetometer arrays ... See Entry 110297

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Flood frequency analysis: a review of 1979-1982 ... See Entry 110499

Surface water hydrology: on-line estimation ... See Entry 110500

Surface water hydrology—runoff generation and basin structure ... See Entry 110501

Urban hydrology ... See Entry 110502

Progress in hydrodynamic modeling. Review of US contributions, 1979-1982 ... See Entry 110503

Unsaturated soil water flow ... See Entry 110504

Ground water: a review ... See Entry 110505

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Planetary lightning: Earth, Jupiter, and Venus ... See Entry 110595

Organic films on atmospheric aerosol particles, fog droplets, cloud droplets, raindrops, and snowflakes ... See Entry 110596

Organic material in the global troposphere ... See Entry 110597

The geologic record of climatic change ... See Entry 110646

The International Satellite Cloud Climatology Project (ISCCP): The first project of the World Climate Research Programme ... See Entry 110660

Dynamics of the Earth's thermosphere ... See Entry 110746

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Middle atmosphere dynamics ... See Entry 110750

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The method of multiply reflected waves in the problem of the propagation of electromagnetic waves in regular waveguides ... See Entry 110789

Ionospheric electrodynamics and irregularities: a review of contributions by US scientists from 1979 to 1982 ... See Entry 110790

Polar and auroral phenomena: a review of US progress during 1979-1982 ... See Entry 110791

New tools for magnetospheric research ... See Entry 110792

Near-equatorial magnetospheric particles from $\sim$1 eV to $\sim$1 MeV ... See Entry 110809

Plasma boundaries and shocks ... See Entry 110810

Energy transfer in the quiet and disturbed magnetosphere ... See Entry 110811

Modeling planetary magnetospheres ... See Entry 110812

Overview of cosmic ray studies and associated topics (1979-1982) ... See Entry 110814

The elemental and isotopic composition of galactic cosmic ray nuclei ... See Entry 110820

The association of energetic particles and shocks in the heliosphere ... See Entry 110822

The composition, propagation and acceleration of energetic solar particles: a review of United States research 1979-1982 ... See Entry 110825

Cosmic-ray modulation and the anomalous component ... See Entry 110826

Solar cycle and long term changes in the solar wind ... See Entry 110840

Heliospheric magnetic fields and plasmas ... See Entry 110841

Progress toward the origin of the solar system ... See Entry 110941

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Planetary science: 1979-1982 ... See Entry 110944

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Planetary ring systems ... See Entry 110947

Planetary radar astronomy ... See Entry 110948

Solar-planetary relationships: magnetospheric physics ... See Entry 110949

Plasma waves in planetary magnetospheres ... See Entry 110950

Aeronomy of the inner planets ... See Entry 110954

Asteroids and comets ... See Entry 110958

The Jovian magnetosphere ... See Entry 110966

The magnetosphere of Saturn ... See Entry 110983

Solar activity ... See Entry 111019

A general solution of the Einstein equations with a time singularity ... See Entry 111277

01.30T Bibliographies

105056 Fuel cycles: A bibliography of AECL publications.
Report AECL-6425 Rev.1, Atomic Energy Canada Ltd., Chalk River, Ont. (May 1983), 32 pp.
AECL publications, from the open literature, on fuels and fuel cycles used in CANDU reactors are listed in this bibliography. The accompanying index is by subject.

01.40 EDUCATION

105057 Biomedical engineering training in Dundee. S.Hughes (School of Biomedical Engng., Univ. of Dundee, Dundee, Scotland).
Eng. Med. (GB), vol.12, no.3, p.145-7 (July 1983).
A brief outline of the activities and supporting departments involved in biomedical engineering is presented together with a description of existing and potential training facilities. (no refs.)

105058 Education in bioengineering: experience at the University of Leeds. V.Wright, D.Dowson (Univ. of Leeds, Leeds, England).
Eng. Med. (GB), vol.12, no.3, p.151-3 (July 1983).
At the University of Leeds, bioengineering has developed mainly as a postgraduate discipline, but undergraduate students are given a taste of the subject both in formal teaching and in final year projects. The multi-disciplinary field of biomedical engineering has a substantial appeal to graduates in engineering and science. The University of Leeds has responded to the position through the provision of undergraduate courses in bioengineering in both the mechanical engineering and mechanical schemes of study, short courses of both introductory and specialist nature, laboratory facilities and opportunities for postgraduate research in several aspects of the subject, the formation of an informal Bioengineering Group for the Study of Human Joints in 1966,

and the creation of a University Centre for Studies in Medical Engineering in 1971. (18 refs.)

105059 Medical biophysics in Manchester. B.R.Pullan, J.A.Chapman, A.R.Williams, C.J.Taylor, D.W.L.Hukins, H.Sharma (Dept. of Medical Biophys., Univ. of Manchester, Manchester, England).
Eng. Med. (GB), vol.12, no.3, p.155-6 (July 1983).
The Department of Medical Biophysics in the University of Manchester provides research training in the application of physical and engineering sciences to biomedical problems. A wide range of projects is available for students who wish to work for MSc and PhD degrees. (11 refs.)

105060 The masters degree in bioengineering at the University of Strathclyde. J.P.Paul (Bioengng. Unit, Univ. of Strathclyde, Glasgow, Scotland).
Eng. Med. (GB), vol.12, no.3, p.157-61 (July 1983).
Discusses a number of matters relating to University courses in Bioengineering at MSc level. The experience at the University of Strathclyde over the past twenty years is reviewed with regard to entrants and their qualifications, material presented and employment prospects. (no refs.)

105061 The Microelectronics Education Programme (MEP) the half-term report (1981-82). J.S.A.Anderson.
Wescon/82 Conference Record, Anaheim, CA, USA, 14-16 Sept. 1982 (El Segundo, CA, USA: Electron. Conventions 1982), p.13-1/1-8
The report covers the 'half-term' of the UK national government initiative to stimulate microelectronics education in British schools in England, Wales and Northern Ireland. Originally announced on 4 March 1980 by the Minister of State at the national government's Department of Education and Science (DES), it was intended to run for four years at £9 million sterling. The overall aim of the Programme is to help schools to prepare children for life in a society in which devices and systems based on microelectronics are commonplace and pervasive. In May 1982 the Programme had established a plateau of achievement and provided a sound foundation for further innovation and dissemination. The Programme is under active consideration for immediate extension to 1985 and beyond. (4 refs.)

105062 The BBC Computer Literacy Project. R.Salkeld (BBC, Leeds, England).
Wescon/82 Conference Record, Anaheim, CA, USA, 14-16 Sept. 1982 (El Segundo, CA, USA: Electron. Conventions 1982), p.13-3/1-4
The author discusses the BBC Computer Literacy Project. This was launched on 11th January 1982 with the first public screening of 'The Computer Programme'—a ten part television series produced by the BBC's Continuing Education Television Department and designed to provide a beginner's guide to computers and computing. These ten programmes form the central core of the project providing an easily available introduction from which anyone, regardless of their previous knowledge, can begin to gain some insight into computers and their applications. But the project is multi-layered, offering the interested viewer opportunities to become very much more involved with computers and computing than simply watching a few hours of television. A key note of the whole project is what has come to be known as 'hands-on experience', the opportunity to learn about computers by actually operating one yourself. (no refs.)

An interdisciplinary science-humanities course ....See Entry 105085

01.50 EDUCATIONAL AIDS

105063 In vino veritas: a study of wineglass acoustics. A.P.French (Phys. Dept., MIT, Cambridge, MA, USA).
Am. J. Phys. (USA), vol.51, no.8, p.688-94 (Aug. 1983).
Describes an investigation of the natural resonant frequencies of vessels such as wineglasses. Measurements on a number of glasses are interpreted with the help of theoretical predictions based on the analysis of vibrating systems by means of the energy method. Results and analysis are given for empty glasses and for glasses containing different amounts of liquid. Evidence for vibrational modes above the lowest is presented. (6 refs.)

105064 An electrostatic example to illustrate dimensional regularization and renormalization group technique. M.Hans (Phys. Theorique et Math., Univ. de Liege, Liege, Belgium).
Am. J. Phys. (USA), vol.51, no.8, p.694-8 (Aug. 1983).
An easy and intuitive introduction to the regularization and renormalization techniques in elementary particle physics is given. It is based on the use of a simple electrostatic problem. (19 refs.)

105065 Photon mass experiment. R.E.Crandall (Dept. of Phys., Reed Coll., Portland, OR, USA).
Am. J. Phys. (USA), vol.51, no.8, p.698-702 (Aug. 1983).
A Coulomb null experiment is described that enables physics students to obtain rigorous upper bounds on photon mass. The experimenter searches for subnanovolt signals that would escape a closed shell were photon mass to be positive. The approach can be adapted for several college levels. At the simplest level, a 'miniature' low-cost experiment allows a student to verify the exponent '-2' in Coulomb's law to eight or more decimal places. An advanced student given a full-size apparatus (at greater cost) can obtain mass bounds very close to the established laboratory limit. (13 refs.)

105066 Exactly solvable three-dimensional scattering problem. C.Eftimiu (McDonnell Douglas Res. Labs., St. Louis, MO, USA).
Am. J. Phys. (USA), vol.51, no.8, p.709-11 (Aug. 1983).
Schrodinger's equation is solved exactly for a potential vanishing outside a prolate spheroid. The potential is then reconstructed from the first Born approximation for the scattering amplitude. (5 refs.)

105067 Universal variables in the two-body problem. E.Everhart (Phys. Dept., Univ. of Denver, Denver, CO, USA), E.T.Pitkin.
Am. J. Phys. (USA), vol.51, no.8, p.712-17 (Aug. 1983).
Universal variables offer a considerable improvement on classical methods of solving the two body problem. The method has the same structure regardless of whether the orbit is an ellipse, parabola, or hyperbola. The near-parabolic orbit is handled with ease. Universal variables are particularly useful when starting with a position-velocity vector at time zero and finding this vector at any other time. This paper is tutorial, written in the belief that this method should be better known. A laboratory exercise is described which uses universal variables in plotting orbits in the Solar System. The Appendix contains a concise derivation of the equations for universal variables. (23 refs.)

105068 Center-of-mass properties of composite systems subject to nonlinear external interactions. J.A.Lock (Dept. of Phys., Cleveland State Univ., Cleveland, OH, USA).
Am. J. Phys. (USA), vol.51, no.8, p.717-21 (Aug. 1983).
If two bound nonrelativistic quantum particles are each subject to a nonlinear external potential, their Schrodinger equation does not separate in relative and center-of-mass coordinates. For this case, the details of internal state of the composite affect its center-of-mass properties. The extent of this internal state influence is examined for an exactly soluble one-dimensional model system. (8 refs.)

105069 The simple pendulum in a rotating frame. A.-M.M.Abdel-Rahman (Dept. of Phys., Faculty of Sci., King Saud Univ., Riyadh, Saudi Arabia).
Am. J. Phys. (USA), vol.51, no.8, p.721-4 (Aug. 1983).
The classical, semiclassical, and quantum aspects of the motion of a simple pendulum rotating in the direction perpendicular to its plane of oscillations and having negative total energy in its rotating frame are considered. The system is studied for angular velocities that barely exceed the value at which spontaneous symmetry breaking sets in, as well as for angular velocities away from this value. In the former case the semiclassical methods give the energy levels and in the latter they indicate that the quantum effects manifest themselves when the velocity of rotation is very high. The solutions of the Schrodinger equation in this limit are discussed and it is noted, in contrast to the plane pendulum system, that both odd- and even-order periodic Mathieu functions are admissible eigenfunctions. (10 refs.)

105070 The photoelectric determination of h/e: a new approach to an old problem. A.W.Knudsen (Phys. Dept., Univ. of Calgary, Calgary, Alberta, Canada).
Am. J. Phys. (USA), vol.51, no.8, p.725-9 (Aug. 1983).
A method is described for the photoelectric determination of h/e, based on Fowler's classic theory of the frequency-dependent photoelectric yield. In this method, the geometrical arrangement of the electrodes in the h/e phototube is found to be of fundamental importance, and great care was taken to ensure that plane-parallel geometry was maintained. This method, which provides a value of h/e to within $^2/_3$% of the accepted value, is objective and accurate and is considered to be a very suitable experiment for an advanced undergraduate physics laboratory. (13 refs.)

105071 Quantum theory of an electron in external fields using unitary transformations. R.M.O.Galvao, L.C.M.Miranda (Centro Tecnico Aerospacial, Inst. de Estudos Avancados, Sao Paulo, Brazil).
Am. J. Phys. (USA), vol.51, no.8, p.729-33 (Aug. 1983).
The technique of using unitary transformations to solve quantum-mechanical problems involving nontrivial time-dependent Hamiltonians is discussed. After introducing the basic ideas in simple examples, the technique is used to solve the problem of an electron in crossed magnetic and electric static fields plus laser (plane wave) field. (5 refs.)

105072 Le Chatelier reciprocal relations and the mechanical analog. R.Gilmore (Dept. of Phys. & Atmospheric Sci., Drexel Univ., Philadelphia, PA, USA).
Am. J. Phys. (USA), vol.51, no.8, p.733-43 (Aug. 1983).
Le Chatelier's principle is discussed carefully in terms of two sets of simple thermodynamic examples. The principle is then formulated quantitatively for general thermodynamic systems. The formulation is in terms of a perturbation-response matrix, the Le Chatelier matrix $[L]$. Le Chatelier's principle is contained in the diagonal elements of this matrix, all of which exceed one. These matrix elements describe the response of a system to a perturbation of either its extensive or intensive variables. These response ratios are inverses of each other. The Le Chatelier matrix is symmetric, so that a new set of thermodynamic reciprocal relations is derived. This quantitative formulation is illustrated by a single simple example which includes the original examples and shows the reciprocities among them. The assumptions underlying this new quantitative formulation of Le Chatelier's principle are general and applicable to a wide variety of nonthermodynamic systems. Le Chatelier's principle is formulated quantitatively for mechanical systems in static equilibrium, and mechanical examples of this formulation are given. (10 refs.)

105073 APL and the numerical solution of high-order linear differential equations. N.A.Gershenfeld (Bell Labs., Murray Hill, NJ, USA), E.H.Schadler, O.M.Bilaniuk.
Am. J. Phys. (USA), vol.51, no.8, p.743-6 (Aug. 1983).
An Nth-order linear ordinary differential equation is rewritten as a first-order equation in an $N \times N$ matrix. Taking advantage of the matrix manipulation strength of the APL language this equation is then solved directly, yielding a great simplification over the standard procedure of solving N coupled first-order scalar equations. This eases programming and results in a more intuitive algorithm. Example applications of a program using the technique are given from quantum mechanics and control theory. (12 refs.)

105074 Solar escape. A.Z.Handel (Dept. of Phys., Univ. of Michigan, Ann Arbor, MI, USA).
Am. J. Phys. (USA), vol.51, no.8, p.746-8 (Aug. 1983).
If one tries to calculate the minimum velocity a spaceship needs to escape from the solar gravitational field one is likely to get a wrong answer. The author illustrates the difficulties with several examples and gives a simple method to solve a certain class of problems. (1 ref.)

105075 Astronautical velocities. A.Diaz-Jimenez (Investigador Cientifico, Bogota, Colombia).
Am. J. Phys. (USA), vol.51, no.8, p.749 (Aug. 1983).
A space vehicle moving in a circular orbit or radius r_1 transfers to a circular orbit of radius r_2 by means of a elliptical path between A and B. This transfer path is known as the Hohman transfer ellipse. The author considers the problem of getting from Earth [orbital speed $V_{c1} = (GM_s/R_{es})^{1/2} = 29.8$ km/s] to the planet B [orbital speed $V_{c2} = (GM_s/R_{Bs})^{1/2}$]. He uses the good approximation that the orbits of the planets are circles with the sun at their common center. (6 refs.)

105076 Space-time symmetries and photon selection rules. G.E.Stedman (Dept. of Phys., Univ. of Canterbury, Christchurch, New Zealand).
Am. J. Phys. (USA), vol.51, no.8, p.750-5 (Aug. 1983).
The effects of time and space inversion, and also spatial rotation, on photons and their interaction with matter are discussed. Simple analyses are given for spinorial sign reversal effects and for various selection rules on the interaction with matter. Several rules require for their interpretation a judicious combination of arguments from spatial and temporal symmetry operations. (55 refs.)

105077 Instructional laboratory experiment on the sound field of a small ultrasonic transducer. I.Kinyuy, F.B.Stumpf (Phys. Dept., Ohio Univ., Athens, OH, USA).
Am. J. Phys. (USA), vol.51, no.8, p.756-7 (Aug. 1983).
The directivity pattern and the axial-pressure profile were measured for a small ultrasonic transducer. This is a useful basic experiment for an undergraduate course in sound or musical acoustics. (5 refs.)

105078 Fixed points in torque-angular momentum relations. G.Faucher (Dept. of Engng. Phys., Ecole Polytech., Montreal, Canada).
Am. J. Phys. (USA), vol.51, no.8, p.758-9 (Aug. 1983).
The use of relation $\tau_A = \dot{\mathbf{L}}_A$, where τ_A is the resultant torque of the external forces applied on a body and $\mathbf{L}_A$ is the resultant angular momentum, is straightforward when both quantities refer to a fixed point A. However, these quantities are often referred to a point which is not fixed; though incorrect in general, the relation is valid in many cases. Generally students do not under-

stand under what conditions the relation is valid. The author derives the general expression and states the conditions under which it can be reduced to the simpler form given above. (10 refs.)

105079 A linkage for representing sine, cosine, and the reference circle. R.D.Ayers (Dept. of Phys. Astron., California State Univ., Long Beach, CA, USA).
Am. J. Phys. (USA), vol.51, no.8, p.760-1 (Aug. 1983).
The resolution of the complex exponential $e^{i\theta}$ into its real and imaginary parts is demonstrated dynamically with a simple linkage. This model also illustrates how those real and imaginary parts are composed from linear combinations of $e^{i\theta}$ and $e^{-i\theta}$. A 12-in-diam., version has proved large enough for classroom demonstrations and sturdy enough for use in a hands-on museum. (no refs.)

105080 Radioactive half-life measurements in a freshman or sophomore laboratory. F.W.Supon, J.J.Kraushaar (Dept. of Phys., Univ. of Colorado, Boulder, CO, USA).
Am. J. Phys. (USA), vol.51, no.8, p.761-3 (Aug. 1983).
Elementary modern physics laboratories frequently include an experiment on the measurement of a radioactive half-life. While a number of possible experiments can be designed, there are usually the constraints that the half-life involved be measurable in the two- or three-hour laboratory period and that the students are exposed to a minimum of radiation. Because it was felt desirable to have the students become acquainted with electronic counting devices, random counting statistics and modern detectors, a new type of experiment has been designed that is not being used successfully. The alpha detector is patterned after the detectors used by the US Bureau of Mines for monitoring randon. (3 refs.)

105081 A microcomputer air-track timer. J.B.Rafert, R.C.Nicklin (Dept. of Phys. Astron., Appalachian State Univ., Boone, NC, USA).
Am. J. Phys. (USA), vol.51, no.8, p.763-4 (Aug. 1983).
The authors have used a microcomputer equipped with an analog to digital converter (ADC) to measure times as air-track gliders pass a pair of photodetectors. This has produced a versatile timing instrument which allows measurements as good as any reported in the air-track literature. The cost is reasonable if a microcomputer is already available. (12 refs.)

105082 Some experiments in partially coherent imaging and modulation transfer function evaluation. G.Indebetouw (Dept. of Phys., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
Appl. Phys. B (Germany), vol.B32, no.1, p.21-4 (Sept. 1983).
A relatively simple and inexpensive scanning optical system is described as a versatile tool for the demonstration and analysis of a variety of optical imaging properties. Some examples of partially coherent imaging and modulation transfer function (MTF) evaluation are presented. (8 refs.)

105083 Audiovisual environments and equipment standards for education. A.J.Powell (McGill Univ., Montreal, Canada).
SMPTE J. (USA), vol.92, no.7, p.735-8 (July 1983).
Using the proposed Engineering Committee Recommendations ECR 3, Standards for Conference Facilities, as a starting point, the paper traces the design relationships between the architectural and projection parameters of learning spaces for front projection within the topic of audio-visual environments. The two sets of parameters are combined to illustrate professional techniques used in reaching optimum image dimensions for the learning spaces. The effects on projection equipment performance are shown. The design process is reviewed as involving the necessary application of three distinct standards. Further research into the subject is proposed, to develop a media facilities specification standard for the construction industry. (11 refs.)

The BBC Computer Literacy Project .... See Entry 105062

01.60 BIOGRAPHICAL, HISTORICAL, AND PERSONAL NOTES

105084 Photography and the long-focus visual refractor: three American case studies, 1885-1914. J.Lankford (Univ. of Missouri, Columbia, MO, USA).
J. Hist. Astron. (GB), vol.14, pt.2, p.77-91 (June 1983).
Examines the process of adapting large refracting telescopes for astronomical photography and to demonstrate how the experience led to the construction of the first large photographic refractor in the United States, the Thaw refractor. (71 refs.)

01.65 HISTORY OF SCIENCE

105085 An interdisciplinary science-humanities course. B.G.Dick (Dept. of Phys., Univ. of Utah, Salt Lake City, UT, USA).
Am. J. Phys. (USA), vol.51, no.8, p.702-8 (Aug. 1983).
A course in the intellectual tradition of the West containing a generous amount of the history of science is described. It has been successfully taught by scientist-humanist teams of two for the last seven years. A selected bibliography of books and articles which have proved to be useful is given. (5 refs.)

105086 Quantum physics and the stars. I. The establishment of a stellar temperature scale. D.H.DeVorkin, R.Kenat.
J. Hist. Astron. (GB), vol.14, pt.2, p.102-32 (June 1983).
After a review of the temperature-scale problem, and the establishment of a perceived need for an absolute calibration and physical interpretation of stellar spectra, the authors turn to the application of the quantum theory by Meg Nad Saha and the development of his theory of ionization, in which he identified for the first time a theoretical rationale for the Harvard spectral sequence. Finally, the authors examine how Saha's theory was elaborated and refined by Russell, by E.A. Milne, and by Cecilia Payne in her elucidation of the temperature scale represented by the spectral sequence of the stars. (109 refs.)

Nondestructive inspection by the method of magnetic leakage fields. Theoretical and experimental foundations of the detection of surface cracks of finite and infinite depth .... See Entry 109682

Hearing aids .... See Entry 110240

01.75 SCIENCE AND SOCIETY

105087 Proceedings of Symposium 5 of the COSPAR Twenty-Fourth Plenary Meeting.
Adv. Space Res. (GB), vol.3, no.7 (1983).
Conference held at: Ottawa, Canada. Date 16 May-2 June 1982. Sponsors: COSPAR; Committee Sci. Tech. Developing Countries. The following topics were dealt with: Transfer of space science and technology to third world countries, space research policies, space science in India and Europe, Space science in Australia, Latin America and Austria, African space research, satellite data base development, meteorological satellites and remote sensing technology and programs.

01.90 OTHER TOPICS OF GENERAL INTEREST

Proceedings of Symposium 5 of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 105087

ASTM D 4000: a new classification system devoted to plastics .... See Entry 109119

02.00 MATHEMATICAL METHODS IN PHYSICS

02.10 ALGEBRA, SET THEORY, AND GRAPH THEORY

105088 An upper bound on the Fibonacci number of a maximal outerplanar graph. A.F.Alameddine (Dept. of Math. Sci., Univ. of Petroleum & Minerals, Dhahran, Saudi Arabia).
Arabian J. Sci. & Eng. (GB), vol.8, no.2, p.129-31 (April 1983).
The Fibonacci number $f(G)$ of a simple graph G is the number of complete subgraphs of the complement graph of G. An upper bound on f is established for all maximal outerplanar graphs and this bound is proved to be the best possible. In particular, it is shown that $f(G) \leq F_n + 1$, where G is a maximal outerplanar graph of order $n \geq 3$ and F_n is the nth number in the Fibonacci sequence. (5 refs.)

105089 Semi-commutative operators for nonlinear evolution equations. N.Asano (Dept. of Engng. Maths., Utsunomiya Univ., Utsunomiya, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2320-4 (July 1983).
In local jet space, the author has constructed a pair of operators commuting on a given arbitrary manifold. The algorithm is applied to the nonlinear evolution equation of the polynominal type to obtain the Lax pair and the condition necessary and sufficient for the existence of the pair is given in the formal theory.

Discussion of several analytical approximate expressions for the eigenvalues of the bounded harmonic oscillator and hydrogen atom .... See Entry 105140

Homothetic Killing tensors .... See Entry 105196

New approach to the one-particle Green's function for finite Fermi systems .... See Entry 105228

02.20 GROUP THEORY

(for algebraic methods in quantum mechanics, see 03.65; for symmetries in elementary particle physics, see 11.30)

105090 Contact super-algebra Lie-coarse. G.S.Shmelev.
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.5, p.569-70 (1983). In Russian.
As in the Lie-algebra, a space $H^2(g;g)$ describes the infinitesimal deformation of the super-algebra, Lie g. Since the quantisation is localised WRT the domain, the deformation of the Poisson super-algebra naturally would suggest that it is possible to 'quantize' over the space with an uneven number of even variables, as the contact super-algebra-analogue of the Poisson super-algebra is coarse. 'g' $= K(2n+1, m)$ — is the Lie contact super-algebra with standard filtering and OK, the corresponding scaling. The theorem $H^2(g;g)=0$ is supported by the three following lemmas: (i) the corresponding representative ω in $CU^2(g;g)$ of an element in $H^2(g;g)$ can be selected so that $\omega(K_0, k_-1 \oplus K_{-2})=0$ and $\omega(K_{-1}, K_{-1})=0$, (ii) with g: $K_{-1} \oplus K_{-1} \rightarrow K_{-2} \oplus K_{-1}$, there is such a linear operator so that $Z_i g(1) = 1g(z_i)$, $z_j g(z_j)$-$(-1)^{p(2i)p(2j)} Z_i g(Z_i) = g([Z,Z,])$, where 1-generatrix into K_{-2} and Z_i are homogeneous generatrices into K_{-1}. Then there is a singular element $1 \in K$ so that $g(x)=[x,1]$, (iii) if ω satisfies lemma(i) then ω is fine. (1 ref.) *R.H.*

105091 The Casimir operators of inhmogeneous groups. M.Chaichian (Dept. of High Energy Phys., Univ. of Helsinki, Helsinki, Finland), A.P.Demichev, N.F.Nelipa.
Commun. Math. Phys. (Germany), vol.90, no.3, p.353-72 (1983).
The authors have found the number of invariant operators for the inhomogeneous groups $IGL(n,R)$, $ISL(n,R)$, $ISO(p,q)$, $IU(p,q)$, $ISU(p,q)$, $ISp(2n)$, i.e. the inhomogeneous groups with the classical homogeneous subgroups, and also for the Weyl group $W(p,q)$. For some special cases explicit forms of the invariant operators are obtained. They also discuss the methods applied, together with problems in some cases, possible further developments and relevance for the supersymmetric theories. (21 refs.)

105092 Determination of the Weyl invariants and calculation of the coupling coefficients for unitary groups. M.Hage Hassen (Inst. de Phys. Nucleaire, Univ. Claude Bernard Lyon I, Villeurbanne, France).
J. Phys. A (GB), vol.16, no.13, p.2891-903 (11 Sept. 1983). In French.
The author presents a new approach for determining the Weyl invariants of unitary groups. Such an approach is based on the generating function of the basis of the representation for unitary groups built in an earlier work (Hage Hassan 1983). The author obtains two expressions for the Weyl invariants, both including the parameters involved in the generating function. Coupling coefficients appear in one of the expressions. The comparison of the development of the two expressions allows the calculation of the coupling coefficients. The application of this approach to the calculation of the coupling coefficients for the direct product $[\lambda^1 0] \otimes [\lambda^2 \mu^2]$ of SU(3) leads to an expression of the isoscalar factor where no summation occurs in contradistinction with the known expression for the coupling coefficients which involve five summations. (13 refs.)

105093 A family of groups generalising the Poincare group and their physical applications. A.O.Barut, M.A.Weiss (Dept. of Phys., Univ. of Colorado, Boulder, CO, USA).
J. Phys. A (GB), vol.16, no.13, p.2905-15 (11 Sept. 1983).
A family of groups $P^{(m,n)}$ parametrised by non-negative integers $m>n$ is studied generalising the Poincare group $P^{(1,1)}$. The action of finite-dimensional irreducible real representations of $SL(2, C)$ is used to form semi-direct products. The authors define the complete list of unitary irreducible representations for each $P^{(m,n)}$ by finding all sub-groups of $SL(2, C)$ which are little groups; some of the subgroups do not occur in the Poincare group. The geometry of the $SL(2, C)$ action and the classification of $SL(2, C)$ invariant tensors is considered. These groups are appropriate symmetry groups for field

theories in higher dimensions and generalise the notion of elementary relativistic quantum systems. (14 refs.)

Integral and Backlund transforms within symmetry groups of certain families of nonlinear differential equations .... See Entry 105122

Contact symmetries of general linear second-order ordinary differential equations .... See Entry 105145

Parallel torsions on Lie groups and spontaneous compactification in Kaluza-Klein theories .... See Entry 105198

Renormalization theory of the interacting Bose fluid .... See Entry 105230

Similarity reduction of modified Kadomtsev-Petviashvili equation .... See Entry 105501

Chemical applications of topology and group theory. XIII. Chirality and framework groups .... See Entry 106300

02.30 FUNCTION THEORY, ANALYSIS

105094 On the dimension of the solution space of systems of linear differential equations. E.Akyildiz (Dept. of Maths., Middle East Tech. Univ., Ankara, Turkey).
Arabian J. Sci. & Eng. (GB), vol.8, no.2, p.133-7 (April 1983).
The author considers the systems of linear differential equations in n unknown functions on an open interval I in R $A_0Y^{(m)}+A_1Y^{(m-1)}+\ldots+A_mY=0$, where A_i is an $n\times n$ real matrix for each $i=0, 1,\ldots,m$, and $Y^{(k)}=[(d^ky_1)/(dx^k)]\ldots(d^ky_n)/(dx^k)]$, $k=0, 1,\ldots,m$. Writing D^k for d^k/dx^k, $k=0,1,\ldots,m$, system (1) can be written as $L(D)Y=0$, where $L(D)=A_0D^m+A_1D^{m-1}+\ldots+A_m$. $C_n{}^m(I)$ is taken as the space of m-times differentiable $n\times 1$ real matrix-valued functions on I, and $V=\{Y\in C_n{}^m(I):L(D)Y=0\}$. It is one of the classical theorems of the theory of differential equations that if A_0 is nonsingular, V is a finite-dimensional vector space, and $\dim V=mn$. The author discusses the case when A_0 is singular. The main theorem is then as follows: If the determinant of $L(t)$ is not equal to zero, then V is a finite-dimensional vector space, and in fact the dimension of V is equal to the degree of the determinant of $L(t)$. (2 refs.)

105095 Laplace transforms of Airy functions via their integral definitions. P.G.L.Leach (Dept. of Appl. Maths., La Trobe Univ., Bundoora, Australia).
J. Phys. A (GB), vol.16, no.13, p.L451-3 (11 Sept. 1983).
The Laplace transforms of the functions $\mathrm{Ai}(\pm\eta)$ and $\mathrm{Bi}(-\eta)$ are obtained using the integral definitions of these functions and a correction made to a recent derivation of the results of $\mathrm{Ai}(-\eta)$ and $\mathrm{Bi}(-\eta)$. (4 refs.)

105096 On the extremality of the action integral. A.Galindo, G.G.Alcaine (Dept. de Fisica Teorica, Facultad de Ciencias Fisicas, Ciudad Univ., Madrid, Spain).
J. Phys. A (GB), vol.16, no.13, p.2923-37 (11 Sept. 1983).
Some necessary and sufficient conditions for a critical point of the action integral to be locally or globally extremal are proved. Applications to systems with finite or infinite number of degrees of freedom are discussed. (36 refs.)

105097 Periodic solutions of some nonlinear evolution equations. G.Cicogna (Dipartimento di Fisica, Univ. di Pisa, Pisa, Italy).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.15, p.529-32 (13 Aug. 1983).
The author considers nonlinear evolution equations, and studies how steady bifurcating solutions can be transformed into time-dependent solutions as an effect of some symmetry-breaking perturbation. (18 refs.)

105098 Direct linearization of nonlinear difference-difference equations. F.W.Nijhoff, G.R.W.Quispel, H.W.Capel (Inst. Lorentz voor Theoretische Natuurkunde, Leiden, Netherlands).
Phys. Lett. A (Netherlands), vol.97A, no.4, p.125-8 (22 Aug. 1983).
Starting from the linear integral equation for the solutions of the Korteweg-de Vries (KdV) equation, the authors obtain the direct linearization of a general nonlinear difference-difference equation. In a continuum limit this equation reduces to a general integrable differential-difference equation which contains e.g. the Toda equation and the discrete KdV and MKdV as special cases. (19 refs.)

105099 On the analytic solution of certain functional and difference equations. K.Mahler (Math. Dept., Res. School of Phys. Sci., Australian Nat. Univ., Canberra, Australia).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1796, p.1-13 (8 Sept. 1983).
Let $P(u,v)$ be an irreducible polynomial with complex coefficients and let $q\geq 2$ be an integer. The author establishes the necessary and sufficient conditions under which the functional equation (F): $P(f(z),f(z^q))=0$, has a non-constant analytic solution that is either regular in a neighbourhood of the point $z=0$ or has a pole at this point (theorem 1). By a simple change of variable, the difference equation $P(F(Z),F(Z+1))=0$, can be proved under the same restrictions to have a non-constant solution of the form $F(Z)=\Sigma_{j=1}{}^{\infty}f_j\exp(-jq^z)$, $\mathrm{Re}\ Z\geq X_0$, $|\mathrm{Im}\ Z|<\pi/2\ \ln q$, if X_0 is sufficiently large (theorem 2). (2 refs.)

Semi-commutative operators for nonlinear evolution equations .... See Entry 105089

Nonconvex energy functions. Hemivariational inequalities and substationarity principles .... See Entry 105100

On the stability of nonconservative differential equations .... See Entry 105114

Integral and Backlund transforms within symmetry groups of certain families of nonlinear differential equations .... See Entry 105122

On the integration of a three-wave set of equations .... See Entry 105125

Ideal gas of particle-like excitations at low temperatures .... See Entry 105126

Nonlinear dispersive systems: theory and examples .... See Entry 105128

Evolution scheme to compute periodic solutions of first-order nonlinear equations containing translation operators .... See Entry 105129

Derivation of the nonlinear Schrodinger equation for shoaling wave-groups .... See Entry 105130

Field-theoretic study of the nonlinear Fokker-Planck equation .... See Entry 105223

New approach to the one-particle Green's function for finite Fermi systems .... See Entry 105228

Quantum statistics of parametric oscillation .... See Entry 105229

Stochastic solution method of the master equation and the model Boltzmann equation .... See Entry 105235

Note on a paper by G. Rowlands [chaotic trajectories of ordinary differential equations] .... See Entry 105236

Approximate solution methods for linear stochastic difference equations. II. Inhomogeneous equations, multi-time averages, biological application .... See Entry 105239

Evolution equations for dissipative bodies and hyperbolicity .... See Entry 105287

Soliton-like solutions of some nonlinear theories and transformations among them .... See Entry 105493

Analysis of stationary electrical fields generated by sets of thin conductive electrodes in non-homogeneous environment .... See Entry 106649

Electrical field in cylindrical symmetrical layouts by variational calculus .... See Entry 106652

Steady heat conduction from an infinite row of holes in a half-space or a uniform slab .... See Entry 106961

The generalized exponential-integral $V(x,y)=\int 1\infty\ \exp(-xt)\ln(t+y)dt/t$ and computer algorithms for $y=0,1$ .... See Entry 106977

Solution of Stefan problem for melting bodies .... See Entry 106981

Optimal plastic design of stiffened shells .... See Entry 106998

A note on the solution of two finite plain strain problems .... See Entry 107003

Use of initial parameters method in calculations of nonlinear behaviour of shells of revolution .... See Entry 107004

Mathematical modelling of a flexible beam under gravity .... See Entry 107012

Variational estimates for dispersion and attenuation of waves in random composites. III. Fibre-reinforced materials .... See Entry 107033

On the validity of the singular integral equations of crack problems at the crack tips .... See Entry 107048

A note on the asymptotic approach to boundary layers of constant thickness .... See Entry 107090

Approximate Green function for a semi-infinite solid with varying properties .... See Entry 108253

Solutions and critical times for the polydisperse coagulation equation when $a(x,y)=A+B(x+y)+Cxy$ .... See Entry 109816

A unified treatment of some expansion procedures in perturbation theory: Lie series, Faa di Bruno operators, and Arbogast's Rule .... See Entry 110870

02.40 GEOMETRY, DIFFERENTIAL GEOMETRY, AND TOPOLOGY

(see also 04. Relativity and gravitation)

Lagrangian mechanics and the geometry of configuration spacetime .... See Entry 105102

On a class of nonstatic perfect fluid spheres in general relativity .... See Entry 105180

The initial value problem and dynamics .... See Entry 105182

On the positivity of total gravitational energy at retarded times .... See Entry 105185

On the existence of asymptotically flat and empty spaces .... See Entry 105190

General relativistic collapse of rotating stars .... See Entry 105192

Chemical applications of topology and group theory. XIII. Chirality and framework groups .... See Entry 106300

02.50 PROBABILITY THEORY, STOCHASTIC PROCESSES, AND STATISTICS

(see also 05. Statistical physics)

Institute of Statisticians International Conference on Practical Bayesian Statistics .... See Entry 105021

Stochastic solution method of the master equation and the model Boltzmann equation .... See Entry 105235

The time scale of Monte Carlo experiments .... See Entry 105243

Stochastic quantization method in operator formalism .... See Entry 105244

Scattering and absorption of turbid materials determined from reflection measurements. I. Theory .... See Entry 106703

Bandwidth of multimode fibres with random fluctuation in the index profile: a Monte Carlo approach .... See Entry 106880

Statistical evaluation of the mechanical strength of insulators .... See Entry 107800

The Weibull distribution function and wind power statistics. .... See Entry 109848

02.60 NUMERICAL APPROXIMATION AND ANALYSIS

Construction of a working model in the finite-element method for solution of three-dimensional problems of elasticity theory .... See Entry 105113

Finite element techniques for computational fluid mechanics .... See Entry 105115

Extending the region of convergence of the iteration method of solution of the inverse refraction problem .... See Entry 105167

Iteration algorithm for the solution of the inverse scattering problem .... See Entry 105168

An estimate of scatterers by the method of averaging in tomographic problems .... See Entry 105169

Maximum principle in finite element models for convection-diffusion phenomena .... See Entry 105286

Finite element steady-state solutions of the traveling magnetic field problem .... See Entry 106657

Modal analysis of spatially periodic anisotropic media .... See Entry 106694

A finite-element front-tracking enthalpy method for Stefan problems .... See Entry 106966

Analysis of vibration by component mode synthesis method. III. Application to cylinder block of 4 cylinders .... See Entry 106985

Numerical determination of limit loads for an axisymmetrical orthotropic material in plane strain .... See Entry 106992

A singular hybrid finite element analysis of boundary-layer stresses in composite laminates .... See Entry 106999

Calculating shell of rotation by finite element method when material operates beyond limit of elasticity .... See Entry 107014

Large strain inelastic behaviour of cylindrical tubes .... See Entry 107016

A method for obtaining stress intensity factor by FEM and its application to dynamic problem. II. A treatment for mixed mode cracks .... See Entry 107049

An annular crack in microelasticity ....See Entry 107062

A viscoplastic analysis of rapid crack propagation experiments in steel ....See Entry 107067

The dynamic behaviour of slender structure with cross-sectional cracks ....See Entry 107068

Compression of an elastic cylinder between two rigid planes. Application of the indirect fictitious-boundary integral method to a contact problem ....See Entry 107076

Analysis of some low-order finite element schemes for the Navier-Stokes equations ....See Entry 107092

Experiments with some low-order finite elements schemes for the Navier-Stokes equations ....See Entry 107093

Calibration of hot-wire probes and determination of their directional sensitivity by numerical methods ....See Entry 107284

The breaking of axisymmetric non-cylindrical liquid bridges ....See Entry 108126

Numerical analysis for nonlinear equation of evolution in nonequilibrium systems—diffusive instability of quasiparticles and their time evolution in nonequilibrium superconductors ....See Entry 108600

Application of the boundary value integral equations method to the investigation of press working of metals ....See Entry 109329

Discrete mechanics: some remarks ....See Entry 110867

Generalized f and g series and convergence of the power series solution of the n-body problem ....See Entry 110869

A unified treatment of some expansion procedures in perturbation theory: Lie series, Faa di Bruno operators, and Arbogast's Rule ....See Entry 110870

02.70 COMPUTATIONAL TECHNIQUES

(for data handling and computation, see 06.50)

Computers in analysis and design [of heat transfer] ....See Entry 106965

The quantitative representation of fiber- and sheet-texture in metals in cubic crystal system. I. Computer programs for texture analysis ....See Entry 109326

02.90 OTHER TOPICS IN MATHEMATICAL METHODS IN PHYSICS

The enumeration of reaction pathways using Burnside's lemma ....See Entry 109707

03.00 CLASSICAL AND QUANTUM PHYSICS; MECHANICS AND FIELDS

105100 Nonconvex energy functions. Hemivariational inequalities and substationarity principles. P.D.Panagiotopoulos (Aristotle Univ., Thessaloniki, Greece).
Acta Mech. (Austria), vol.48, no.3-4, p.111-30 (1983).
The author derives certain new classes of variational principles for material laws and boundary conditions resulting from nonconvex, generally nondifferentiable, potentials. To this end two recently defined notions are employed, the 'generalized gradient' of Clarke and the 'derivate container' of Warga. Several general classes of problems are discussed and the respective variational forms called hemivariational inequalities are derived. For the respective static problems the equivalence of these forms to the 'substationarity' of the potential and complementary energy is discussed. Finally an integral inclusion formulation for certain classes of static problems is presented. (42 refs.)

03.20 CLASSICAL MECHANICS OF DISCRETE SYSTEMS: GENERAL MATHEMATICAL ASPECTS

(for applied classical mechanics of discrete systems, see 46.10; for celestial mechanics, see 95.10)

105101 Damped nonlinear oscillations modeled by a 3-dimensional differential system. G.N.Bojadziev (Simon Fraser Univ., Burnaby, British Columbia, Canada).
Acta Mech. (Austria), vol.48, no.3-4, p.193-201 (1983).
The asymptotic solution in the sense of Krylov-Bogoliubov-Mitropolskii of a 3-dimensional weakly nonlinear autonomous differential system is investigated. The system models oscillating processes characterized by strong damping. (9 refs.)

105102 Lagrangian mechanics and the geometry of configuration spacetime. M.Trumper (Max-Planck-Inst. fur Phys. und Astrophys., Garching, Germany).
Ann. Phys. (USA), vol.149, no.1, p.203-33 (Aug. 1983).
Holonomic rheonomic systems having a finite number of degrees of freedom are considered in classical nonrelativistic mechanics. It is shown that the configuration spacetime manifold $\mathfrak{M}$ of such a system can be furnished with a linear symmetric connection in such a way that the worldline of the system is a geodesic on $\mathfrak{M}$. The connection is based upon a degenerate metric structure which in turn is uniquely determined by the system and the forces acting on it. The connection is compatible with the generalised Galilei structure in the sense that the covariant derivatives of the latter vanish. Systems which can be described in terms of a Lagrangian give rise to a particularly interesting class of dynamical connections, called 'Lagrange connections', whose geometry is studied in some detail. Within the class of generalised Galilei connections they are characterised by a geometrical condition imposed on the affine curvature tensor. Noether symmetries of the dynamical system turn out to be equivalent to 'isometries' of the generalised Galilei structure together with the collineations of the Lagrange connection. They form a Lie group. Spacelike generators of Noether symmetries are linked to the existence of 'conservors'. Timelike generators of Noether symmetries give rise to (second rank) Killing tensors. (25 refs.)

105103 Damping estimation method using the spectral analysis technique based on the auto-regressive model fitting. K.Suzuki, A.Nakashima (Faculty of Technol., Tokyo Metropolitan Univ., Tokyo, Japan).
Bull. JSME (Japan), vol.26, no.215, p.832-8 (May 1983).
A practical method whereby the damping ratio of a structure subjected to random excitations can be estimated is proposed. This method is based on the characteristics of the AR spectral analysis technique by H. Akaike (1972). Using good correspondence of the shape of the frequency response function around the dominant peaks in the proposed method to that in the linear structural theory, estimation of the damping ratio to the fundamental vibration modes can be satisfactorily carried out by using curve-fitting technique. As a practical example, the damping ratio for the ground model which is necessarily used for the generation of an artificial earthquake motion is estimated and quite good results are obtained. It is expected that this method will be widely applicable to other technical dynamic problems in which estimation of damping is required. (14 refs.)

105104 A weighted least squares method for circle fitting to frequency response data. J.A.Brandon, A.Cowley (Mfg. & Machine Tool Div., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
J. Sound & Vib. (GB), vol.89, no.3, p.419-24 (8 Aug. 1983).
Despite the recent development of powerful multidegree of freedom curve fitting programs the advent of the microcomputer has meant that there is still scope for improvement of simpler single degree of freedom models. A weighted least squares curves fitting method, based on a well known conformal mapping, is described. This method is shown to have important theoretical advantages over some established methods. (8 refs.)

105105 Periodically forced linear oscillator with impacts: chaos and long-period motions. S.W.Shaw, P.Holmes (Dept. of Theoretical & Appl. Mech., Cornell Univ., Ithaca, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.8, p.623-6 (22 Aug. 1983).
A simple model is discussed for a periodically forced oscillator with a constraint which leads to motions with impacts. For 'perfectly plastic' impacts the dynamics is represented by a discontinuous map defined on the circle. The map is shown to undergo period-doubling bifurcations followed by complex sequences of transitions, due to the discontinuities, in which arbitrarily long superstable periodic motions occur. (12 refs.)

105106 Two uniform asymptotic expansions of $d_{MN}^{I}(\beta)$ for high values of I (angular momentum). N.Grama, S.Stoica (Central Inst. of Phys., Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.4, p.289-94 (1983).
Based on the method of matched asymptotic expansions, two uniform asymptotic expansions of $d_{MN}^{I}(\beta)$ for high I ($M \ll I$, $N \ll I$) are established. (11 refs.)

Constrained dynamics with applications to Yang-Mills theory, general relativity, classical spin, dual string model ....See Entry 105039

Universal variables in the two-body problem ....See Entry 105067

The simple pendulum in a rotating frame ....See Entry 105069

Fixed points in torque-angular momentum relations ....See Entry 105078

Fractional angular momentum, fractional charge, and oscillators ....See Entry 105141

Doubling of torus ....See Entry 105245

Analysis of vibration by component mode synthesis method. III. Application to cylinder block of 4 cylinders ....See Entry 106985

A periodically forced piecewise linear oscillator ....See Entry 106987

Determination of the dynamic characteristics of nonlinear vibrating systems by the measured motion ....See Entry 106989

A note on the bathtub vortex and the Earth's rotation ....See Entry 107162

Discrete mechanics: some remarks ....See Entry 110867

Special cases in the problem of two rigid bodies ....See Entry 110868

Generalized f and g series and convergence of the power series solution of the n-body problem ....See Entry 110869

Equations of motion of the restricted problem of three bodies with variable mass ....See Entry 110871

Necessary conditions for the existence of plane motions in the problem of translatory-rotary motion of two rigid bodies. II ....See Entry 110872

On the collinear libration points of the photogravitational three-body problem ....See Entry 110873

On the motion of gravitating bodies with the radiation reaction force taken into account ....See Entry 110874

The averaged, hyperbolic, restricted three-body problem ....See Entry 110875

Some particular solutions of the restricted problem of three rigid bodies ....See Entry 110877

03.30 SPECIAL RELATIVITY

105107 The arrow of electromagnetic time and the generalized absorber theory. J.G.Cramer (Dept. of Phys., Univ. of Washington, Seattle, WA, USA).
Found. Phys. (USA), vol.13, no.9, p.887-902 (Sept. 1983).
The problem of the direction of electromagnetic time, i.e. the complete dominance of retarded electromagnetic radiation over advanced radiation in the Universe, is considered in the context of a generalized form of the Wheeler-Feynman absorber theory in an open expanding Universe with a singularity at T=0. It is shown that the application of a four-vector reflection boundary condition at the singularity leads to the observed dominance of retarded radiation; it also clarifies the role of advanced and retarded waves in the emission of very weakly absorbed radiation such as neutrinos. (24 refs.)

105108 Anisotropic speed of light and four-dimensional symmetry of physical laws. J.P.Hsu (Phys. Dept., Southeastern Massachusetts Univ., North Dartmouth, MA, USA).
Phys. Lett. A (Netherlands), vol.97A, no.4, p.137-9 (22 Aug. 1983).
The author demonstrates that Earth's west-east motion will not be detected by a recently proposed laser experiment. Within the four-dimensional symmetry framework, there is anisotropy of the one-way speed of light when one uses clock systems which differ from the relativistic clock systems; however, the two-way speed of light is still isotropic. (3 refs.)

Lorentz invariance in relativistic potential theory ....See Entry 105522

03.40 CLASSICAL MECHANICS OF CONTINUOUS MEDIA: GENERAL MATHEMATICAL ASPECTS

105109 Interfacial operators in the mechanics of composite media. R.Hill (Dept. of Appl. Math. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
J. Mech. & Phys. Solids (GB), vol.31, no.4, p.347-57 (1983).
Stress discontinuities in composite media can be treated systematically by splitting second-rank tensors at an interface into exterior and interior parts. With anisotropic response the decomposition needs support by an appropriate algebra of fourth-rank interfacial operators. This topic is reviewed by the author and some fresh standpoints are proposed. These lead to a reorganization of the algebra and its further development. The main new application is to elastoplastic composite whose response is subject to the normality flow-rule. Contact is also made with existing theories of incipient discontinuities in hyperbolic states of plastic deformation. (5 refs.)

105110 Coupled fields and nonclassical continuous media. D.Rogula.
Mech. Teor. & Stosow. (Poland), vol.20, no.1-2, p.19-28 (1982). In Polish.
Classical and non-classical continuous media theories are briefly reviewed referring to basic theories and authors. Recent contributions to a continuum theory (microstructures, momentary and hyperstresses, asymmetric sensors etc.) are briefly discussed. Micropolar elasticity theory is elaborated deriving basic mathematical expressions. Coupled fields are magneto-thermo-elasticity theories are similarly treated. An extensive bibliography is included. (66 refs.) *T.H.*

Constrained dynamics with applications to Yang-Mills theory, general relativity, classical spin, dual string model ....See Entry 105039

On the static and kinetic methods of conservative system stability and Rayleigh's principle: a reexamination ....See Entry 107000

03.40D Mathematical theory of elasticity

(see also 46.20 Continuum mechanics, and 46.30 Mechanics of solids)

105111 Homogenization with Fourier series. H.Dumontet (Univ. Pierre et Marie Curie, Paris, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.21, p.1625-8 (13 June 1983). In French.
Considers an elastic matrix with periodic elastic inclusions. The homogenized law is obtained by means of Fourier analysis. The computation of the homogenized behaviour requires the resolution of an infinite system of linear equations which depends on the geometry of the inclusion. (1 ref.)

105112 Thermoelasticity problems. W.Nowacki.
Mech. Teor. & Stosow. (Poland), vol.20, no.1-2, p.5-17 (1982). In Polish.
A mathematical analysis of thermoelasticity is presented, highlighting recent works of Polish scientists in this field. Basic equations of thermal elasticity are derived referring to the original contributors and explaining physical theories of elasticity. Stress wave propagation theories are reviewed. Asymmetric thermoelasticity and coupling effect theories are elaborated with reference to piezo- and magneto-thermoelasticity. An extensive bibliography is included. (64 refs.) *T.H.*

105113 Construction of a working model in the finite-element method for solution of three-dimensional problems of elasticity theory. G.A.Koklyuev (All-Union Thermotech. Sci.-Res. Inst., Moscow, USSR).
Strength Mater. (USA), vol.14, no.10, p.1404-6 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.102-3 (Oct. 1982). [received: Sept. 1983]
An algorithm is proposed for the numbering of nodes of arbitrary three-dimensional grids of second-order finite elements, which ensures convenient interpretation of the working model. A method of representing a body of arbitrary shape in the form of large-scale curvilinear finite elements (first-level grid), which are then divided into smaller elements (second-level grid) is proposed on the basis of this algorithm. (5 refs.)

105114 On the stability of nonconservative differential equations. W.Kliem (Danmarks Ingeniorakademi, Lyngby, Denmark).
Z. Angew. Math. & Mech. (Germany), vol.63, no.7, p.329-31 (1983). In German.
An application of Gerschgorin's law to equations of type: $A\ddot{q}+B\dot{q}+Cq=0$ where A, B and C are matrices. Stability ensues when the Cassini curve lies to the left of a vertical line whose position is deduced from the coefficients. Two examples are given: one of a matrix equation and one to determine the stability of an elastically mounted motor with internal damping and elasticity. (10 refs.) *N.C.*

Elastic media with microstructure I. One-dimensional models ....See Entry 105051

Coupled fields and nonclassical continuous media ....See Entry 105110

Use of initial parameters method in calculations of nonlinear behaviour of shells of revolution .... See Entry 107004

03.40G Fluid dynamics: general mathematical aspects

(see also 47. Fluid dynamics)

105115 Finite element techniques for computational fluid mechanics. B.Haggblad, M.Mattsson.
ASEA J. (Sweden), vol.56, no.1, p.32-9 (1983).
An overview is given of the basic steps in the application of the finite element method to a class of fluid flow problems commonly occurring at ASEA. Numerical techniques widely used for the solution of the resulting nonlinear equations are discussed and the experience gained in their use is reported. Some procedures for avoiding frequently experienced difficulties are described and demonstrated with the aid of a model problem. Laminar flow solutions to some engineering problems are presented. New solution strategies on larger and faster computers will have a great impact on computational work within industry. (2 refs.)

105116 Slowly rotating fluid spheres in the Einstein-Yukawa theory. K.D.Krori, A.R.Sheikh (Math. Phys. Forum, Cotton Coll., Gauhati, India).
Can. J. Phys. (Canada), vol.61, no.9, p.1324-7 (Sept. 1983).
The authors introduce slow rotation to a solution given by Krori et al. (1983) which represents fluid spheres in the Einstein-Yukawa theory, and present two new analytic solutions which are nonsingular and satisfy physical conditions throughout the spheres. One of the interior solutions represents uniformly rotating spheres and the other represents differentially rotating spheres. The authors also match the interior and exterior solutions on the boundary. (6 refs.)

105117 Many-sphere hydrodynamic interactions. II. Mobilities at finite frequencies. W.Van Saarloos, P.Mazur (Inst. Lorentz, Rijksuniv. te Leiden, Leiden, Netherlands).
Physica A (Netherlands), vol.120A, no.1-2, p.77-102 (1983).
For pt.I see ibid., vol.115, p.21 (1982). The authors extend their previously developed scheme to evaluate the static mobility tensors of an arbitrary number of spheres in a viscous fluid, to the case of finite frequencies. (27 refs.)

105118 Statistical mechanics of nonlinear hydrodynamic fluctuations. D.N.Zubarev, V.G.Morozov (V.A. Steklov Math. Inst., Acad. of Sci., Moscow, USSR).
Physica A (Netherlands), vol.120A, no.1-2, p.411-67 (1983).
The paper studies nonlinear hydrodynamic fluctuations by the methods of nonequilibrium statistical mechanics. The generalized Fokker-Planck equation for the distribution function of coarse-grained densities of conserved quantities is derived from the Liouville equation and then is investigated by using the gradient expansions in the flux correlation matrix. The authors have obtained the functional-differential Fokker-Planck equation describing the nonlinear hydrodynamic fluctuations in spatially nonuniform systems to second order in gradients of coarse-grained fluctuating fields. An outline of the derivation of Fokker-Planck equations containing the Burnett terms is also given. The explicit coordinate representations for the hydrodynamic Fokker-Planck equation is discussed in the case of one-component simple fluid. The general scheme of a change of coarse-grained functional variables is developed for hydrodynamic Fokker-Planck equations. The corresponding transformation rules are found for 'drift' terms, 'diffusion coefficients' and thermodynamic forces. The dynamical equations and stationary conditions for averages of functions (functionals) of hydrodynamic fields are discussed by using the Fokker-Planck operators acting on such functions. The explicit form of these operators are found for various sets of fluctuating fields. As an application of the formalism the calculation of the stationary correlation functions is presented for a simple nonequilibrium steady state. (28 refs.)

An integral of the triplet distribution function of a simple fluid in thermal equilibrium ....See Entry 105238

Evolution equations for dissipative bodies and hyperbolicity ..See Entry 105287

A note on the asymptotic approach to boundary layers of constant thickness ... .See Entry 107090

New representation of Navier-Stokes equations governing self-similar homogeneous turbulence ....See Entry 107096

03.40K Waves and wave propagation: general mathematical aspects

(see also 46.30M Mechanical and elastic waves, 43.20 General linear acoustics)

105119 Basic methods for stability analysis of nonlinear oscillations and waves. F.M.Hamzeh (Dept. of Phys., Univ. of Petroleum & Minerals, Dhahran, Saudi Arabia).
Arabian J. Sci. & Eng. (GB), vol.8, no.2, p.87-97 (April 1983).
Linear stability analysis, Lyapunov analysis, and the Nyquist diagram are powerful tools to study plasma stability. Their applications, however, are not limited to the field of plasma physics. The paper presents a comprehensive (nonspecialized) discussion of these methods for stability analysis of nonlinear oscillations and waves. (8 refs.)

105120 On wave propagation in random particulate composites. A.I.Beltzer (Holon Technol. Inst. Holon, Israel), C.W.Bert, A.G.Striz.
Int. J. Solids & Struct. (GB), vol.19, no.9, p.785-91 (1983).
A new method is presented for analysis of wave propagation in random particulate viscoelastic composites. The method incorporates both the scattering effect and viscoelastic losses as well as the Kramers-Kronig relationships valid for any casual linear system. Explicit expressions for the attenuation and dispersion are given and compared with available experimental data. (21 refs.)

105121 Cylindrical Korteweg de Vries equation and Painleve property. W.-H.Steeb, M.Kloke, B.M.Spieker, W.Oevel (Theoretische Phys., Univ. Paderborn, Paderborn, Germany).
J. Phys. A (GB), vol.16, no.13, p.L447-50 (11 Sept. 1983).
The authors demonstrate that the Lax representation for the cylindrical Korteweg de Vries equation can be obtained with the help of the Painleve property of this equation. (6 refs.)

105122 Integral and Backlund transforms within symmetry groups of certain families of nonlinear differential equations. L.Hlavaty (Inst. de Investigaciones en Matematicas Aplicadas y en Sistemas, Univ. Nacional Autonoma de Mexico, Mexico City, Mexico), K.B.Wolf, S.Steinberg.
J. Phys. A (GB), vol.16, no.13, p.2917-22 (11 Sept. 1983).
The authors consider the symmetry groups for Burgers-type and KdV-type equations, as well as their intertwining under the Hopf-Cole and Miura transformations. It is shown that Lie point symmetries of the one equation in the family may be mapped into integral or Backlund transformations of another equation in the family. (11 refs.)

105123 Comparison of averaging methods for scalar wave propagation in a random elastic layer. B.Lenoach (Dublin Inst. for Advanced Studies, Dublin, Ireland).
J. Phys. A (GB), vol.16, no.13, p.2979-86 (11 Sept. 1983).
The problem of elastic wave propagation in a random layer overlying a homogeneous half-space is treated using an averaging method and the Born approximation. The wave is assumed to propagate normally to the layer so that the equations of motion are ordinary differential equations with random coefficients The two methods are shown to have different ranges of validity; the averaging method applies in the range where stochastic effects are important. (8 refs.)

105124 Molecular dynamics of interacting kinks. I. T.Nagai (Dept. of General Education, Kyushu Kyoritsu Univ., Kitakyushu, Japan), K.Kawasaki.
Physica A (Netherlands), vol.120A, no.1-2, p.587-99 (1983).
A system consisting of a large number (up to 40000) of kinks and antikinks moving under attractive interactions, which are annihilated on contacting each other, is studied using the method of molecular dynamics computer simulation. The average distance between neighboring kinks increases logarithmically in time after a short initial transient period. The size distribution function of domains between neighboring kinks is also computed and found to develop a characteristic cut-off structure. Interpretation of the results in terms of simple kinetic models is given. The results are compared with the recent neutron scattering experiments on layered antiferromagnets by Ikeda. (5 refs.)

105125 On the integration of a three-wave set of equations. R.O.Dendy, D.Ter Haar (Dept. of Theoretical Phys., Univ. of Oxford, Oxford, England).
Phys. Lett. A (Netherlands), vol.97A, no.4, p.129-30 (22 Aug. 1983).
It is shown that a certain set of equations describing the evolution of a three-wave system can be derived from a Hamiltonian. The authors show that this set has three integrals of motion which are in involution, so that the system is integrable. They then show how the equations can be integrated. (5 refs.)

105126 Ideal gas of particle-like excitations at low temperatures. V.K.Fedyanin, V.G.Makhankov (Joint Inst. for Nuclear Res., Lab. of Computation Techn. & Automation, Dubna, USSR).
Phys. Scr. (Sweden), vol.28, no.2, p.221-8 (Aug. 1983).
A phenomenological approach to the description of the equilibrium characteristics of 'kink' gas is proposed, which is based on model of lattice gas. A general simple technique for obtaining the dynamical structure factors (DSF) of solitons and bions in the 'gas' approximation is developed. The DSF defined by soliton excitations in the framework of the Klein-Gordon equation are obtained and discussed. It is shown that at low temperatures the bion type excitations dominate the contribution to the central peak (CP) as well as give rise to the satellites to appear at harmonics of the main bion frequency. Both the frequency of bions, Ω and their average density are defined by the temperature of a system. A possibility is discussed to generalize the results to (2+1) and (3+1) dimensional modes. (27 refs.)

105127 Soliton propagation in a randomly inhomogeneous medium. F.G.Bass, Yu.A.Sinitsyn (Inst. of Radiophys. & Electronics, Acad. of Sci., Ukrainian SSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.11, p.933-9 (Nov. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.11, p.1302-9 (Nov. 1982). [received: Sept. 1983]
Propagation of a one-dimensional soliton through a layer of three-dimensional random inhomogeneities is considered using the Sine-Gordon equation in the Born approximation. The structure and correlation functions of the soliton-resonator eigenmode are studied, as well as the fields which propagate in both directions from the soliton upon its transit through the inhomogeneous layer. (8 refs.)

105128 Nonlinear dispersive systems: theory and examples. F.A.Howes (Dept. of Math., Univ. of California, Davis, CA, USA).
Stud. Appl. Math. (USA), vol.69, no.1, p.75-97 (Aug. 1983).
Some recent results in the asymptotic theory of differential equations are applied to certain third-order scalar and vector boundary-value problems that model various nonlinear physicochemical and dispersive wave phenomena. The key to the author's approach is the reduction of the third-order problems to asymptotically equivalent second-order ones which are more amenable to analysis. Many examples are discussed, including the problem of solitary-wave solutions of generalized Korteweg-de Vries equations and coupled systems of such equations. (21 refs.)

105129 Evolution scheme to compute periodic solutions of first-order nonlinear equations containing translation operators. J.J.Keller, W.Egli (Brown Boveri Res. Centre, Baden, Switzerland).
Z. Angew. Math. & Phys. (Switzerland), vol.34, no.4, p.510-33 (July 1983).
An evolution scheme is proposed to compute periodic solutions of equations of the general form $f(df/dt)+Lf=0$ where L is a linear operator which may include translations. The convergence properties of the proposed scheme are investigated and compared with the convergence properties of alternative numerical solution methods. The application of the evolution scheme is illustrated with the computation of solutions of equations arising in nonlinear wave propagation. (7 refs.)

105130 Derivation of the nonlinear Schrodinger equation for shoaling wave-groups. M.Stiassnie (Ralph M. Parsons Lab., MIT, Cambridge, MA, USA).
Z. Angew. Math. & Phys. (Switzerland), vol.34, no.4, p.534-44 (July 1983).
A nonlinear Schrodinger equation with varying coefficients, describing the evolution of surface wave groups moving over an uneven bottom, is derived from Whitham's modulation equations (1974). The derivation yields new expressions for the wave-induced mean flow field. (6 refs.)

105131 Physics of vibrations and waves. 3rd edition. H.J.Pain.
Chichester, West Sussex, England: Wiley (1983), xvi+416 pp. [0 471 90182 2]
The book is written at undergraduate level and comprises 12 chapters dealing with the following subjects: simple and damped simple harmonic motion; the forced oscillator; coupled oscillations; transverse wave motion; longitudinal waves; waves on transmission lines; electromagnetic waves; waves in more than one dimension; Fourier methods; waves in optical systems; nonlinear oscillations; wave mechanics.

Geometrical characterisation of asymptotic wavefronts in N-body scattering .... See Entry 105166

Stochastic Korteweg-de Vries equation .... See Entry 105234

Soliton-like solutions of some nonlinear theories and transformations among them .... See Entry 105493

Vibrations of noncircular cylindrical shells .... See Entry 107030

Gaussian beams and paraxial ray approximation in three-dimensional elastic inhomogeneous media .... See Entry 110323

03.50 CLASSICAL FIELD THEORY

105132 Existence, uniqueness and iterative construction of motions of charged particles with retarded interactions. E.Eder (Max-Planck-Inst. fur Phys. und Astrophys., Garching, Germany).
Ann. Inst. Henri Poincare Sect. A (France), vol.39, no.1, p.1-27 (1983).
The author provides an existence and uniqueness proof and an iterative construction with an error estimate for the solution of a system of truncated equations of motion for the scattering problem of classical electrodynamics with initial conditions in the infinite past. It is assumed that the fields produced by the particles are given by the velocity-dependent terms of the retarded Lienard-Wiechert fields and that each particle moves according to the Lorentz force corresponding to the field produced by the other particle or particles. The acceleration-dependent parts of the retarded Lienard-Wiechert fields as well as the radiation reaction terms are disregarded. It is proved that one can choose, as initial values, the three components of the velocity of each particle and, in addition, three real numbers for each particle which can be looked at as initial values for the location of the particle in the infinite past. (4 refs.)

105133 Cerenkov radiation from periodic electron bunches. F.R.Buskirk, J.R.Neighbours (Phys. Dept., Naval Postgraduate School, Monterey, CA, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1531-8 (Sept. 1983).
Cerenkov radiation is calculated for electron beams which exceed the velocity of radiation in a nondispersive dielectric medium. The electron beam is assumed to be bunched as emitted from a traveling-wave accelerator, and the emission region is assumed to be finite. Predictions include (a) emission at harmonics of the bunch rate, (b) coherence of radiation at low frequencies, (c) smearing of the emission angle for finite emission regions, and (d) explicit evaluation of the power spectrum in terms of bunch dimensions. The results apply to microwave emission from fast electrons in air or other dielectrics. (13 refs.)

Photon mass experiment .... See Entry 105065

The arrow of electromagnetic time and the generalized absorber theory .... See Entry 105107

Radiation balance and the stochastic Van der Pol-Duffing equation .... See Entry 105237

Vector particle in a constant magnetic field .... See Entry 106683

General method for solving the self-consistent equations of motion and Maxwell equations .... See Entry 106684

03.65 QUANTUM THEORY; QUANTUM MECHANICS

(see also 05.30 Quantum statistical mechanics; for relativistic wave equations, see 11.10)

105134 A reinterpretation of quantum mechanics. A.H.Anastassov (Faculty of Phys., Sofia Univ., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.5, p.583-5 (1983).
A solution of the problem of corpuscular-wave dualism is proposed. It consists in the establishment of a continual-discrete, stochastic-deterministic space-time model of the 'particle in a quantum-mechanical sense'. This solution differs radically from the so-called Copenhagen interpretation. It has points of contact with de Broglie's double solution as well as with the fluid models (Schrodinger, Madelung, Janossy, etc.), but avoids their shortcomings. The main shortcoming of the double solution is that it retains the particle's trajectory while in the fluid models there is no trace of discreteness. Moreover, when two or more interacting particles are involved, the wave function and the corresponding fluid both lose their physical reality, being defined in a configurational rather than in a real physical space. The corpuscular-wave object described will be called a poletron. Mathematically, this is a pair of geometric objects in the space-time of the relativity theory. However, at the partial expense of depth and naturalness, a poletron can also be described classically, although its behaviour runs counter to the classical rules. This non-relativistic description will be given here. It is based on the notion of a quanton. A quanton is a classical particle (material point) which, however, is supershortliving (a 'particle-phantom'). (4 refs.)

105135 Algebraic representation for multiple anharmonic oscillators via compact and non-compact unitary groups. M.E.Kellman (Dept. of Chem., Northeastern Univ., Boston, MA, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.437-41 (19 Aug. 1983).
Couling of two and three Morse oscillators is treated algebraically using the compact and non-compact Lie groups $SU(n)$ and $SU(n,1)$. A model Hamiltonian which separates into harmonic, anharmonic, and coupling terms is expressed simply in terms of the ground generators. (29 refs.)

105136 Almost periodic Schrodinger operators. III. The absolutely continuous spectrum in one dimension. P.Deift, B.Simon (Dept. of Math., California Inst. of Technol., Pasadena, CA, USA).
Commun. Math. Phys. (Germany), vol.90, no.3, p.389-411 (1983).
For pt.II see Duice Math. J., vol.50, p.369-391 (1983). The authors discuss the absolutely continuous spectrum of $H=-d^2/dx^2+V(x)$ with V almost periodic, and its discrete analog $(hu)(n)=u(n+1)+u(n-1)+V(n)u(n)$. Special attention is paid to the set, A, of energies where the Lyaponov exponent vanishes; this set is known to be the essential support of the a.c. part of the spectral measure. They also provide a new proof of the Pastur-Ishii theorem and that the multiplicity of the absolutely continuous spectrum is 2. (19 refs.)

105137 $1/N$ expansion for invariant potentials in quantum mechanics. J.Avan, H.J.de Vega (Lab. de Phys., Theorique et Hautes Energies, Paris, France).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.1, p.61-80 (29 Aug. 1983).
The $1/N$ series for a general $O(N)$ invariant potential in quantum mechanics is analyzed in the functional integral approach. The authors solve the stationary-point equation (here it is a non-linear and non-local equation). The instanton solutions and their action are expressed in closed form. Potentials of different shapes are analyzed. The Kth order of the $1/N$ expansion for the ground state energy is obtained from the instanton solution up to order K^{-1}. This asymptotic formula reads in terms of quadratures of the potential. The series appears to be Borel summable for a wide class of potentials. (17 refs.)

105138 Some remarks on Coulomb and oscillator problems in R^N. H.Grinberg, J.Maranon, H.Vucetich (Dept. de Fisica, Univ. Nacional de la Plata, La Plata, Argentina).
KINAM Rev. Fis. (Mexico), vol.5, no.2, p.127-34 (1983).
The generalization of the Coulomb and harmonic oscillator problems to N dimensions, which easily follows from the basic commutation relations that are satisfied by any pair of mutually conjugate generalized coordinates and momenta, is used to generate connection for any dimension $N \geq 2$. (6 refs.)

105139 Some properties of the solutions of the Schrodinger equation with von Neumann boundary conditions. F.M.Fernandez, E.A.Castro (Seccion Quimica Teorica, INIFTA, La Plata, Argentina).
KINAM Rev. Fis. (Mexico), vol.5, no.2, p.179-84 (1983).
One of the best known approximations used in the study of the physical properties of alkaline metals consists in solving the Schrodinger equation for an electron moving within a spherical box. The volume of the sphere is taken as the atomic volume, and interactions are those with the nucleus and the remaining electrons. The solutions of the differential equation must satisfy the von Neumann boundary conditions (VNBC) on the spherical surface. This procedure has been widely applied, but up to now the analysis made about the eigenvalues and eigenfunctions have not shown their relevant properties with sufficient clearness. The purpose of the note is to show in a rigorous way the dependence of the eigenvalues as a function of the radius of the sphere. (12 refs.)

105140 Discussion of several analytical approximate expressions for the eigenvalues of the bounded harmonic oscillator and hydrogen atom. G.A.Arteca, S.A.Maluendes, F.M.Fernandez, E.A.Castro (Seccion Quimica Teorica, INIFTA, La Plata, Argentina).

Int. J. Quantum Chem. (USA), vol.24, no.2, p.169-84 (Aug. 1983).

Several approximate analytical formulas for the multidimensional isotropic bounded oscillators and the bounded hydrogen atom are compared. Numerical results show that the coth z method is in both cases better than the Pade approximants method. Perturbational polynomials, necessary in order to build the approximate eigenvalues, are obtained through the hypervirial perturbative method. (57 refs.)

105141 Fractional angular momentum, fractional charge, and oscillators. E.Lubkin (Dept. of Phys., Univ. of Wisconsin, Milwaukee, WI, USA).

Int. J. Theor. Phys. (USA), vol.22, no.7, p.653-75 (July 1983).

The monoaxial torsional pendulum's angle Θ relative to the lab is free real, neither mod 2π nor 4π. Hence the conjugate angular momentum is also free real, even quantum mechanically. If the ${}^1/_2 k\Theta^2$ potential is relaxed at large Θ to $2\pi N$ periodicity, then the quantum of angular momentum is partially reestablished, to fractional $\hbar/N$. If the pendulum were built by tensor product from designated constituent atoms, addition of angular momentum would deny the foregoing; however, the tie to atoms is as a collective mode instead. Similarly, the L-C oscillator has free real electric charge Q on one plate of the capacitor. The other plate, accommodating $-Q$, is here 'the lab' or 'ground'; observability of current breaks superselection of charge. These comments should alternatively develop from a Born-Oppenheimer approximation. (27 refs.)

105142 Computational complementarity. D.Finkelstein, S.R.Finkelstein (School of Phys., Georgia Inst. of Technol., Atlanta, GA, USA).

Int. J. Theor. Phys. (USA), vol.22, no.8, p.753-79 (Aug. 1983).

Interactivity generates paradox in that the interactive control by one system C of predicates about another system-under-study S may falsify these predicates. The authors formulate an 'interactive logic' to resolve this paradox of interactivity. The construction generalizes one, the Galois connection, used by Von Neumann for the similar quantum paradox. The authors apply the construction to a transition system, a concept that includes general systems, automata, and quantum systems. In some (classical) automata S, the interactive predicates about S show quantumlike complementarity arising from interactivity. The interactive paradox generates the quantum paradox. Some classical Ss have noncommutative algebras of interactively observable coordinates similar to the Heisenberg algebra of a quantum system. It is conceivable that some quantum effects in nature arise from interactivity. (24 refs.)

105143 Limiting absorption principle for some Schrodinger operators with exploding potentials. II. W.Jager (Univ. Heidelberg, Heidelberg, Germany), P.Rejto.

J. Math. Anal. & Appl. (USA), vol.95, no.1, p.169-94 (Aug. 1983).

For pt.I see ibid., vol.91, no.1, p.192 (1983). In part I, the authors used the assumption that for real $\mu=\lambda$ the solution of their basic equation is unique in the class of smooth functions which satisfy their adjustment of the Sommerfield radiation condition. This adjustment was defined with the aid of an approximate phase, introduced in conditions I-V of part I. They prove this uniqueness property. Their proof is, essentially, an adjustment of that of Kato (1959) concerning growth properties of the solutions of the reduced wave equation. Their description of these growth properties is with the aid of their approximate phase, which for the case of a short range potential gives the usual one. (12 refs.)

105144 The nonlinear Schrodinger-type equations reducible to the second Painleve equation. S.Kawamoto.

J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2613-16 (Aug. 1983).

It is shown that similarity solutions of the nonlinear Schrodinger equation with an inhomogeneous term satisfy the second Painleve equation, and a new nonlinear partial differential equation reducible to the second Painleve equation can be derived through the similarity variables.

105145 Contact symmetries of general linear second-order ordinary differential equations. R.Martini, P.H.M.Kersten (Dept. of Appl. Maths., Twente Univ. of Technol., Enschede, Netherlands).

J. Phys. A (GB), vol.16, no.13, p.L455-60 (11 Sept. 1983).

Using 1-1 mappings, the complete symmetry groups of contact transformations of general linear second-order ordinary differential equations are determined from two independent solutions of those equations, and applied to the harmonic oscillator with and without damping. (7 refs.)

105146 On the radius of convergence of Rayleigh-Schrodinger perturbative solutions for quantum oscillators in circular and spherical boxes. V.C.Aguilera-Navarro (Inst. de Fisica Teorica, Sao Paulo, Brazil), J.F.Gomes, A.H.Zimerman, K.Ley Koo.

J. Phys. A (GB), vol.16, no.13, p.2943-52 (11 Sept. 1983).

The energy eigenvalues of harmonic oscillators in circular and spherical boxes are obtained through the Rayleigh-Schrodinger perturbative expansion, taking the free particle in a box as the non-perturbed system. The perturbative series is shown to be convergent for small boxes, and an upper bound for the radius of convergence is established. Pade-approximant solutions are also constructed for boxes of any size. Numerical comparison with the exact eigenvalues—which are obtained by constructing and diagonalising the Hamiltonian in the basis of the eigenfunctions of the free particle in a box—corroborates the accuracy and range of validity of the approximate solutions, particularly the convergence and the radius of convergence of the perturbative series. (13 refs.)

105147 On the applicability of the Hill determinant method. A.Hautot, M.Nicolas (Inst. of Phys., Univ. of Liege, Liege, Belgium).

J. Phys. A (GB), vol.16, no.13, p.2953-9 (11 Sept. 1983).

The authors show that, contrarily to what Flessas and Anagnostatos claim (1982), the so-called Hill determinant method is perfectly suited to the numerical resolution of Schrodinger's equation. (19 refs.)

105148 Radiation damping in the pilot wave interpretation of quantum mechanics. M.C.Robinson, C.E.Aveledo, L.A.Lameda, D.Bonyuet-Lee (Dept. de Fisica, Univ. de Oriente, Cumana, Venezuela).

J. Phys. A (GB), vol.16, no.13, p.2987-91 (11 Sept. 1983).

To avoid the internal contradiction in the pilot wave interpretation inherent in the assumption of a charged particle moving in a closed orbit without radiating, it is proposed that the wavefunctions, $\psi_n(\mathbf{r})$, corresponding to stationary states be real, implying that the particle is stationary. If the effect of radiation damping is included, the Hamiltonian contains a nonlinear term resulting in the stability of the stationary states. (5 refs.)

105149 Quantum decay and the Mandelstam-Tamm-energy inequality. K.Bhattacharyya (Dept. of Phys. Chem., Indian Association for the Cultivation of Sci., Jadavpur, Calcutta, India).

J. Phys. A (GB), vol.16, no.13, p.2993-6 (11 Sept. 1983).

The Mandelstam-Tamm time-energy inequality is exploited to obtain a transparent expression of the lifetime-energy uncertainty relation for decaying quantum systems along with some useful features of the quantum non-decay probability. (13 refs.)

105150 Exact propagator for reflectionless potentials. R.E.Crandall (Dept. of Phys., Reed Coll., Portland, OR, USA).

J. Phys. A (GB), vol.16, no.13, p.3005-11 (11 Sept. 1983).

The exact space-time propagation for a general reflectionless potential is obtained in closed form involving error functions. It is indicated how bound states and transmission coefficients may be recovered from asymptotic behaviour of the propagator. A sum rule is derived that shows how the leading terms of the short-time form of the propagator can be used rigorously in a Feynman path integral formalism. (15 refs.)

105151 The close-coupling equations for three-particle Coulomb system with finite masses. M.Gailitis (Inst.of Phys., Acad. of Sci., Riga-Salaspils, Latvian SSR).

J. Phys. B (GB), vol.16, no.17, p.3201-12 (14 Sept. 1983).

In scattering processes with three charged finite mass particles the close-coupling approximation equations are derived separating the angular part and transforming the exchange terms to the form without derivatives. General expressions are obtained to compute the potentials and exchange kernels between any bound two-particle Coulomb states at any masses, charges and total angular momentum. (17 refs.)

105152 A coarse grained description of time evolution: irreversible state reduction and time-energy relation. R.Bonifacio (Dipartimento di Fisica, Univ. di Milano, Milano, Italy).

Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.14, p.481-9 (6 Aug. 1983).

Shows that proper coarse grained description of time evolution leads to a finite-difference equation with step τ for the density operator. This implies state reduction to the diagonal form in the energy representation and a quasi-ergodic behaviour of quantum-mechanical ensemble averages. An intrinsic time-energy relation $\tau_{\triangle}E \geq \hbar/2$ is proposed and its equivalence to a time quantization discussed. (4 refs.)

105153 A conceivable lattice structure of the Coulomb law. E.Papp, R.M.Santilli (Inst. for Basic Res., Cambridge, MA, USA).

Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.14, p.505-8 (6 Aug. 1983).

Presents a few heuristic remarks on recent extensions of the Coulomb law via effective potentials and other means, which appear to admit a lattice structure in time and space whose spacings are given by the characteristic period of the electron and its Compton wavelength, respectively. (12 refs.)

105154 Dispersion approach to the quantum-mechanical stability. E.Papp (Inst. for Basic Res., Cambridge, MA, USA).

Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.17, p.593-9 (27 Aug. 1983).

Proofs have been given that it is possible to define valuable quantum-mechanical stability constraints on the coupling constants or on the rest mass values in terms of underlying controllability requirements of the dispersion-shifts due to the interactions. The evaluation of such dispersions is accomplished by using suitable non-Hermitian operators which belong generally to a nonassociative algebra. (20 refs.)

105155 A Darboux-Backlund transformation associated with a discrete nonlinear Schrodinger equation. A.R.Chowdhury, G.Mahato (Dept. of Phys., Jadavpur Univ., Calcutta, India).

Lett. Math. Phys. (Netherlands), vol.7, no.4, p.313-17 (July 1983).

A Darboux-Backlund transformation for the differential-difference nonlinear Schrodinger equation is deduced. It is observed that it is also possible to derive the analogue of the usual Backlund transformation giving the direct connection between the two sets of the old and new nonlinear field variables, from the Darboux-Backlund itself. Also, it is seen that the different polynomial dependence of the B matrix on the eigenvalue parameter gives rise to various kinds of Backlund transformations—a phenomena not encountered in the usual derivation of the Backlund transformation. (3 refs.)

105156 Stochastic processes and the evolution of quantum observables. J.Bertrand, G.Rideau (Univ. Paris VII, Paris, France).

Lett. Math. Phys. (Netherlands), vol.7, no.4, p.327-37 (July 1983).

The classical results of stochastic calculus are extended to the equations giving the evolution of quantum observables in terms of their Weyl symbols, when the free Hamiltonian in $h_0(p)+qh_1(p)$ or $(p^2/2m)+(m\omega^2/2)q^2$ and the interaction potential is the Fourier transform of a bounded measure. The arising stochastic processes are purely jump processes. (5 refs.)

105157 Contractive states and the standard quantum limit for monitoring free-mass positions. H.P.Yuen (Dept. of Electrical Engng. & Computer Sci., Northwestern Univ., Evanston, IL, USA).

Phys. Rev. Lett. (USA), vol.51, no.9, p.719-22 (29 Aug. 1983).

The familiar minimum-uncertainty wave packets for masses are generalized in analogy with the two-photon coherent states of the radiation field. The free evolution of a subclass of these states, the contractive states, leads to a narrowing of the position uncertainty in contrast with the usual minimum-uncertainty wave packets. As a consequence the standard quantum limit for monitoring the positions of a free mass can be breached. Further implications on quantum nondemolition measurements are discussed. (15 refs.)

105158 Distribution of energy eigenvalues in the irregular spectrum. P.Pechukas (Dept. of Chem., Columbia Univ., New York, NY, USA).

Phys. Rev. Lett. (USA), vol.51, no.11, p.943-6 (12 Sept. 1983).

The distribution of energy eigenvalues in the irregular spectrum is derived in the semiclassical unit $\hbar \to 0$ by use of a plausible assumption on the spatial distribution of the corresponding eigenfunctions. (21 refs.)

105159 Quantum Kolmogorov-Arnol'd-Moser-like theorem: fundamentals of localization in quantum theory. G.Hose, H.S.Taylor (Fundamenteel Onderzoek der Materie, Inst. voor Atoom-en Molecuulfysica, Amsterdam, Netherlands).

Phys. Rev. Lett. (USA), vol.51, no.11, p.947-50 (12 Sept. 1983).

A quantum Kolmogorov-Arnol'd-Moser-like theorem is formulated with use of an existence condition of a unique transformation between eigenstates of integrable and nonintegrable Hamiltonians. This condition determines the ability to assign local quantum numbers to eigenstates of nonintegrable Hamiltonians and explains localization phenomena. (11 refs.)

105160 A new three-body equation. A.V.Matveenko (Joint Inst. for Nuclear Res., Dubna, USSR).

Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.11-14 (15 Sept. 1983).

The author starts with the Schrodinger equation for the three-body problem in the molecular state approach. A new representation is built, which 'kills' cross derivatives in the Schrodinger equation. This new equation has a simple form and 'good' asymptotic properties. It may be interpreted as an equation for quasiparticles with masses depending on coordinates. Moreover, a potential energy term is modified and acquires the form of the three-particle interaction. This modification is of kinematic nature. (6 refs.)

105161 Sturmian expansion approximation to three-body scattering. D.Eyre, H.G.Miller (Nat. Res. Inst. for Math. Sci., CSIR, Pretoria, S Africa).
Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.15-17 (15 Sept. 1983).
An L^2 discretization of continuum effects using sturmian functions is tested in a model three-body problem. Numerical results are obtained in the low energy scattering region for a system of three bosons interacting via nonseparable pairwise interactions. The present results suggest that the method may be applicable to solving the more general N-body case. (4 refs.)

105162 Aharonov-Bohm effect for trapped ions. R.R.Lewis (Dept. of Phys., Univ. of Michigan, Ann Arbor, MI, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1228-36 (Sept. 1983).
The role of the Aharonov-Bohm effect is analyzed for the bound states of a charged particle in the superposition of two fields: a uniform magnetic field plus the vector potential of a solenoid. Exact solutions are given for a solenoid of zero size and the corrections due to finite size are discussed. It is shown that a series of new 'betatron resonances' appear in the spectrum, dependent on the flux quantum number $f=e\Phi/hc$. The fundamental betatron resonance remains narrow and unshifted for solenoid radii large enough to broaden and shift the cyclotron resonance. (16 refs.)

105163 Kinetic equation for correlation functions of a quantum system interacting with a Gaussian thermostat. S.A.Dyagilev (Gor'kii State Univ., Gor'kii, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.12, p.1029-35 (Dec. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.12, p.1455-63 (Dec. 1982). [received: Sept. 1983]
An exact kinetic equation is found for the correlators of a quantum system interacting with a Gaussian thermostat. In the case when the energy of interaction of the system and thermostat is small, one-moment and two-moment approximations are constructed and regression equations for the fluctuations are obtained. The expressions found are illustrated on the example of the non-Markov relaxation of a quantum harmonic oscillator. (14 refs.)

Constrained dynamics with applications to Yang-Mills theory, general relativity, classical spin, dual string model ....See Entry 105039

Exactly solvable three-dimensional scattering problem ....See Entry 105066

Center-of-mass properties of composite systems subject to nonlinear external interactions ....See Entry 105068

The simple pendulum in a rotating frame ....See Entry 105069

Quantum theory of an electron in external fields using unitary transformations ....See Entry 105071

APL and the numerical solution of high-order linear differential equations ....See Entry 105073

Derivation of the nonlinear Schrodinger equation for shoaling wave-groups ....See Entry 105130

Stochastic quantization method in operator formalism ....See Entry 105244

An attempt toward quantum theory of 'maximally-decoupled' collective motion ....See Entry 105766

Long-range forces in heavy particle scattering ....See Entry 106525

Quantization in the large ....See Entry 111280

03.70 THEORY OF QUANTIZED FIELDS
(see also 11.10 Field theory)

105164 On one effective realisation of the canonical calculations procedure in quantum field theory using as an example the self-energies in n-dimensional models of scalar neutral fields. V.I.Kucheryavii.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.5, p.62-4 (1983). In Ukrainian.
Obtains explicit expressions for regular (finite) values of self-energies for n-dimensional neutral scalar field models with self-interaction $L_{int}=g_0\phi^N(x)$. The author also proposes an effective realisation of a canonical subtraction procedure which uses some properties of special functions. (9 refs.)

Quantization of the tensor gauge field of second rank in any gauge ....See Entry 105463

03.80 GENERAL THEORY OF SCATTERING
(see also 11.20 S-matrix theory, and 11.80 Relativistic scattering)

105165 Multiple scattering in closely packed systems of arbitrary non-overlapping shapes. B.D.Keister (TRIUMF, Vancouver, BC, Canada).
Ann. Phys. (USA), vol.149, no.1, p.162-78 (Aug. 1983).
It has long been known that the multiple scattering of waves from a system of obstacles of finite extent can be described completely with a knowledge of the on-shell amplitudes of the individual scatterers, provided that the minimally enclosing spheres concentric with the scattering centres do not overlap. It is shown that on-shell amplitudes alone suffice for a wider class of scattering configurations, in which the individual scatterers do not overlap, but their geometries do not satisfy the above condition. These extended geometries require a careful treatment of certain partial wave sums. An example is also discussed in which a pair of non-overlapping scatterers requires more than the on-shell amplitudes for a solution. (28 refs.)

105166 Geometrical characterisation of asymptotic wavefronts in *N*-body scattering. S.Servadio (Istituto di Fisica, Univ. di Pisa, Pisa, Italy).
J. Phys. A (GB), vol.16, no.13, p.2997-3003 (11 Sept. 1983).
The differential geometry of admissible wavefronts of N-body scattering is investigated for each term of the multiple scattering series and within angular sectors of uniform asymptotic behaviour. The differential equations are dimension independent in form and thus investigated in R_n. A general theorem is proved stating that, if not spherical, the wavefront must be a (ruled) $K=0$ surface tangent to a sphere around the origin. For $n=3$ a rather simple geometrical description is given of the most general structure. (10 refs.)

105167 Extending the region of convergence of the iteration method of solution of the inverse refraction problem. S.V.Baikov, V.A.Burov, A.A.Goryunov, A.V.Saskovets (Dept. of Acoustics, Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.24-8 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.22-6 (1982).
The authors consider the determination of the inhomogeneity of the velocity of propagation on waves in a medium, from the data on the field scattered from this inhomogeneity. A multistage iteration algorithm is presented for the solution of the problem which is free from limitations of the region of convergence, and can also be used for scattering from strong inhomogeneity for which the scattered field exceeds in the incident field. This extension of the region of convergence is achieved by solving only a small fraction of the scattered field at each stage, and the obtained intermediate estimates of the inhomogeneity are used in the calculation of the Green function for the following interaction stage. (9 refs.)

105168 Iteration algorithm for the solution of the inverse scattering problem. V.A.Burov, A.A.Goryunov, A.V.Saskovets (Dept. of Acoustics, Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.102-4 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.87-9 (1982).
The authors develop an effective iteration algorithm for the solution of the inverse scattering problem. The rate and region of convergence, are estimated. (2 refs.)

105169 An estimate of scatterers by the method of averaging in tomographic problems. V.A.Burov, A.A.Goryunov, A.V.Saskovets (Dept. of Acoustics, Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.105-7 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.89-91 (1982).
The authors give an estimate for the error in the determination of reemission coefficients of discrete scatterers in the solution of the inverse scattering problem by the averaging method. The results are presented of a model experiment which confirm the theoretical estimates of the accuracy of the solution. (3 refs.)

The close-coupling equations for three-particle Coulomb system with finite masses ....See Entry 105151

04.00 RELATIVITY AND GRAVITATION
(for special relativity, see 03.30; for relativistic astrophysics, see 95.30; for relativistic cosmology, see 98.80)

04.20 GENERAL RELATIVITY
(see also 02.40 Geometry and topology)

105170 Nonlinear electromagnetics in vacuo: gravitational effects. C.Biscari, D.Cuomo, G.Franceschetti, G.Panariello, I.Pinto (Univ. di Napoli, Istituto Elettrotecnico, Napoli, Italy).
Alta Freq. (Italy), vol.52, no.3, p.167-9 (May-June 1983). (4th Italian National Meeting on Applied Electromagnetics, Florence, Italy, 4-6 Oct. 1982).
Nonlinear corrections to vacuum electromagnetic fields are predicted by both Quantum Theory and Classical General Relativity. The Volterra functional expansion allows evaluation of these corrections up to any order in a systematic way. (15 refs.)

105171 Locally Hermit-Einstein, self-dual gravitational instantons. M.Przanowski (Inst. of Phys., Tech. Univ., Lodz, Poland).
Acta Phys. Pol. B (Poland), vol.B14, no.8, p.625-7 (Aug. 1983).
It is shown that for locally Hermit-Einstein, self-dual gravitational instanton, Einstein's equations can be reduced to a single, second-order, non-linear equation. (3 refs.)

105172 Localisation of energy in general relativity. Liu Wen-sen (Dept. of Phys., Shanxi Univ., Taiynan, China).
Acta Phys. Sin. (China), vol.32, no.4, p.515-19 (April 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)* [received: Sept. 1983] (6 refs.)

105173 The fibrous space-time structure of the rotating disc. R.Martinez-Chavanz (Dept. de Fisica, Univ. de Antioquia, Medellin, Colombia).
Rev. Colomb. Fis. (Colombia), vol.15, no.1, p.141-8 (1981). In Spanish. [received: Aug. 1983]
A treatment of the geometrical infrastructure for a future gauge theory for the interference phenomena which take place above a rotating disc. These are the result of the interaction between a gravitational field and an electromagnetic field. A method is developed which will lead to second order corrections to the previous treatment of the Sagnac effect. (12 refs.) *N.C.*

105174 Classical and quantal Einstein relativistic two-particle systems. T.Aaberge (Dept. de Phys. Theorique, Univ. de Geneve, Geneve, Switzerland).
Int. J. Theor. Phys. (USA), vol.22, no.8, p.723-52 (Aug. 1983).
The author presents formalisms for the description of two-particle systems of classical and of quantal Einstein relativistic particles. For each case the presentation follows a standard scheme. The author defines the phase-space, the observables, and the action of the kinematical symmetry group in the center-of-mass representation. The author then discusses some of the elementary features of the description of two-particle systems in order to interpret the objects considered. In particular it is shown that the description of the free particles conforms to standard relativistic kinematics. As an application the author discusses the system consisting of two charged particles interacting via the Coulomb field. (21 refs.)

105175 Motion of a classical particle with spin. II. Calculation of Dirac brackets. J.R.Ellis (School of Math. & Phys. Sci., Univ. of Sussex, Brighton, England).
J. Phys. A (GB), vol.16, no.13, p.2967-78 (11 Sept. 1983).
For pt.I see ibid., vol.15, p.409 (1982). The author continues the canonical formalism of paper I for the motion of a free particle. By the use of a computer the relevant matrices necessary for the computation of all Dirac brackets are established. An algorithm is described which allots numerical values to the canonical variables satisfying the constraints, and these values are used in the construction of the matrices. Algebraic expressions for Dirac brackets are predicted from a first set of numerical data, and these predicted expressions are confirmed by at least two further sets of data. Reduction to a sufficient set of variables is attempted and the reduced set expressed as a Lie algebra. (16 refs.)

105176 Rigidly rotating charged dust distribution in general relativity. S.K.Chakraborty, N.Bandyopadhyay (Phys. Dept., Presidency Coll., Calcutta, India).
J. Phys. A (GB), vol.16, no.13, p.3013-17 (11 Sept. 1983).
Following two recent papers by Bonnor (1980) and Raychaudhuri (1982) on the motion of charged dust in general relativity, the authors obtain exact solutions of the Einstein-Maxwell equations in both cylindrically symmetric and axially symmetric cases. (5 refs.)

105177 Cylindrically symmetric Einstein-Maxwell-massless scalar field equations. T.Singh, L.N.Rai, R.B.S.Yadav (Inst. of Technol., Banaras Hindu Univ., Varanasi, India).
J. Math. & Phys. Sci. (India), vol.17, no.3, p.245-30 (June 1983).
A procedure is presented which enables one to construct solutions to the cylindrically symmetric gravitational field coupled to electromagnetic and massless scalar fields. The method is applied to a known solution of Einstein-Maxwell equations. (20 refs.)

105178 A note on electromagnetic 'tidal' force. S.Prakash, S.R.Roy (Dept of Math., Banaras Hindu Univ., Varanasi, India).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.15, p.525-8 (13 Aug. 1983).
A brief outline for the study of the structure of $F_{ij;k}$ is presented and has been illustrated for a Coulomb field and a plane electromagnetic wave. (3 refs.)

105179 Parallel-tetrad on null geodesics in Kerr and Kerr-Newman space-time. J.-A.Marck (Groupe d'Astrophys. Relativiste, Obs. de Paris, Meudon, France).
Phys. Lett. A (Netherlands), vol.97A, no.4, p.140-2 (22 Aug. 1983).
A quasi-orthonormal tetrad that is parallel-propagated along null geodesics in the Kerr and Kerr-Newman space-time is constructed explicitly. (8 refs.)

105180 On a class of nonstatic perfect fluid spheres in general relativity. H.Knutsen (Inst. of Theoretical Astrophys., Univ. of Oslo, Oslo, Norway).
Phys. Scr. (Sweden), vol.28, no.2, p.129-35 (Aug. 1983).
The line element given by McVittie for a spherically symmetric distribution of matter is generalized. Conditions which are necessary and sufficient are given for the density to be uniform. The motion of the matter configuration is investigated with a view to oscillations using different physical conditions and initial conditions. It is shown that for many classes of solutions, these conditions are sufficient to conclude that oscillations are not possible. Particularly it is found that for a gaseous mass, oscillations are not possible. For other classes of solutions, it is shown that the conditions necessary for the solutions to be physically acceptable, are consistent with oscillations. However, these conditions are in general not sufficient. (14 refs.)

105181 General relativistic axisymmetric rotating systems: coordinates and equations. J.M.Bardeen (Univ. of Washington, Seattle, WA, USA), T.Piran.
Phys. Rep. (Netherlands), vol.96, no.4, p.205-250 (June 1983).
The Einstein equations for rotating axisymmetric configurations in asymptotically flat spacetimes are put in a form suitable for numerical calculations of dynamics. The discussion is motivated by the astrophysical problem of gravitational collapse with generation of gravitational radiation and possibly black hole formation. In the context of topological spherical coordinates there are two spatial gauge conditions which greatly simplify the Einstein equations and are compatible with regularity at the origin. The authors focus on one, the radial gauge, which generalizes Schwarzschild coordinates and is asymptotically a transverse-traceless gauge for gravitational radiation. The shift vector equation and the Hamiltonian constraint are parabolic equations in the radial gauge, rather than the usual elliptic equations. Two hypersurface conditions are explored in detail, the maximal hypersurface condition and another 'polar' hypersurface condition which fits naturally with the radial gauge. (20 refs.)

105182 The initial value problem and dynamics. J.W.York,Jr. (Dept. of Phys. & Astron., Univ. of North Carolina, Chapel Hill, NC, USA).
Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School, France, 2-21 June 1982 (Amsterdam, Netherlands: North-Holland 1983), p.175-201
The author reviews general relativity as a dynamical theory of gravity with an initial data surface. The initial value problem is considered with construction of space-times. (45 refs.)

Lagrangian mechanics and the geometry of configuration spacetime .... See Entry 105102

Gravitational radiation and the motion of compact bodies ...... See Entry 105184

Methods of numerical relativity .... See Entry 105186

Two points of view on gravitational energy .... See Entry 105189

On the existence of asymptotically flat and empty spaces ..... See Entry 105190

Gauge and radiation conditions in numerical relativity .... See Entry 105191

Interaction of gravitational waves with an elastic solid medium .... See Entry 105193

Kaluza-Klein theory over coset spaces .... See Entry 105197

A general solution of the Einstein equations with a time singularity .... See Entry 111277

Where has the four dimensionality come from? .... See Entry 111285

Alternative descriptions of the discrete mixmaster universe ... See Entry 111292

04.30 GRAVITATIONAL WAVES AND RADIATION: THEORY

105183 The theory of gravitational radiation: an introductory review. K.S.Thorne (California Inst. of Technol., Pasadena, CA, USA).
Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School, France, 2-21 June 1982 (Amsterdam, Netherlands: North-Holland 1983), p.1-57
The author presents a mathematical description of gravitational waves suitable for astrophysical applications. Various methods for analysing propagation, interaction with detectors and computation of waves from sources are described. (66 refs.)

105184 Gravitational radiation and the motion of compact bodies. T.Damour (Obs. de Paris-Meudon, Meudon, France).
Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School, France, 2-21 June 1982 (Amsterdam, Netherlands: North-Holland 1983), p.59-144
Using a post-Minkowskian approximation method supplemented by a technique of asymptotic matching, the authors obtain the general relativistic gravitational field outside two compact bodies (neutron stars or black holes). The equations of orbital motion of the compact bodies are deduced from the vacuum field equations by an Einstein-Infeld-Hoffmann-Kerr type approach simplified by the use of complex analytic continuation. The same process of analytic continuation allows one to push the accuracy of the calculations up to the third order: gravitational field containing cubic nonlinearities and equations of motion deduced from the quartically non-linear vacuum Einstein equations. The construction of Noetherian quantities conserved up to c^{-4} allows separation and investigation of the c^{-5} secular kinematical effects caused by the finite velocity of propagation of gravity. These results agree with the phenomena observed in the Hulse-Taylor pulsar PSR 1913+16. (165 refs.)

105185 On the positivity of total gravitational energy at retarded times. M.Walker (Max-Planck-Inst. fur Astrophys., Garching, Germany).
Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School, France, 2-21 June 1982 (Amsterdam, Netherlands: North-Holland 1983), p.145-73
The author investigated the structure of the space-time asymptotically along null geodesics to determine the positivity of the gravitational energy at retarded times. (49 refs.)

105186 Methods of numerical relativity. T.Piran (Racah Inst. for Phys., Hebrew Univ., Jerusalem, Israel).
Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School, France, 2-21 June 1982 (Amsterdam, Netherlands: North-Holland 1983), p.203-56
Numerical relativity is an alternative to analytic methods for obtaining solutions for Einstein equations. Numerical methods are particularly useful for studying generation of gravitational radiation by potential strong sources. The author reviews the analytical background, the numerical analysis aspects and techniques and some of the difficulties involved in numerical relativity. (82 refs.)

105187 Theoretical models for sources of gravitational waves. D.M.Eardley (Harvard Coll. Obs., Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA).
Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School, France, 2-21 June 1982 (Amsterdam, Netherlands: North-Holland 1983), p.257-96
Sources of gravitational radiation are never more than 100% efficient, by the Positive Energy Theorems, and efficiencies in likely astronomical sources are considerably less. Stellar core collapse to a neutron star or black hole is one possible source; for high efficiency the core must be deformed somehow. Accretion of bodies onto neutron stars or black holes provides another source, best when two nearly equally massive bodies collide; much theoretical work remains to be done in this case. Binary systems emit gravitational waves; observations of period change in PSR 1913+16 confirm this. (6 refs.)

105188 Extragalactic sources of gravitational waves. M.J.Rees (Inst. of Astron., Cambridge Univ., Cambridge, England).
Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School, France, 2-21 June 1982 (Amsterdam, Netherlands: North-Holland 1983), p.297-320
The prospects of detecting gravitational waves from galactic nuclei are shown to be bleak: although some 'scenarios', such as those involving black hole coalescence, would emit a pulse with ~ 0.1 efficiency, the predicted event rate is discouragingly low. If most of the 'unseen' mass in the Universe were in the remnants of massive 'Population III' stars—a possibility discussed—then the overlapping bursts from the collapse of such objects in early epochs would yield a stochastic background that could amount to $\sim 10^{-3}$ (or even more) of the critical cosmological density. Such a background may be above the detectability threshold for future experiments, and can be probed by studying the timing noise of pulsars, and the secular behaviour of the binary pulsar. General constraints on stochastic backgrounds, including 'primordial' gravitational radiation, are summarised. (57 refs.)

105189 Two points of view on gravitational energy. Y.Choquet-Bruhat (Univ. Paris VI, Paris, France).
Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School, France, 2-21 June 1982 (Amsterdam, Netherlands: North-Holland 1983), p.399-406
The author gives two examples of a rigorous mathematical study which leads to the appearance of a positive conserved quantity which it is legitimate to consider, in the context where it appears, as the energy of the gravitational field. The first example will be a high frequency perturbation of a given background, whose energy density can be defined locally, the second the global energy of an asymptotically flat space: the author in treating this example gives a new 3+1 formulation of Einstein equations (obtained in collaboration with T. Ruggeri), which splits them into the constraints and a hyperbolic evolution system, without use of harmonic coordinates. (no refs.)

105190 On the existence of asymptotically flat and empty spaces. H.Friedrich (Hochschule der Bundeswehr Hamburg, Hamburg, Germany).
Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School, France, 2-21 June 1982 (Amsterdam, Netherlands: North-Holland 1983), p.407-19
It is shown that Penrose's geometrical concept of 'asymptotical flatness' not only allows to investigate null infinity in terms of local differential geometry but also to discuss the existence of solutions of Einstein's vacuum field equations which have a smooth structure at null infinity by solving local initial value problems. For this purpose a regular representation of the conformal vacuum field equations is derived and a technique to reduce initial value problems for these equations is proposed. (19 refs.)

105191 Gauge and radiation conditions in numerical relativity. J.M.Bardeen (Phys. Dept., Univ. of Washington, Seattle, WA, USA).
Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School, France, 2-21 June 1982 (Amsterdam, Netherlands: North-Holland 1983), p.433-41
Gauge conditions suitable for numerical calculations of emission of gravitational radiation by compact sources are explored, with particular emphasis on algebraic conditions which simplify the structure of the Einstein equations. The expansion of the radiation field in powers of r^{-1} is compared in different gauges, and formulas for outgoing wave boundary conditions and asymptotic energy flux in the waves are obtained in the radial gauge which are accurate through order r^{-2}. (10 refs.)

105192 General relativistic collapse of rotating stars. T.Nakamura (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School, France, 2-21 June 1982 (Amsterdam, Netherlands: North-Holland 1983), p.443-53
Combining Geroch's and the ADM formalisms, the author gives a new formalism (called $[(2+1)+1]$-formalism) to treat the dynamical problems of space-time having a rotational Killing vector. By using this formalism, numerical calculations have been made for the collapse of rotating supermassive stars ($\sim 10^8\ M_\odot$) and rotating stars of 10 $M_\odot$. The number of calculated models is 22. It is suggested that Kerr black holes may be formed for wide ranges of initial conditions if $q(=\text{total angular momentum}/M(GM/C))$ is smaller than unity. For $q>1$, an expanding disk, ring or jets appears. The present numerical results approve the cosmic censorship hypothesis. (15 refs.)

105193 Interaction of gravitational waves with an elastic solid medium. B.Carter (Groupe d'Astrophys. Relativiste, Obs. de Paris, Meudon, France).
Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School, France, 2-21 June 1982 (Amsterdam, Netherlands: North-Holland 1983), p.455-64
The author presents an exactly consistent fully non-linear theory of the interaction of a gravitational field with an elastic solid from Einstein's theory. The weak field limit and conditions are obtained and the Dyson-Papapetrou equations derived. (15 refs.)

Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School ....See Entry 105034

General relativistic axisymmetric rotating systems: coordinates and equations ....See Entry 105181

The initial value problem and dynamics ....See Entry 105182

04.40 CONTINUOUS MEDIA; ELECTROMAGNETIC AND OTHER MIXED GRAVITATIONAL SYSTEMS

105194 Electromagnetism non-integrable phases and fibre bundles. J.Millan (Dept. de Fisica, Univ. del Valle, Cali, Colombia).
Rev. Colomb. Fis. (Colombia), vol.15, no.1, p.31-81 (1981). [received: Aug. 1983]
The author shows that the essential physical concepts required in a quantum description of electromagnetism (without magnetic monopoles) have the geometric structure of a connection on a trivial principal fiber bundle. Starting from a brief description of the general principles of quantum mechanics and using the physical notion of non-integrable phase he introduces the Principle of Gauge Invariance and its description according to Fiber Bundle Theory. (30 refs.)

Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School ....See Entry 105034

Slowly rotating fluid spheres in the Einstein-Yukawa theory ....See Entry 105116

Nonlinear electromagnetics in vacuo: gravitational effects ....See Entry 105170

Rigidly rotating charged dust distribution in general relativity ....See Entry 105176

On a class of nonstatic perfect fluid spheres in general relativity ....See Entry 105180

General relativistic axisymmetric rotating systems: coordinates and equations ....See Entry 105181

On a unified theory for interaction and matter fields ....See Entry 105199

Induced Einstein-Maxwell action in Kaluza-Klein theory ....See Entry 105200

The dynamical role of a primordial electromagnetic field in spatially homogeneous, diagonal Bianchi type I-IX cosmologies ....See Entry 111294

04.50 UNIFIED FIELD THEORIES AND OTHER THEORIES OF GRAVITATION

105195 The change of e/m in the five-dimensional theory of gravitation, electromagnetism and scalar field. Yu.S.Vladimirov, V.V.Kislov (Dept. of Theoretical Phys., Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.19-23 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.18-21 (1982).
The authors present the main equations of the unified five-dimensional theory of gravitation, electromagnetism and scalar field. The dependence of the ratio of the electric charge to the mass of a probe particle, on the value of the fundamental scalar field in a given point is discussed. This last quantity is determined by the solution of the system of Einstein, Maxwell and Klein-Fock equations. A formula is derived which describes the change of e/m. Data are presented on the measurement of the Josephson frequency ($\omega_J=2e/h$), which show a dependence on the time of year (the distance from the Earth to the sun), which makes it desirable to carry out direct experiments to test the stability of the ratio e/m. (6 refs.)

105196 Homothetic Killing tensors. G.Prince (School of Theoretical Phys., Dublin Inst. for Advanced Studies, Dublin, Ireland).
Phys. Lett. A (Netherlands), vol.97A, no.4, p.133-6 (22 Aug. 1983).
A vectorfield approach to Killing tensors (KTs) is used to analyse the conventional definition of conformal Killing tensors (CKTs). It is shown that the CKT associated with a KT is removable and that so far as constants of the motion are concerned the homothetic Killing tensor defined here is more useful. A geometric interpretation of CKTs is also given. (5 refs.)

105197 Kaluza-Klein theory over coset spaces. M.A.Awada (Blackett Lab., Imperial Coll., London, England).
Phys. Lett. B (Netherlands), vol.127B, no.6, p.415-18 (11 Aug. 1983).
The author presents a new model of Kaluza-Klein reduction of Einstein theory over an arbitrary space $M_4 \times G/H$ which is a generalization of previous models. It resolves some confusion in the literature and uses techniques which should be applicable for constructing Kaluza-Klein supergravity theories. (8 refs.)

105198 Parallel torsions on Lie groups and spontaneous compactification in Kaluza-Klein theories. C.-H.Tze (Phys. Dept., Yale Univ., New Haven, CT, USA).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.160-4 (25 Aug. 1983).
In d-dimensional Kaluza-Klein theories of gravity coupled to a rank-three fully antisymmetric gauge field, a Freund-Rubin type compactification into a product space of a $(d-r)$ hyperbolic constant curvature spacetime and a compact manifold of a r-parameter semisimple Lie group G_r is achieved. The index-three field takes on the geometrical meaning of the left or right parallelizable torsion of G_r. (23 refs.)

105199 On a unified theory for interaction and matter fields. N.A.Batakis (CERN, Geneva, Switzerland).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.165-8 (25 Aug. 1983).
A unified theory is proposed for the gravitational and electromagnetic fields, as well as matter fields with spin and electric charge, all accommodated into the connection of a Riemann-Cartan space-time. The construction seems to admit a maximal extension, incorporating the electroweak interactions. (9 refs.)

105200 Induced Einstein-Maxwell action in Kaluza-Klein theory. D.J.Toms (Dept. of Phys., Univ. of Wisconsin-Milwaukee, Milwaukee, WI, USA).
Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.31-5 (15 Sept. 1983).
It is shown how quantum corrections due to matter fields on a five-dimensional Kaluza-Klein background can lead to an induced Einstein-Maxwell action in four dimensions. Results are given for the induced cosmological and gravitational constants when scalar and spinor fields are present. (23 refs.)

105201 Spontaneous creation of almost scale-free density perturbations in an inflationary universe. J.M.Bardeen (Dept. of Phys., Univ. of Washington, Seattle, WA, USA), P.J.Steinhardt, M.S.Turner.
Phys. Rev. D (USA), vol.28, no.4, p.679-93 (15 Aug. 1983).
The creation and evolution of energy-density perturbations are analyzed for the 'new inflationary universe' scenario proposed by Linde (1982), and Albrecht and Steinhardt (1982). According to the scenario, the Universe underwent a strongly first-order phase transition and entered a 'de Sitter phase' of exponential expansion during which all previously existing energy-density perturbations expanded to distance scales very large compared to the size of our observable Universe. The existence of an event horizon during the de Sitter phase gives rise to zero-point fluctuations in the scalar field ϕ, whose slowly growing expectation value signals the transition to the spontaneous-symmetry-breaking (SSB) phase of a grand unified theory (GUT). When a fluctuation reenters the horizon (radius$\simeq H^{-1}$) during the Friedmann-Robertson-Walker (FRW) phase that follows the exponential expansion, it has a perturbation amplitude $\delta\rho/\rho|_H=(4 \text{ or } {}^2/_5)H\Delta\phi/\dot{\phi}(t_1)$, where H is the Hubble constant during the de Sitter phase (H^{-1} is the radius of the event horizon), $\dot{\phi}(t_1)$ is the mean value of $\dot{\phi}$ at the time (t_1) that the wavelength of the perturbation expanded beyond the Hubble radius during the de Sitter epoch, $\Delta\phi$ is the fluctuation in ϕ at time t_1 on the same scale, and 4 (${}^2/_5$) applies if the Universe is radiation (matter) dominated when the scale in question reenters the horizon. Scales larger than about 10^{15}-$10^{16} M_\odot$ reenter the horizon when the Universe is matter dominated. Owing to the Sachs-Wolfe effect, these density perturbations give rise to temperature fluctuations in the microwave background which, on all angular scales $\gg 1°$, are $\delta T/T \simeq ({}^1/_5)H\Delta\phi/\dot{\phi}(t_1)$. The value of $\Delta\phi$ expected from de Sitter fluctuations is $O(H/2\pi)$. For the simplest model of 'new inflation', that based on an SU(5) GUT with Coleman-Weinberg SSB, $\dot{\phi}(t_1) \ll H^2$ so that $\delta T/T \gg 1$—in obvious conflict with the large-scale isotropy of the microwave background. One remedy for this is a model in which the inflation occurs when $\dot{\phi}(t_1) \gg H^2$. The authors analyze a supersymmetric model which has this feature, and show that a value of $\delta\rho/\rho|_H \simeq 10^{-4}$-$10^{-3}$ on all observable scales is not implausible. (24 refs.)

Rigidly rotating charged dust distribution in general relativity ....See Entry 105176

Quantum versus gravitational effects in supersymmetric theories ....See Entry 105500

The anthropic principle and the actual size of the Universe ..See Entry 111281

Where has the four dimensionality come from? ....See Entry 111285

Entropy from extra dimensions ....See Entry 111286

04.60 QUANTUM THEORY OF GRAVITATION

105202 Interaction radius and strong gravity. S.Biswas, L.Das, M.Mukhopadhyaya (Dept. of Phys., Univ. of Kalyani, Kalyani, India).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.8, p.877-88 (1983).
The role of interaction radius in the understanding of hadronic interaction is analysed in the light of strong gravity theory. Source with finite extension leads the authors to identify the radius as Schwarzchild radius. 'Hawking miracle' is seen in the light of the authors approach resulting in Regge-like relations and Hagedorn's (1970) hadronic temperature is obtained with correct range of magnitude. Success of various models like geometrodynamics of Preparata (1976) tunneling model of Schrempp and Schrempp (1977) and strong gravity theory of Salami (1975), Wess and Zumino (1979) are understood in the light of the role played by interaction radius. (19 refs.)

105203 Geometrical description of BRS and anti-BRS transformations for the gravitational fields. H.Kikugawa (Lab. of Engng. Oceanography, Univ. of Kagoshima, Kagoshima, Japan), J.Kikugawa.
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1835-6 (June 1983).
The BRS and anti-BRS transformations for the gravitational fields are derived from the heuristic geometrical considerations with the aid of the Hirayama-Hirano (1982) condition. (5 refs.)

Locally Hermit-Einstein, self-dual gravitational instantons ....See Entry 105171

The fibrous space-time structure of the rotating disc ....See Entry 105173

Parallel torsions on Lie groups and spontaneous compactification in Kaluza-Klein theories ....See Entry 105198

Topological geometrodynamics ....See Entry 105457

Quantum versus gravitational effects in supersymmetric theories ....See Entry 105500

04.65 SUPERGRAVITY

105204 Relation between different auxiliary field formulations of $N=1$ supergravity coupled to matter. S.Ferrara, L.Girardello, T.Kugo, A.Van Proeyen (CERN, Geneva, Switzerland).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.1, p.191-217 (15 Aug. 1983).
The authors establish the connection between the old minimal set of auxiliary fields, the new minimal set and the Breitenlohner set (1977) show that the class of interactions which can be described by the latter two sets are particular cases of the interactions described in the old minimal set. The old and new minimal sets of auxiliary fields are equivalent for R-symmetric lagrangians. The precise correspondence of the bosonic part of the lagrangians in the two minimal formulations is exhibited. In particular, this equivalence shows that one can have both a Fayet-Iliopoulos term (1974) and spontaneously broken supersymmetry with vanishing cosmological constant. (23 refs.)

105205 Still on the non-minimal versions of $N=1$ supergravity. V.O.Rivelles (Dept. de Fisica, Univ. Federal da Paraiba, Joao Pessoa, Brazil), J.G.Taylor.
J. Phys. A (GB), vol.16, no.13, p.3019-22 (11 Sept. 1983).
The authors show that a recently found non-minimal version of $N=1$ Poincare supergravity with (28+28) degrees of freedom is reducible to the non-minimal Breitenlohner set, in agreement with an earlier result that there exist

at most five irreducible versions with auxiliary fields of spin up to one. (17 refs.)

105206 On the reducibility of the new non-minimal sets of auxiliary fields for $N=1$ supergravity. V.O.Rivelles (Dept. de Fisica, Univ. Federal da Paraiba, Joao Pessoa, Brazil), J.G.Taylor.
J. Phys. A (GB), vol.16, no.13, p.3023-5 (11 Sept. 1983).
If a new criterion of reducibility for auxiliary field sets is employed, the authors show that the two new non-minimal sets for $N=1$ supergravity are reducible. (16 refs.)

105207 An irreducible representation of $N=4$ SUSY with two central charges. G.R.J.Bufton, J.G.Taylor (Dept. of Maths., King's Coll., London, England).
J. Phys. A (GB), vol.16, no.13, p.3027-35 (11 Sept. 1983).
Using a method of dimensional reduction from an on-shell multiplet in ten space-time dimensions the authors give the supersymmetry transformation laws of a general irreducible representation of $N=4$ SUSY with central charges present. With more than one central charge an extra condition is used to give a finite number of components and they give the field transformations and Lagrangian for the case of two central charges. (17 refs.)

105208 The spectrum of multiplets with two off-shells central charges. D.Gorse (Dept. of Phys., Queen Mary Coll., London, England), A.Restuccia, J.G.Taylor.
J. Phys. A (GB), vol.16, no.13, p.3037-47 (11 Sept. 1983).
The authors analyse the spectrum of multiplets with two central charges which vanish on-shell, and show that the general spin-reducing constraint still leaves an infinite number of propagating modes of the same mass. They perform an analysis by deriving field equations from actions involving integration over the central charge dimensions. The implications of the results for bypassing the $N=3$ barrier are briefly considered. (26 refs.)

105209 Some new extrema of the scalar potential of gauged $N=8$ supergravity. N.P.Warner (California Inst. of Technol., Pasadena, CA, USA).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.169-73 (25 Aug. 1983).
Five new critical points are found for the scalar potential of gauged $N=8$ supergravity. These comprise a complete list of all the extrema which induce a symmetry breaking of SO(8) to some smaller group containing SU(3). Possible relationships between solutions based on these extrema and dimensional reduction schemes are suggested. One of the new extrema may have phenomenological significance since it breaks SO(8) to SU(3)×U(1) and has gauged $N=2$ supersymmetry. (13 refs.)

105210 The ghost spectrum of supergravity is not OSp(4/2) supersymmetric. J.Thierry-Mieg (Groupe d'Astrophys. Relativiste, CNRS, Obs. de Meudon, Meudon, France).
Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.36-8 (15 Sept. 1983).
All spinorial representations of OSp(m,n) have vanishing superdimension. Therefore, in contradistinction with the theories of Yang-Mills, gravitation and gauge tensors, the Faddeev-Popov ghost spectrum of supergravity is not OSp(4,2) supersymmetric. (15 refs.)

105211 Compactification of $d=11$ supergravity on $K3\times T^3$. M.J.Duff, B.E.W.Nilsson, C.N.Pope (Center for Theoretical Phys., Univ. of Texas, Austin, TX, USA).
Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.39-42 (15 Sept. 1983).
When $d=11$ supergravity spontaneously compactifies to $d=4$, the number of unbroken supersymmetries, $0\leq N\leq 8$, is determined by the holonomy group, $\mathcal{H}$, of the $d=7$ ground-state connection. The authors present a new solution: Minkowski spacetime$\times K3\times T^3$, for which $\mathcal{H}=SU(2)$ and $N=4$. The massless sector in $d=4$ is given by $N=4$ supergravity coupled to 22 $N=4$ vector multiplets. Aside from its intrinsic interest, this example throws new light on Kaluza-Klein supergravity. In particular, they note that the 192+192 massless degrees of freedom obtained from $K3\times T^3$ exceed the 128+128 of the $N=8$ theory obtained from T^7 or S^7. (14 refs.)

Kaluza-Klein theory over coset spaces ....See Entry 105197

The axial anomaly and anti-symmetric tensor fields .... See Entry 105451

Quantum versus gravitational effects in supersymmetric theories ....See Entry 105500

04.80 EXPERIMENTAL TESTS OF GENERAL RELATIVITY AND OBSERVATIONS OF GRAVITATIONAL RADIATION

105212 The limiting accuracy of measurement of the second derivatives of the gravitational potential. V.S.Nazarenko (P.K. Shternberg State Astron. Inst., Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.29-35 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.26-32 (1982).
The author considers the static, dynamic and modulation methods of measurement of the second derivatives of the gravitational potential by using a high-quality mass-quadrupole oscillator. It is assumed that the useful signal is masked by the noise of the displacement indicator, or by the Brownian oscillations of the oscillator. Algorithms are presented for the analysis of the output signals which correspond to the method of maximum of a probability function, and formulae are obtained for the dispersion of estimates of the second derivatives of the potential, i.e. for the instrumental and thermal limits of accuracy of various methods of measurements. (3 refs.)

105213 Interferometric detectors for gravitational radiation. R.W.P.Drever (California Inst. of Technol., Pasadena, CA, USA).
Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School, France, 2-21 June 1982 (Amsterdam, Netherlands: North-Holland 1983), p.321-38
Most of the experiments aimed at the detection of gravitational radiation carried out to date have employed resonant bar gravity wave detectors, in which changes in longitudinal vibration of a suspended metal bar, due to the apparent differential action of the gravity wave on the material towards the ends of the bar, are sought. An alternative approach, in which changes in the relative motions of two or more widely separated and nearly free test masses are monitored using laser interferometry, is now being developed in several laboratories. The authors outline some of the principles and ideas behind these laser interferometer gravitational wave detectors, and also some possibilities for further development of these techniques which seem interesting for future experiments. (15 refs.)

105214 Resonant bar detectors for gravitational waves. D.G.Blair (Dept. of Phys., Univ. of Western Australia, Nedlands, Australia).
Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School, France, 2-21 June 1982 (Amsterdam, Netherlands: North-Holland 1983), p.339-85
The author presents the work done so far, the methods, the problems and prospects, as applied to the present generation of cryogenic 'Weber bar' antennae for gravitational waves. (49 refs.)

105215 Gravitational antennae Weber type: the problem of high sensitivity. V.B.Braginsky (Dept. of Phys., Moscow State Univ., Moscow, USSR).
Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School, France, 2-21 June 1982 (Amsterdam, Netherlands: North-Holland 1983), p.387-98
The author describes the main problems, which are to be solved to realize very sensitive gravitational antenna of Weber type, to estimate the level of sensitivity which may be obtained within a few years, basing on the program developed in the Department of Physics at Moscow State University. (28 refs.)

105216 The low temperature gravitational wave detector at Stanford University. P.F.Michelson (Phys. Dept., Stanford Univ., Stanford, CA, USA).
Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School, France, 2-21 June 1982 (Amsterdam, Netherlands: North-Holland 1983), p.465-74
The sensitivity of a 4800 kg cryogenic resonant mass gravitational radiation detector operated at Stanford University is discussed. The RMS noise level at the output of the detector corresponds to a dimensionless strain sensitivity of 10^{-18}. The observed noise level has been used to establish a new observational upper limit on the flux of 1 kHz gravity wave bursts. (19 refs.)

105217 Discussion on optical detectors of gravitational radiation. A.Brillet (Lab. de l'Horloge Atomique, Faculte des Sci., Orsay, France), P.Tourrenc.
Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School, France, 2-21 June 1982 (Amsterdam, Netherlands: North-Holland 1983), p.475-84
In the prospect of defining a project for building a gravitational wave antenna in France, the authors report on a preliminary study consisting in the comparison between active and passive interferometers and in the evaluation of a 'spectroscopic' detection technique. They discuss the design of a wideband antenna whose sensitivity would be large enough to detect gravitational bursts resulting from star collapses as far as the Virgo cluster. According to the available theoretical estimates, these events would produce gravitational waves of amplitude $h=310^{-21}$ to 310^{-24} Hz$^{-1/2}$ on earth, with a spectrum extending from 0 to a few KHz. They take a pessimistic value $h=310^{-24}$ Hz$^{-1/2}$ as a basis for the following discussion. At first sight active devices display less problems in optics and electronics than the passive ones. But, on the other hand, extra noises arise from the medium. An accurate analysis is necessary to know whether these extra noises are negligible or not. They summarize this analysis. They also consider a spectroscopic detector of gravitational radiations. In such an antenna, several difficulties displayed by interferometers do not appear (seismic isolation, laser frequency stability). A proposal was made a few years ago and is still discussed. Unfortunately it was not completely convincing on the theoretical level, moreover no analysis was performed of the signal to noise ratio. The authors study the question and give a conclusion concerning earth bound experiments. (13 refs.)

105218 Electromagnetically-tracked free-mass gravitational wave antennas. R.W.Hellings (Jet Propulsion Lab., Pasadena, CA, USA).
Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School, France, 2-21 June 1982 (Amsterdam, Netherlands: North-Holland 1983), p.485-93
The response to a gravitational wave of two free masses whose relative motion is monitored with an electromagnetic tracking signal is derived. The results indicate a two-feature signature in one-way data and a three-feature signature in two-way data. The effect is applied to gravitational wave experiments using laser interferometers, spacecraft Doppler tracking, planetary ranging, and pulsar timing analysis. Actual results are presented from spacecraft Doppler experiments and from pulsar timing data analysis, with new upper limits being set on a possible cosmic gravitational wave background via the pulsar data. (5 refs.)

105219 A simple linear model for gravity wave detector analysis. W.G.Unruh (Dept. of Phys., Univ. of British Columbia, Vancouver, BC, Canada).
Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School, France, 2-21 June 1982 (Amsterdam, Netherlands: North-Holland 1983), p.495-503
A simple linear model for a gravity wave detector and readout system is presented. This model, using a massless scalar field in one dimension as the readout system, contains the essential feature of giving the readout system an infinite number of degrees of freedom, is exactly solvable in the Heisenberg representation and demonstrates quantum non-demolition measurement by readout state preparation. (6 refs.)

Contractive states and the standard quantum limit for monitoring free-mass positions ....See Entry 105157

05.00 STATISTICAL PHYSICS AND THERMODYNAMICS

(see also 02.50 Probability theory, stochastic processes, and statistics)

05.20 STATISTICAL MECHANICS

105220 Broken ergodicity. R.G.Palmer (Dept. of Phys., Duke Univ., Durham, NC, USA).
Adv. Phys. (GB), vol.31, no.6, p.669-735 (Nov.-Dec. 1982). [received: Sept. 1983]
The breakdown of ergodic behaviour is discussed as a general phenomenon in condensed matter physics. Broken symmetry is a particular case of this broken ergodicity. In a system that is nonergodic on physical timescales the phase point is effectively confined in one subregion or component of phase space. Theoretical treatments of such systems should compute thermal averages over one component at a time. The probability distribution of physical properties can then be obtained from occurrence probabilities for different components, and moments of these distributions may be used for predicting

the results of typical measurements. A two-level statistical mechanics is therefore proposed. Various aspects of the breakdown of ergodicity are discussed, including: the definition of components; mechanisms for the confinement of components; methods for computing the properties of one component; the choice of occurrence probabilities for different components; and average thermodynamic properties of broken ergodicity systems. The theory is illustrated by application to well-understood systems. It is also applied to the spin glass, which is reviewed in some detail. The broken ergodicity viewpoint is combined with a suggested characterization of the components in a spin glass, involving a bifurcation cascade. Together these provide a qualitative explanation for the irreversibility signature, the long time decays, the apparent failure of linear response theory and Maxwell relations and blocking. (106 refs.)

105221 Rigorous calculation of the microcanonical distribution function for the nonintegrable Barbanis Hamiltonian. R.Caboz, P.Poletti (Inst. Univ. de Recherche Sci., Pau, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.21, p.1633-6 (13 June 1983). In French.
The authors give for the nonintegrable Barbanis (1966) hamiltonian the microcanonical distribution function Z expressed in the form of a hypergeometric function of Gauss. Generalizing the above result the microcanonical mean of $q_1^{\alpha}q_2^{\beta}p_1^{\gamma}p_2^{\delta}$($\alpha$, β, γ and δ integers ≥ 0) as a ratio of two hypergeometric functions is obtained. This led the authors to transform the invariant $H=E$ into an identity between five hypergeometric functions. (15 refs.)

105222 Hamiltonian formulation of the evolution of movements over clusters of noninteracting particles. M.Andrews (Dept. of Theoretical Phys., Australian Nat. Univ., Canberra, Australia).
J. Phys. A (GB), vol.16, no.13, p.2961-6 (11 Sept. 1983).
The study of the evolution of the moments over a cluster of identical classical particles without mutual interactions is extended to the case where the motion of each particle is described by an arbitrary Hamiltonian. In the case of moments of the second and third order and ignoring contributions from moments higher than the third, differential equations are derived for the moments as well as explicit expansions. A distinction is made between the evolution of moments relative to the centroid and that of moments relative to a particle with initial position and velocity equal to those of the centroid. Although the former moments are more directly applicable and are independent of the choice of initial time, the latter have formal advantages. It is shown that these two types of moments differ in terms of order not less than four. (5 refs.)

105223 Field-theoretic study of the nonlinear Fokker-Planck equation. A.Munoz Sudupe, R.F.Alvarez-Estrada (Dept. de Fisica Teorica, Facultad de Ciencias Fisicas, Univ. Complutense, Madrid, Spain).
J. Phys. A (GB), vol.16, no.13, p.3049-64 (11 Sept. 1983).
A new field-theoretic formulation of the Fokker-Planck approach to nonequilibrium statistical mechanics is presented. Starting with the nonlinear functional Fokker-Planck equation, a new generating functional is derived. No use of auxiliary conjugate fields or response functions is needed. The Feynman rules are deduced, and the renormalisation of the theory is carried out. Finally, the renormalisation group equation is solved, and scaling laws and critical exponents are calculated, which are in good agreement with previous results obtained through different formalisms. (22 refs.)

105224 Algebraic invariants in soluble models. M.T.Jaekel (Lab. de Phys. Theorique, Ecole Normale Superieure, Paris, France), J.M.Maillard.
J. Phys. A (GB), vol.16, no.13, p.3105-17 (11 Sept. 1983).
Exhibits, on the known solutions of the triangle relation for the exactly solved models, some simplifying methods of recovering their parametrisation in terms of algebraic varieties. The relation to the automorphy group, generated by the inverse and spatial symmetries of the model, is also analysed. (19 refs.)

105225 Periodicity of classical ground states. C.Radin (Math. Dept., Univ. of Texas, Austin, TX, USA), L.S.Schulman.
Phys. Rev. Lett. (USA), vol.51, no.8, p.621-2 (22 Aug. 1983).
A model of classical particles in one space dimension with an elementary length and general finite-range interaction with hard core is considered. It is shown that such a model must have a periodic ground state. (18 refs.)

105226 On various approaches to macrodescription based on the Fokker-Plank equation. M.Yu.Tseitlin.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1251-6 (Aug. 1983). In Russian.
The Fokker-Plank equation is used as an evolution equation for the microscopic distribution function, which makes it possible to analyze in detail many suppositions of the theory of irreversible processes. (9 refs.)

Statistical mechanics of nonlinear hydrodynamic fluctuations .... See Entry 105118

On the $e^{-\alpha t}$ damping of the coherent memory functions ....See Entry 105282

Statistical mechanics of two-dimensional vortex fluids or guiding center plasmas .... See Entry 105291

Dynamic scaling law for a first-order phase transition ....See Entry 105294

Thermodynamics of hard dumbell mixtures ....See Entry 107987

05.30 QUANTUM STATISTICAL MECHANICS

(see also 67. Quantum fluids, and 71. Electron states in condensed matter)

105227 On the relativistic partition function of ideal gases. Yu.M.Sinyukov (State Standards Committee, Moscow, USSR).
Phys. Lett. B (Netherlands), vol.127B, no.6, p.443-7 (11 Aug. 1983).
The covariant partition function method for ideal Boltzmann and Bose gases is developed within quantum field theory. This method is a basis to describe the statistical and thermodynamical properties of the gases in canonical, grand canonical and pressure ensembles in an arbitrary inertial system. It is shown that when statistical systems are described relativistically it is very important to take into account the boundary conditions. This is due to the fact that an equilibrium system is not closed mechanically. The results may find application in hadron physics. (10 refs.)

105228 New approach to the one-particle Green's function for finite Fermi systems. J.Schirmer, L.S.Cederbaum, O.Walter (Lehrstuhl fur Theoretische Chem., Univ. Heidelberg, Heidelberg, Germany).
Phys. Rev. A (USA), vol.28, no.3, p.1237-59 (Sept. 1983).
A new approach to the one-particle Green's functions $\underline{G}$ for finite electronic systems is presented. This approach is based on the diagrammatic perturbation expansions of the Green's function and of the dynamic self-energy part $\underline{M}$ related to $\underline{G}$ via the Dyson equation. The exact summation of the latter expansion is reformulated in terms of a simple algebraic form referred to as algebraic diagrammatic construction (ADC). The ADC defines in a systematical way a set of approximation schemes (*n*th-order ADC schemes) that represent infinite partial summations for $\underline{M}$ and (via the Dyson equation) for $\underline{G}$ being complete through *n*th order or perturbation theory. The corresponding mathematical procedures are essentially Hermitian eigenvalue problems in restricted configuration spaces of unperturbed ionic configurations. Explicit equations for the second-, third-, and fourth-order ADC schemes are derived and analyzed. While the second- and third-order schemes can be viewed as systematic rederivations of previous approximation schemes, the fourth-order ADC scheme represents a complete fourth-order approximation for the self-energy and the one-particle Green's function which was hitherto not available. (37 refs.)

105229 Quantum statistics of parametric oscillation. K.J.McNeil (Dept. of Phys., Univ. of Auckland, Auckland, New Zealand), C.W.Gardiner.
Phys. Rev. A (USA), vol.28, no.3, p.1560-6 (Sept. 1983).
The authors present a quantum-statistical analysis of the steady-state light fields in driven parametric oscillation in a cavity. Using the solution of a Fokker-Planck equation for the generalized *P* representation of the signal and idler modes, they calculate the mean photon numbers, second-order correlation functions, and intermode correlation function as functions of the driving field. The generalized *P* distribution describes the signal and idler modes' statistics over the whole range of driving-field strengths except in the region far below the oscillation threshold. The second-order correlation functions are found to violate the Cauchy-Schwartz inequality, a violation allowed because the *P* distribution is complex. Squeezing is also found in a linear combination of the signal and idler fields. (20 refs.)

105230 Renormalization theory of the interacting Bose fluid. R.J.Creswick, F.W.Wiegel (Dept. of Appl. Phys., Twente Univ. of Technol., Enschede, Netherlands).
Phys. Rev. A (USA), vol.28, no.3, p.1579-86 (Sept. 1983).
The authors derive an approximate closed form for the infinitesimal generator of the renormalization group for the interacting Bose fluid. The Bose-condensed phase is treated by the method of Bogoliubov, and a simple scaling law is found for the condensate density. It is shown that the quantum-mechanical features are irrelevant close to the λ line. This is demonstrated by calculating the critical behavior in $4-\epsilon$ dimensions to order ϵ. (21 refs.)

105231 Model for relativistic Bose systems in *d* dimensions. V.V.Dixit (Dept. of Phys., Univ. of the West Indies, Kingston, Jamaica), D.E.Miller.
Phys. Rev. A (USA), vol.28, no.3, p.1709-16 (Sept. 1983).
The authors consider a model for the relativistic Bose gases with certain forms of the energy spectra in *d* spatial dimensions. First they discuss how some of the effects of the interactions can be brought into the energy spectra for independent particles. The thermodynamical properties arising from the energy spectra are calculated with particular attention to the spatial dependence of Bose-Einstein condensation. Then the authors explicitly interpret some special cases of the energy spectra through Fourier transformation to the usual coordinate-dependent potentials. (16 refs.)

105232 Scaling and universality of thermodynamics and correlations of an ideal relativistic Bose gas with pair production. S.Singh, P.N.Pandita (Dept. of Phys., North-Eastern Hill Univ., Shillong, Meghalaya, India).
Phys. Rev. A (USA), vol.28, no.3, p.1752-61 (Sept. 1983).
An ideal relativistic Bose-gas model with pair production is solved exactly in *d* dimensions. The critical behaviour is shown to be the same as the usual nonrelativistic Bose gas. Scaling functions (including nonuniversal parameters) for the equation of state and the correlation functions are obtained in a closed form. The scale-factor universality is verified by the formation of the expected universal ratios. Various limiting cases of the model depending on the relative magnitudes of the three basic length scales, i.e. Compton wavelength, thermal wavelength, and interparticle distance are discussed. In these limiting cases, previously known results are recovered, wherever these are available. (24 refs.)

105233 Holstein-Primakoff theory for many-body systems. L.R.Mead, N.Papanicolaou (Dept. of Phys., Washington Univ., St. Louis, MO, USA).
Phys. Rev. B (USA), vol.28, no.3, p.1633-6 (1 Aug. 1983).
The authors discuss the relationship between generalized coherent states and suitable extensions of the Holstein-Primakoff theory of quantum spin systems illustrating the common origin of a variety of semiclassical approximation schemes encountered in many-body theory. (14 refs.)

Stochastic quantization method in operator formalism ....See Entry 105244

Localization-delocalization transition by interactions in one-dimensional fermion systems .... See Entry 108353

On the quantum statistics of Brillouin scattering ....See Entry 108961

Statistical mechanics of light elements at high pressure. V. Three-dimensional Thomas-Fermi-Dirac theory .... See Entry 110880

05.40 FLUCTUATION PHENOMENA, RANDOM PROCESSES, AND BROWNIAN MOTION

105234 Stochastic Korteweg-de Vries equation. M.Wadati (Inst. of Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2642-8 (Aug. 1983).
The Korteweg-de Vries equation with external noise is studied. It is shown that a soliton under Gaussian noise satisfies a diffusion equation in transformed coordinates. The deformation of the soliton during propagation is explicitly obtained. The phenomenon is designated as the diffusion of the soliton.

105235 Stochastic solution method of the master equation and the model Boltzmann equation. K.Nanbu (Inst. of High Speed Mech., Tohoku Univ., Sendai, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2654-8 (Aug. 1983).
The author describes the stochastic solution method of two integro-differential equations for probability density; one is the master equation appearing in the theory of stochastic processes and the other is the Kac model of the Boltzmann equation. The basic idea of the method is in that a set of mutually independent random variables sampled from the probability density can take the place of the role of the probability density function. A few examples are calculated. When the exact solution is known, it is ascertained that the solution obtained from the stochastic solution method agrees with the exact solution.

105236 Note on a paper by G. Rowlands [chaotic trajectories of ordinary differential equations]. A.C.Fowler (Dept. of Math., MIT, Cambridge, MA, USA).
J. Phys. A (GB), vol.16, no.13, p.3139-43 (11 Sept. 1983).
This note discusses the possible use of perturbation methods in studying chaotic trajectories of ordinary differential equations, with particular focus on a recent paper on this topic by Rowlands (ibid., vol.16, p.585, 1983). (24 refs.)

105237 Radiation balance and the stochastic Van der Pol-Duffing equation. S.M.Moore (Dept. de Fisica, Univ. de los Andes, Bogota, Colombia).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.14, p.490-4 (6 Aug. 1983).
The Van der Pol-Duffing equation with additive Gaussian noise is treated as a radiation problem by equating the noise with a stochastic electromagnetic field. If one defines the free spectrum of this field to be that for which the anharmonic terms are zero, then the hypothesis of radiation balance forces a change in the free spectrum. The magnitude of this change to first-order in the anharmonic coupling constant is calculated. (6 refs.)

105238 An integral of the triplet distribution function of a simple fluid in thermal equilibrium. B.U.Felderhof (Inst. fur Theoretische Phys., Rheinisch-Westfaelisches Tech. Hochschule Aachen, Aachen, Germany).
Physica A (Netherlands), vol.120A, no.1-2, p.103-15 (1983).
The author derives some properties of the triplet distribution function of a simple fluid in thermal equilibrium. The exact second equation of the Yvon-Born-Green hierarchy is used to express a wavenumber-dependent integral of the triplet distribution function in terms of the pair-correlation function. The integral is studied in some detail for a system of hard spheres. It is shown that there is a simple relation to the effective diffusion coefficient of a suspension of interacting Brownian particles. (17 refs.)

105239 Approximate solution methods for linear stochastic difference equations. II. Inhomogeneous equations, multi-time averages, biological application. J.B.T.M.Roerdink (Inst. for Theoretical Phys., Utrecht, Netherlands).
Physica A (Netherlands), vol.120A, no.1-2, p.153-77 (1983).
For pt.I see ibid., vol.119, p.455 (1983). The cumulant expansion for linear stochastic difference equations introduced in part I is applied to the general case, where the equation contains multiplicative, additive and initial value terms which are all random and statistically interdependent. Also the two-time correlation functions of the solution are discussed. Finally the expansion for the probability density functions is studied. In the case that the coefficient matrix constitutes a Markov process, an exact equation for the joint probability density function of the solution of the difference equation and the random coefficient matrix is derived. From this equation the moments of the solution can be obtained in a simple way. As an application the author considers the growth of a biological population with two age classes in a random environment, which itself is modelled by a two-state Markov chain. The exact results are compared with those of the cumulant expansion and with previous findings of Tuljapurkar. (10 refs.)

105240 Behaviors of generalized random walks. The model and its evaluations. H.Hara, H.Sato (Dept. of Engng. Sci., Tohoku Univ., Sendai, Japan).
Physica A (Netherlands), vol.120A, no.1-2, p.351-66 (1983).
Behaviors of the generalized random walks (GRW) are directly studied by using a computer. The GRW have a nonlinear term yielding a nonMarkovian character. The nonMarkovian character represents memory effects in the processes through the jumping probabilities $\tilde{P}_N^{\alpha}(m|m-\alpha 1)$ between sites $m-\alpha 1$ and m at Nth step. In the computations, the probability that the walker starting at origin arrives at site m after N steps, $W(m,N)$, is plotted by varying three parameters. The three parameters specify the jumping probabilities and the memory effects. Furthermore, the $\tilde{P}_N^{\alpha}(m|m-\alpha 1)$s are numerically evaluated from the $W(m,N)$. The $W(m,N)$ is compared with the corresponding probability density $w(x,t)$ obtained by taking the continuous limit. (19 refs.)

105241 Random walks on pseudo-lattices. B.D.Hughes, M.Sahimi, H.T.Davis (Dept. of Chem. Engng. & Materials Sci., Univ. of Minnesota, Minneapolis, MN, USA).
Physica A (Netherlands), vol.120A, no.1-2, p.515-36 (1983).
The problem of a Polya (unbiased, nearest-neighbor stepping) random walk is solved for several pseudo-lattices related to the Bethe lattice (Cayley tree). In each case, the solution is derived by projecting the walk on a pseudo-lattice onto a walk on a linear chain with internal states and a point defect. Random walk statistics exhibited explicitly include the probability of return to the starting point, the mean time to return if return does occur, and the asymptotic behaviour of the expected number of distinct sites visited in a walk of long duration. Conjectured relationships between random walk statistics and percolation theory are discussed in the context of pseudo-lattices. (18 refs.)

105242 On the spectral properties of dynamical systems in the transition region from order to chaos. V.V.Beloshapkin, G.M.Zaslavskii (L.V. Kirenskii Inst. of Phys., Acad. of Sci., USSR).
Phys. Lett. A (Netherlands), vol.97A, no.4, p.121-4 (22 Aug. 1983).
Computer and qualitative analyses lead both to the formula for the frequency spectrum width and the central peak occurrence in the region of transition from order to chaos for a standard mapping system. (13 refs.)

105243 The time scale of Monte Carlo experiments. U.Larsen (Phys. Lab. I, H.C. Orsted Inst., Univ. of Copenhagen, Copenhagen, Denmark).
Phys. Lett. A (Netherlands), vol.97A, no.4, p.147-9 (22 Aug. 1983).
The time required to reach equilibrium in a standard Monte Carlo experiment is estimated on the basis of exact bounds on the longest time scale in one-dimensional models. The result implies the empirical law of Arrhenius at low temperatures if there are energy barriers. (5 refs.)

105244 Stochastic quantization method in operator formalism. M.Namiki, Y.Yamanaka (Dept. of Phys., Waseda Univ., Tokyo, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1764-93 (June 1983).
The stochastic quantization method is developed in a possible 'Heisenberg' operator theory of stochastic processes. The general theory is first formulated for stochastic processes of the Wiener type and then its application to quantization of boson fields is presented. It seems that the operator formalism is convenient to examine implications of the stochastic quantization method. Within the theoretical framework the authors develop the 'Feynman-Dyson' approach to field propagators in the perturbation theory. This approach enables one to simplify and systematize practical calculations in comparison with the Langevin equation method. They formulate the Green function approach to field propagators using the characteristic functional. (6 refs.)

105245 Doubling of torus. K.Kaneko (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1806-10 (June 1983).
'Doubling of torus' is found in three- or four-dimensional dissipative mappings. In these models, doubling occurs only a finite number of times before chaos appears. An explanation is attempted by a numerical study on the stability against perturbation of the direct product state of coupled logistic and torus maps. (15 refs.)

105246 Origin of long-time tails in strongly chaotic systems. F.Vivaldi (School of Phys., Georgia Inst. of Technol., Atlanta, GA, USA), G.Casati, I.Guarneri.
Phys. Rev. Lett. (USA), vol.51, no.9, p.727-30 (29 Aug. 1983).
The behavior of autocorrelation functions in a K system (the stadium billiard) is studied, and the existence of long-time tails is demonstrated both analytically and numerically. The tails are shown to depend on the presence of arbitrary long segments of regular motion in the time evolution of the stochastic orbits. It is surmised that an analogous mechanism might be responsible for long-time tails in a large class of systems. (10 refs.)

105247 Dynamic scaling function for critical fluctuations in classical fluids. H.C.Burstyn, J.V.Sengers, J.K.Bhattacharjee, R.A.Ferrell (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1567-78 (Sept. 1983).
A closed-form approximant is proposed for the dynamic scaling function that characterizes the behavior of the wave-number-dependent diffusion of the order-parameter fluctuations in a fluid near a critical point. The expression contains two parameters that determine the expected behavior of the diffusion coefficient in the hydrodynamic and in the nonlocal critical limits. The proposed scaling function yields an accurate representation of the authors' recent experimental data for the 3-methylpentane and nitroethane mixture near the critical mixing point with parameter values that are in good agreement with the values predicted from theory. (53 refs.)

105248 Universal scaling property in bifurcation structure of Duffing's and of generalized Duffing's equations. S.Sato, M.Sano, Y.Sawada (Res. Inst. of Electrical Communication, Tohoku Univ., Sendai, Japan).
Phys. Rev. A (USA), vol.28, no.3, p.1654-8 (Sept. 1983).
Computer calculation for the numerical solution of Duffing's and generalized Duffing's equations shows global scale properties for the bifurcation in parameter space. These scaling properties are discussed in terms of a one-dimensional map. The analysis based on a piecewise linear approximation gave results in good agreement with the experimentally observed scaling behavior. (17 refs.)

105249 Instability and irregular behavior of coupled logistic equations. Jian-Min Yuan, Mingwhei Tung, Da Hsuan Feng, L.M.Narducci (Dept. of Phys. & Atmospheric Sci., Drexel Univ., Philadelphia, PA, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1662-6 (Sept. 1983).
The authors analyze some general features of two models of coupled logistic equations. They find that, for selected values of the three control parameters, chaotic patterns may emerge out of an infinite sequence of period-doubling bifurcations. However, there exist large regions of control-parameter space where the approach to irregular behavior appears to be consistent with the Newhouse-Ruelle-Takens scenario, as evidenced by the appearance of two characteristic frequencies. As the ratio of these frequencies is varied, by changing the control parameters, phase locking and quasiperiodic motion are observed on the way to chaos. (8 refs.)

105250 Exact solution of some discrete stochastic models with chaos. R.Graham (Fachbereich Phys., Univ. Essen, Essen, Germany).
Phys. Rev. A (USA), vol.28, no.3, p.1679-91 (Sept. 1983).
A class of two-dimensional maps with sensitive dependence on initial conditions introduced by Kaplan and Yorke (1979) is studied, including the influence of external noise. Exact solutions of the stochastic equations of motion are obtained and used to calculate moments, correlation functions and probability densities. The relation of the steady-state probability density and the attractor of the maps is considered. The models are also used to test the applicability of other methods of solution from the theory of stochastic processes. (10 refs.)

105251 Crossover in diffusion-limited aggregation. M.Nauenberg (Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA), R.Richter, L.M.Sander.
Phys. Rev. B (USA), vol.28, no.3, p.1649-51 (1 Aug. 1983).
The authors consider a generalization of the Witten-Sander model for aggregation to allow for a finite density of diffusing particles. In a continuum treatment they show that for small aggregates they recover the previous behavior that the density of the aggregate decreases inversely with the radius, but larger aggregates cross over to having constant density. Their results are in qualitative agreement with numerical simulations of the discrete model. (8 refs.)

105252 A time-dependent stochastic model of spatial interaction: model framework and properties. R.Kitamura (Dept. of Civil Engng., Univ. of California, Davis, CA, USA), M.Hioki.
Takenaka Tech. Res. Rep. (Japan), no.29, p.89-98 (May 1983).
The study presents a stochastic process model that introduces the following two basic aspects of urban travel behaviour into spatial interaction analysis: time constraints that govern tripmakers' travel choices, and the linkages among trips made by a tripmaker. The model, which is a modification and extension of the Markov-renewal process model, allows the probability of interzonal interaction to vary as a function of time, thus incorporating the temporal factors that affect the tripmakers' spatial choices. The Markovian model structure also allows the representation of travel behaviour as a path in the time-space dimension that may involve series of linked trips. (7 refs.)

Stochastic processes and the evolution of quantum observables ....See Entry 105156

Path-length dependent flux from random walk theory ....See Entry 105272

Laser phase and amplitude fluctuations in the fluorescent Dicke model ....See Entry 106737

Period-doubling cascade in the Rayleigh-Benard convection ...See Entry 107145

Stochastic model of the crystal growth. I. Theory and basic properties ....See Entry 109130

05.50 LATTICE THEORY AND STATISTICS; ISING PROBLEMS

(see also 75.10H Ising models)

105253 On the phase transition of the random bond Ising model. W.F.Wolff, J.Zittartz (Inst. fur Theoretische Phys., Univ. zu Koln, Koln, Germany).
Z. Phys. B (Germany), vol.52, no.2, p.117-26 (1983).
The random bond Ising model on a d-dimensional hypercubic lattice with nearest-neighbour couplings K and impurity couplings aK is studied by expanding the quenched averaged free energy for small concentration p of the impurities. The critical temperature and the leading singular terms of the free energy are calculated up to second order in p for arbitrary interaction parameters a. In two dimensions where the pure, $p=0$, Ising model is soluble the authors obtain explicit expressions for all relevant quantities in the expansion. The phase diagram is qualitatively different if the system contains frustration or not, i.e. if $a<0$ or $a>0$. The specific form of the leading singularities of the free energy leads to a conjecture for the scaling function which describes the crossover from the pure Ising case to the random bond model and determines the critical behaviour. This scaling function is universally the same for all impurity concentrations and independent of the particular value of the interaction parameter a. This means that it is only the disorder which universally determines the critical behaviour, i.e. the type of phase transition, while frustration ($a<0$) is very effective in reducing critical temperatures and

in destroying ordered phases, but does not change the situation qualitatively as compared with the non-frustrated case $a>0$. (31 refs.)

105254 Mean-field limits of the quantum Potts model. A.Cant, P.A.Pearce (Dept. of Theoretical Phys., Res. School of Phys. Sci., Australian Nat. Univ., Canberra, Australia).
Commun. Math. Phys. (Germany), vol.90, no.3, p.373-87 (1983).
The authors consider the q-component quantum Potts model on a d-dimensional cubic lattice with symmetry breaking and transverse fields. The model is solved exactly in two special limiting cases: 1) the infinite lattice-dimensionality ($d\to\infty$) limit and 2) the limit of infinitely-weak long-range interactions of Kac type. In each case the resulting free energy and its first partial derivatives (order parameters) are shown to be identical to the corresponding mean-field expressions. (24 refs.)

105255 Modulated structure of an Ising spin system on a triangular lattice. II. Complete devil's staircase. K.Nakanishi (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2449-58 (July 1983).
A study is made on an Ising spin system on a triangular (actually hexagonal) lattice which contains the couplings of the nearest neighbor (J_1) and the next-nearest neighbor ($J_2<0$: antiferromagnetic). A mean field approximation is employed. Infinite numbers of higher-order commensurate structures with one-dimensional modulation are shown to be stabilized at finite temperatures. Analytic calculations are performed at low temperatures to find that the model exhibits a complete devil's staircase at $J_1\gtrsim0$ and ordinary staircases with infinite steps at $J_1\lesssim0$ and $J_1\lesssim2|J_2|$. It is shown that most of the phases stabilized around $J_1=0$ are partially disordered states. Numerical calculations are also made to construct a global phase diagram. The structure of the phase diagram is discussed in terms of domain boundary. In this context the order-disorder transition of $(Nb_{1-x}Ta_x)_2C$ is compared with the theory.

105256 A fast processor for Monte-Carlo simulation. R.B.Pearson (Inst. fur Theoretical Phys., Univ. of California, Santa Barbara, CA, USA), J.L.Richardson, D.Toussaint.
J. Comput. Phys. (USA), vol.51, no.2, p.241-9 (Aug. 1983).
A special purpose processor for Monte-Carlo simulation of the three-dimensional Ising model is described. This device performs the Monte-Carlo updating algorithm on 25 million spins per second on a 64^3 lattice. The device is also capable of measuring the energy and magnetization of the system or passing the updated lattice to a host computer. (9 refs.)

105257 Exact enumeration approach to fractal properties of the percolation backbone and $1/\sigma$ expansion. D.C.Hong, H.E.Stanley (Dept. of Phys., Boston Univ., Boston, MA, USA).
J. Phys. A (GB), vol.16, no.13, p.L475-81 (11 Sept. 1983).
An exact numeration approach is developed for the backbone fractal of the incipient infinite cluster at the percolation threshold. The authors use this approach to calculate exactly the first low-density expansion of $L_{BB}(p)$ for arbitrary system dimensionality d, where $L_{BB}(p)$ is the mean of backbone bonds and p is the bond occupation probability. Standard series extrapolation methods provide estimates of the fractal dimension of the backbone for all d; these disagree with the Sierpinski gasket model of the backbone. They also calculate the first low-density expansions of $L_{min}(p)$ and $L_{red}(p)$ which are, respectively, the mean number of bonds in the minimum path between i and j and the mean number of singly connected ('red') bonds. (24 refs.)

105258 Absorption of a self-avoiding random walker by a random trap distribution. F.Tanaka (Lab. of Phys., Tokyo Univ. of Agriculture & Technol., Tokyo, Japan).
J. Phys. A (GB), vol.16, no.13, p.L489-92 (11 Sept. 1983).
A particle performing a self-avoiding random walk is considered on a lattice in any number of dimensions d, which contains a fraction q of randomly distributed impurity sites. An impurity is assumed to trap the walker when stepped on. The author finds the average time to trapping to be $\lambda(1-q)/[q-(1-K_c)]$, where K_c and γ are the inverse critical temperature and the critical index of the susceptibility for the classical Heisenberg model of magnetism with vanishing ($n\to0$) internal degrees of freedom. (11 refs.)

105259 Renormalisation of a diffusion on an anisotropic chain. M.Napiorkowski (Inst. of Theoretical Phys., Warsaw Univ., Warsaw, Poland).
J. Phys. A (GB), vol.16, no.13, p.3065-70 (11 Sept. 1983).
A direct renormalisation method is used to calculate the index ν which characterises the mean square displacement of a walk on a one-dimensional, anisotropic, homogeneous lattice: $\langle R_n{}^2\rangle^{1/2}\sim n^\nu$ for large number of steps n. The two-parameter, exact analysis is carried out for arbitrary choice of the cell size. The results are shown to be independent of the cell size. (5 refs.)

105260 Equivalence of the void percolation problem for overlapping spheres and a network problem. A.R.Kerstein (Thermofluids Div., Sandia Nat. Labs., Livermore, CA, USA).
J. Phys. A (GB), vol.16, no.13, p.3071-5 (11 Sept. 1983).
The percolation problem for the complement of the union of randomly located, overlapping spheres is shown to be equivalent to a bond percolation problem on the edges of the Voronoi tesselation of the sphere centres. This result provides a convenient definition of cluster size, and therefore of critical exponents, for this problem. It also provides an efficient algorithm for Monte Carlo computation of the percolation threshold and the critical exponents. (12 refs.)

105261 Hierarchical lattices: some examples with a comparison of intrinsic dimension and connectivity and Ising model exponents. J.R.Melrose (Dept. of Phys., Univ. Coll. Cardiff, Cardiff, Wales).
J. Phys. A (GB), vol.16, no.13, p.3077-83 (11 Sept. 1983).
The recently recognised class of hierarchical lattices is examined through a number of examples. Definitions of length, intrinsic dimension and connectivity are made and used to discuss variations of exponents calculated on the Ising model. Generalisations of regular lattice results are found for exponents at discontinuity fixed points and in $1+\epsilon$ dimensions. (26 refs.)

105262 Latent heats from finite-size scaling. C.J.Hamer (Dept. of Theoretical Phys., Res. School of Phys. Sci., Australian Nat. Univ., Canberra, Australia).
J. Phys. A (GB), vol.16, no.13, p.3085-95 (11 Sept. 1983).
A method of obtaining the latent heat at a first-order transition from finite-lattice matrix elements is discussed, and demonstrated for the case of the $(1+1)$D Potts model. The method is shown to provide smoothly convergent finite-lattice sequences. The structure of the finite-lattice Hamiltonian eigenvalues is exhibited, and a characteristic signal of the first-order transition is proposed. The finite-size scaling behaviour at the transition is also discussed. (28 refs.)

105263 Tests of a method for estimating corrections to scaling from series. V.Privman (Baker Lab., Cornell Univ., Ithaca, NY, USA).
J. Phys. A (GB), vol.16, no.13, p.3097-103 (11 Sept. 1983).
The author studies a recently developed, Pade-type method of series analysis which allows for the leading confluent singularity. A number of properties are described and by applying the method to various test series some pitfalls of the technique are revealed. (26 refs.)

105264 Lattice trees with a restricted number of branch points. J.E.G.Lipson, S.G.Whittington (Dept. of Chem., Univ. of Toronto, Toronto, Ontario, Canada).
J. Phys. A (GB), vol.16, no.13, p.3119-25 (11 Sept. 1983).
The authors investigate the asymptotic behaviour of the number of trees having n vertices, weakly embeddable in the d-dimensional hypercubic lattice, with restrictions on the number (n^+) of vertices with degree greater than two. They show rigorously that if $n^+=o(n/\log n)$ the growth constant is equal to the corresponding quantity for self-avoiding walks. For n^+ increasing linearly with n they show that the growth constant still exists and present arguments indicating that it is strictly greater than that for self-avoiding walks. (16 refs.)

105265 Estimates of the site percolation probability exponents for some directed lattices. K.De'Bell (Dept. of Phys., Dalhousie Univ., Halifax, Nova Scotia, Canada), J.W.Essam.
J. Phys. A (GB), vol.16, no.13, p.3145-7 (11 Sept. 1983).
Series expansion analysis has been used to obtain estimates of the percolation probability exponent, β, for directed site percolation on the square, triangular, simple cubic and body centred cubic lattices. These estimates are consistent with those obtained by Blease (1977) for the corresponding bond problems and the results for site and bond problems on all lattices considered are summarised by $\beta=0.28\pm0.01$ ($d=2$) and $\beta=0.59\pm0.02$ ($d=3$). (4 refs.)

105266 Interdimensional scaling laws for the critical exponents of the percolation threshold. D.J.Bergman (Dept. of Phys. & Astron., Tel Aviv Univ., Tel Aviv, Israel).
J. Phys. A (GB), vol.16, no.13, p.3149-51 (11 Sept. 1983).
The interdimensional scaling laws of second-order phase transitions are modified so as to apply to the percolation threshold. Interesting results are obtained for some of the geometric exponents as well as for some conductivity exponents in the case of a metal-insulator or superconductor-normal conductor composite or a random resistor network. (18 refs.)

105267 Commensurate-incommensurate crossover in quantum sine-Gordon model. K.Hida (Dept. of Engng. Sci., Hokkaido Univ., Sapporo, Japan), M.Imada, M.Ishikawa.
J. Phys. C (GB), vol.16, no.25, p.4945-58 (10 Sept. 1983).
The thermodynamics of the quantum sine-Gordon model with finite winding numbers is investigated by the Bethe ansatz method. The temperature dependences of the specific heat and the winding number are calculated. The crossover from the case with the commensurate ground state to that with the incommensurate ground state is discussed. The quantum effect is shown to be significant in the thermodynamic properties of the system. (28 refs.)

105268 Site-bond disorder in the Ising model. A.R.McGurn (Dept. of Phys., Western Michigan Univ., Kalamazoo, MI, USA).
J. Phys. C (GB), vol.16, no.25, p.5023-30 (10 Sept. 1983).
A general technique is presented which allows site-bond disorder problems in Ising systems to be mapped onto a certain class of decorated lattice problems. The specific case of site-bond disorder on the honeycomb lattice is studied in detail through the use of annealed model solutions of the corresponding decoration problems. The critical temperature and magnetisation as functions of bond and site concentrations are calculated. The zero-temperature magnetisation is used to obtain an approximation to the percolocation probability of the system. (12 refs.)

105269 The critical dynamics and the real-space renormalization group. Y.Achiam (Nuclear Res. Centre, Negev, Beer-Sheva, Israel).
Physica A (Netherlands), vol.120A, no.1-2, p.279-313 (1983).
A general approach of the real-space renormalization group to critical dynamics is described: the formalism is presented and discussed. In particular, the application of this formalism to the study of the 1D kinetic Ising model and to the second order cumulant approximation of the 2D kinetic Ising model on a triangular lattice is carried out. The question of universality in the framework of the above formalism is studied, and the limitations of the method are presented. (47 refs.)

105270 Electrostatic potential at a plane surface of a point ionic crystal. E.R.Smith (Dept. of Math., Univ. of Melbourne, Parkville, Victoria, Australia).
Physica A (Netherlands), vol.120A, no.1-2, p.327-38 (1983).
The electrostatic potential near a plane surface of a plane slab shaped piece of simple cubic structured point ionic crystal is calculated as a lattice sum which is absolutely convergent. The resulting potential can be shape dependent, the shape dependent terms depending on the unit cell dipole and quadrupole moments. The representation developed shows how the potential changes from its bulk values inside the crystal to zero outside the crystal. (13 refs.)

105271 Statistics of flexible rings with excluded volume. E.S.Nikomarov (Landau Inst. for Theoretical Phys., Moscow, USSR).
Physica A (Netherlands), vol.120A, no.1-2, p.647-55 (1983).
A grand partition function of a system of closed self-avoiding lines on a lattice is studied. The examples of such lines are closed linear singularities: dislocations, vortex lines, etc. The partition function is expressed in the form of an integral over fictitious fields so that the behaviour of the whole system and a single ring in the system may be qualitatively described. A length distribution of rings, a mean radius of a ring of length L in the system and an effective interaction of the points of a probe ring, arising from the interaction of the probe ring with other rings, have been derived. An impact of broken rings is discussed. (10 refs.)

105272 Path-length dependent flux from random walk theory. K.Unnikrishnan (Low Level Counting Lab., BARC Hospital Complex, Bombay, India), M.A.Prasad.
Phys. Lett. A (Netherlands), vol.97A, no.4, p.131-2 (22 Aug. 1983).
Calculation of the flux $\Psi(R,s)$ due to a point isotropic source in an infinite medium, as a function of the distance R and actual pathlength s is treated as a random walk problem. In the case of isotropic scattering, this method is shown to lead to a standard transport-theoretical result, for the integrated flux. However, for $\Psi(R,s)$ far from the source, the random walk theory predicts a modified maxwellian form. (5 refs.)

105273 Exact solution of a directed-site animals-enumeration problem in three dimensions. D.Dhar (Tata Inst. of Fundamental Res., Bombay, India).
Phys. Rev. Lett. (USA), vol.51, no.10, p.853-6 (5 Sept. 1983).
An exact equivalence is established between the directed-site animals-enumeration (DSAE) problem in d dimensions and a crystal-growth model defined on the same lattice. In special cases, the latter reduces to the calculation of the free energy of a $(d-1)$-dimensional lattice gas with extended hard cores. The author solves a DSAE problem with $d=3$ exactly by using its equivalence to the hard-hexagon problem, and shows that the exponent $\theta={}^5/_6$. A new and simpler solution to the DSAE problem on the square and triangular lattices is given. (8 refs.)

105274 Supersymmetric dimer Hamiltonian for lattice branched polymers. Y.Shapir (Dept. of Phys., Univ. of Illinois, IL, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1893-5 (Sept. 1983).
A supersymmetric monomer-dimer Hamiltonian is constructed by the assignment of coupled commuting and anticommuting variables to each lattice site. The resulting super-Hamiltonian generates lattice branched polymer configurations. This relation holds for any value of the fugacity above the critical point and at all dimensions. Although this does not yet prove dimensional reduction beyond perturbation theory, it does provide strong support for its validity for these models in any dimension. (25 refs.)

105275 Corrections to scaling for branched polymers and gels. A.Margolina, Z.V.Djordjevic, D.Stauffer, H.E.Stanley (Dept. of Phys., Boston Univ., Boston, MA, USA).
Phys. Rev. B (USA), vol.28, no.3, p.1652-4 (1 Aug. 1983).
The authors have extended series expansions for both lattice animals and percolation (which model branched polymers and gels, respectively), and also have obtained Monte Carlo simulations of systems 1000 times larger than hitherto studied (17 × 10^9 sites). They find more precise estimates of the corresponding 'correction-to-scaling exponents,' and calculate the 'correction-to-scaling function' $f_1(z)$ for the first time. (20 refs.)

Algebraic invariants in soluble models ....See Entry 105224

Random walks on pseudo-lattices ....See Entry 105241

Diffusion and fractal dimensionality on fractals and on percolation clusters ....See Entry 105277

Roughening behavior of a one-dimensional crystal surface with inverse square potential ....See Entry 105292

Dynamic scaling law for a first-order phase transition ....See Entry 105294

Phase transitions in stationary nonequilibrium states of model lattice systems ....See Entry 105295

Full representations of the double space groups based on the simple cubic lattice ....See Entry 107583

Kinetics of domain growth in two dimensions ....See Entry 107865

Eight-vertex model of two-dimensional domain walls ....See Entry 107866

Speculation on a scaling law for superconductor-resistor mixture exponent *s* in a percolation system ....See Entry 108373

The gap exponent Δ for the spin-*s* Ising model on the FCC lattice ....See Entry 108626

Decorated Ising model with classical vector spins ....See Entry 108627

A continued fraction expansion of thermodynamic quantities using high-temperature expansions ....See Entry 108715

05.60 TRANSPORT PROCESSES: THEORY

105276 A generalized diffusion equation: radial symmetries and comparison theorems. J.E.Bouillet (Inst. Argentino de Matematica, Buenos Aires, Argentina).
J. Math. Anal. & Appl. (USA), vol.95, no.1, p.37-68 (Aug. 1983). (14 refs.)

105277 Diffusion and fracton dimensionality on fractals and on percolation clusters. S.Havlin, D.Ben-Avraham (Dept. of Phys., Bar-Ilan Univ., Ramat-Gan, Israel).
J. Phys. A (GB), vol.16, no.13, p.L483-7 (11 Sept. 1983).
The authors present simulations of diffusion on an exact fractal and on percolation clusters at criticality for two and three dimensions. The results for the fractal support the Rammal and Toulouse proposition (1983) that $\mathrm{d}S(N)/\mathrm{d}N \propto B(N)/S(N)$. The results for percolation are in excellent agreement with the Alexander and Orbach conjecture (1982) that the fracton dimensionality $\bar{d}={}^4/_3$. (12 refs.)

105278 Do the higher derivatives of the *H*-function alternate in sign?. J.O.Vigfusson (Inst. fur Theoretische Phys., Univ. Zurich, Zurich, Switzerland).
Lett. Math. Phys. (Netherlands), vol.7, no.4, p.273-7 (July 1983).
The conjecture of complete monotonicity of the Boltzmann *H*-function is shown to be false for a large class of discrete master equations. (10 refs.)

105279 On the spatially homogeneous Boltzmann equation with a velocity-dependent force term. A.Corciovei, C.P.Grunfeld (Dept. of Theoretical Phys., Central Inst. of Phys., Bucharest, Rumania).
Lett. Math. Phys. (Netherlands), vol.7, no.4, p.307-12 (July 1983).
A previous result of G. di Blasio (1979), concerning the global solutions of the spatially homogeneous Boltzmann equations, for a classical gas of identical point particles in the presence of an external constant force, is extended to the case of velocity-dependent external forces. (6 refs.)

105280 Solution to diffusion equations in space distribution problems. J.Waclawik.
Mech. Teor. & Stosow. (Poland), vol.20, no.1-2, p.167-70 (1982). In Polish.
The author refers to diffusion equations and space transport problems used in the E. Bobula series of articles (1974, 1975, 1979). The critical remarks concern equations and expressions dealing with the energy stream with proposed modification to a final equation. Other remarks refer to a definition of 'density' as applied to a diffusion problem with references to classical works on heat diffusion theory. A relevant bibliography is included. (26 refs.) *T.H.*

105281 The Boltzmann equation for very hard particles. E.M.Hendriks, M.H.Ernst (Inst. for Theoretical Phys., Univ. of Utrecht, Utrecht, Netherlands).
Physica A (Netherlands), vol.120A, no.1-2, p.545-65 (1983).
The nonlinear Boltzmann equation is solved analytically for general initial distributions in a (spatially homogeneous) system of very hard particles (VHP) with two translational degrees of freedom and with a transition probability for binary collisions ($vw \to v'w'$) proportional to $\delta(v^2+w^2-v'^2-w'^2)$. The scattering cross-section corresponding to this model increases as the square root of the collision energy (hence the name VHP-model). As the total energy of the system is finite, essentially no highly energetic particles are present to probe the unphysical high-energy behavior of the cross-section. The VHP-model is extended to a multicomponent mixture of particles and solved by the same technique, viz. Laplace transformation. An analogous discrete variable model is solved by a generating function method. Finally the solutions of the nonlinear and linearized Boltzmann equation are compared. Their large-energy behaviour at a fixed (large) time is different; their large-time behavior at a fixed energy is the same. (13 refs.)

105282 On the $e^{-\alpha t}$ damping of the coherent memory functions. L.Skala (Faculty of Maths. & Phys., Charles Univ., Prague, Czechoslovakia).
Phys. Status Solidi b (Germany), vol.118, no.2, p.K89-92 (1 Aug. 1983).
One of the most general approaches to the problems of the nonequilibrium statistical mechanics is based on the generalized master equation. This equation enables a description of both the so-called coherent and incoherent transport. Because of the difficulties in calculating the incoherent memory functions, the following approximate approach is frequently used. First, the coherent transport problem is solved. Then, the interaction with the bath leading to the incoherency is approximately taken into account by multiplying the coherent memory functions $K_{mn}(t)$ by the damping factor $e^{-\alpha t}$. As the damped memory functions do not in general correspond to any real physical system, the following question naturally appears: Are the probabilities $P'_m(t)$ physically reasonable at least in the sense that they lie between O and 1? The author shows that the answer is affirmative. (3 refs.)

105283 Density expansion of viscosity coefficient. A.K.Heblekar (Phys. Dept., Centre of Post-Graduate Instruction & Res., Panaji, India).
Pramana (India), vol.20, no.5, p.405-13 (May 1983).
The author obtains the density expansion of the viscosity coefficient. The important role played by the Hartree average energy in obtaining an explicit temperature dependence for the density coefficients of the viscosity is demonstrated. The results obtained are compared with the available experimental data for the first density coefficient. A satisfactory agreement between theory and experiment is found. (10 refs.)

105284 An effective conductivity of nonuniform media. A.E.Morozovskii, A.A.Snarskii.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1203-8 (Aug. 1983). In Russian.
A renormalization-group-like procedure is suggested which permits finding an effective conductivity of polycrystals and macroscopically nonuniform media, isotropic on the average for arbitrary space dimensions. The concentration dependence of the effective conductivity for stochastic mosaic is compared with numerical variational calculations for the case of three-dimensional medium. (5 refs.)

105285 On unbounded eigenvalues in particle-transport theory. C.V.M.van der Mee, C.E.Siewert (Dept. of Phys. & Astron., Free Univ., Amsterdam, Netherlands).
Z. Angew. Math. & Phys. (Switzerland), vol.34, no.4, p.556-61 (July 1983).
The dispersion function derived from particle-transport theory is analyzed for the specific case of a three-term redistribution law in order to define those $c>1$ cases for which there can be either one or two pairs of unbounded eigenvalues, and the elementary solutions corresponding to the unbounded eigenvalues are reported. (10 refs.)

105286 Maximum principle in finite element models for convection-diffusion phenomena. T.Ikeda.
Amsterdam, Netherlands: North-Holland (1983), ix+159 pp. [0 444 86506 3]
The authors present a study of finite element models for diffusion phenomena in which underlying flow is present: for instance, heat or pollutant transportation. Mathematically, these phenomena are described by convection-diffusion equations, namely, parabolic equations involving first-order derivatives in the spatial coordinates. They give a broad description of all the finite element schemes available for solving convection-diffusion equations. The emphasis is placed on a family of finite element schemes that give solutions satisfying a discrete analogy to the maximum principle. (75 refs.)

Statistical mechanics of nonlinear hydrodynamic fluctuations ....See Entry 105118

Stochastic solution method of the master equation and the model Boltzmann equation ....See Entry 105235

Origin of long-time tails in strongly chaotic systems ....See Entry 105246

Crossover in diffusion-limited aggregation ....See Entry 105251

Renormalisation of a diffusion on an anisotropic chain ....See Entry 105259

Path-length dependent flux from random walk theory ....See Entry 105272

The spreading of a non-Newtonian liquid over a horizontal plane with intensive heat-transfer and mass-transfer processes on the surface of the layer ....See Entry 107193

Experimental investigation of mass transfer from the surface of a sphere under conditions of large Reynolds numbers and cavitation on the surface ....See Entry 107205

Estimation of liquid film mass transfer coefficients for randomly packed absorption columns ....See Entry 107237

Hydrodynamics and mass transfer characteristics of co-current downflow packed tube columns ....See Entry 107238

Mass transfer characteristics of low H/D bubble columns ....See Entry 107239

Self-diffusion of spheres in a concentrated suspension ....See Entry 107311

Critical exponent for 3-D percolation conductivity, revisited .See Entry 108376

An efficient method of randomly sampling the coherent angular scatter distribution ....See Entry 110167

05.70 THERMODYNAMICS

(see also 44.60 Thermodynamic processes, 64. Equations of state, phase equilibria and phase transitions, 65. Thermal properties of condensed matter; for chemical thermodynamics, see 82.60)

105287 Evolution equations for dissipative bodies and hyperbolicity. A.Morro (Univ. of Genova, Genova, Italy).
Acta Mech. (Austria), vol.48, no.3-4, p.227-31 (1983).
With reference to the thermodynamics of materials with internal variables, the author proves that within the 'special case' of Navier-Stokes-Fourier theory, the invariance of internal energy and pressure in nonequilibrium leads to a hyperbolic system of equations for heat conducting and viscous fluids. (5 refs.)

105288 Generalized integral variational principles of phenomenological thermodynamics of irreversible processes, and the nature of variation of thermodynamic action. I.P.Vyrodov (Krasnodar Polytech. Inst., Krasnodar, USSR).
J. Eng. Phys. (USA), vol.44, no.1, p.99-108 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.118-29 (Jan. 1983). [received: Sept. 1983]
Generalized integral variational principles of phenomenological thermodynamics of irreversible processes (PTIP), formulated by the author, are stated. (32 refs.)

105289 Gradient operators and the commensurate-incommensurate transition. H.J.F.Knops (Inst. voor Theoretische Fysica, Katholieke Univ. Nijmegen, Nijmegen, Netherlands).
Physica A (Netherlands), vol.120A, no.1-2, p.116-24 (1983).
It is shown that gradients of bounded operators do not contribute to singularities in the bulk free energy. The formal scaling index of these operators describes at best, depending on the boundary conditions, singularities in the

surface free energy. This observation is used in the context of a model that describes the commensurate-incommensurate transition, to show that Cardy's argument for the renormalization connection of this transition with the point $T=1/\pi$ of the Gaussian fixed line cannot be correct. The same model is further used to demonstrate how gradients of unbounded operators can contribute to singularities in the bulk. (11 refs.)

105290 **Kinetic theory of resonance and relaxation in spin systems. III. Spin bistability phenomena.** J.Luczka (Inst. of Phys., Silesian Univ., Katowice, Poland).
Physica A (Netherlands), vol.120A, no.1-2, p.219-37 (1983).
For pt.II see ibid., vol.111, p.240 (1982). The possibility of existence of nonequilibrium phase transitions, bistability phenomena, and other critical properties of the two-level spin systems considered in the two previous papers is investigated. Under suitable assumptions, an evolution equation for the mean value of the Zeeman operator is obtained from kinetic equations derived in part I. Qualitative methods of analysis of autonomous differential equations are used to study properties of the evolution equation. Vector fields generated by this equation are analyzed. Stationary solutions and their stability are discussed. It is shown that under suitable conditions, the steady state solutions exhibit a hysteresis cycle. Time-dependent solutions of the evolution equation are presented and discussed. (27 refs.)

105291 **Statistical mechanics of two-dimensional vortex fluids or guiding center plasmas.** P.Vieillefosse (Lab. de Phys. Theorique des Liquides, Univ. Pierre et Marie Curie, Paris, France).
Physica A (Netherlands), vol.120A, no.1-2, p.609-26 (1983).
The author shows by an effective calculation of the entropy that negative temperatures do not exist in two-dimensional inviscid fluids or guiding center plasmas. The entropy is always a non-decreasing function of the energy. Its exact form depends on the behaviour of the interaction potential at large distances. (4 refs.)

105292 **Roughening behavior of a one-dimensional crystal surface with inverse square potential.** J.Slurink, H.J.Hilhorst (Lab. voor Tech. Natuurkunde, Delft, Netherlands).
Physica A (Netherlands), vol.120A, no.1-2, p.627-34 (1983).
The discrete Gaussian chain with inverse square potential—which models a one-dimensional crystal surface—is studied by Monte Carlo methods. The system is found to undergo a roughening transition and the temperature-dependent correlation function exponent $\eta(T)$ is shown to be discontinuous at the critical point. These results can be transposed to the metal-insulator transition of a one-dimensional plasma of logarithmically interacting charges. (8 refs.)

105293 **Time-scaling in irreversible thermodynamics.** U.Geigenmuller (Inst. Lorentz, Leiden, Netherlands), B.U.Felderhof, U.M.Titulaer.
Physica A (Netherlands), vol.120A, no.1-2, p.635-46 (1983).
The authors consider linear dynamical systems with motions characterized by two different time-scales. In practice the dynamical matrix in the phenomenological equations of motion often exhibits a strong coupling of the slow and fast variables. It is shown on the basis of the Onsager symmetry relations that a simple transformation of variables leads to a weak coupling. After the transformation one can use perturbation theory to derive reduced matrices describing the slow (fast) motions of the slow (fast) subsystem. (13 refs.)

105294 **Dynamic scaling law for a first-order phase transition.** H.Furukawa (Dept. of Phys. Sci., Yamaguchi Univ., Yamaguchi, Japan).
Phys. Rev. A (USA), vol.28, no.3, p.1717-28 (Sept. 1983).
Giving a statistical-mechanical formulation of structure-function dynamics, the author presents a formulation of a scaling law for the first-order phase transition. The basic idea proposed, which previously appeared in a specific form, is that any function of the form $F_k(t_1,t_2,...)$, where k is the wave number and $t_1,t_2,...$ are times, is scaled as $F_k(t_1,t_2,...)=[R(t_1)]^{x1}[R(t_2)]^{x2}...\tilde{F}(kR(t_1),kR(t_2),...)$, where $R(t)$ is a relevant scale length, such as a linear dimension of an average cluster size, which is found to behave as $R(t)\propto t^{1/z}$ with z being a constant. The autocorrelation function of the density fluctuation is found to obey the scaling law for the conserved system: $J_k(t,t')=[R(t)]^{\theta}[R(t')]^{d-\theta}\tilde{J}(kR(t), kR(t'))$, $\theta\leq d/2$ where d is the dimensionality. For $\theta=0$ this scaling law can be naturally derived on the basis of the dynamic-scaling assumption and the conservation law. However, for large t the possibility of an anomalous scaling law ($\theta\neq 0$) is found. On the computer simulation for the three-dimensional spin-exchange kinetic Ising model, the author examines such a scaling law for the autocorrelation function. A remarkable difference in the temporal behaviors of the autocorrelation function is found. That observation strongly suggests the existence of the spinodal-like line. (38 refs.)

105295 **Phase transitions in stationary nonequilibrium states of model lattice systems.** S.Katz, J.L.Lebowitz, H.Spohn (Dept. of Maths. & Phys., Rutgers Univ., New Brunswick, NJ, USA).
Phys. Rev. B (USA), vol.28, no.3, p.1655-8 (1 Aug. 1983).
The authors investigate the stationary nonequilibrium states of a lattice gas of interacting particles subject to an external field $\bar{E}$. The dynamics of the system are given by hoppings of particles to nearby empty sites with rates biased for jumps in the direction of $\bar{E}$. This system is often used to model fast ionic conductors. Using computer simulations of a two-dimensional lattice with nearest-neighbor interactions the authors studied the dependence of the structure function, current, etc., on temperature and $\bar{E}$. They found evidence for a transition line in the temperature-field plane at which the system develops (anisotropic) long-range order. $\bar{E}$ enhances the transition for attractive interactions and represses it for repulsive ones. (6 refs.)

105296 **An equation of state of Lennard-Jones fluids and evaluation of some thermodynamic properties.** R.V.Gopala Rao, S.K.Dutta (Phys. Dept., Govt. Engng. Coll., Jalpaiguri, West Bengal, India).
Z. Phys. Chem., Leipzig (Germany), vol.264, no.4, p.771-7 (1983). In German.
The Lennard-Jones attractive tail is treated as a perturbation on the hard sphere potential and the direct correlation function in the long wave limit in the random phase approximation has been obtained. Using the compressibiltiy sum rule and through the direct correlation function in the long wave limit an equation of state has been formulated. Through this equation the authors derive the thermal expansion coefficient, compressibility, pressure variation of bulk modulus, the specific heat of the liquids and also their temperature variations. The critical constants have also been derived and presented. The agreement between theory and experiment in the evaluation of many of these properties shows that this forms a very important method in the formulation of equation of state. (13 refs.)

Le Chatelier reciprocal relations and the mechanical analog . See Entry 105072

Broken ergodicity .... See Entry 105220

Model for relativistic Bose systems in *d* dimensions .... See Entry 105231

Scaling and universality of thermodynamics and correlations of an ideal relativistic Bose gas with pair production .... See Entry 105232

On the phase transition of the random bond Ising model ....See Entry 105253

Latent heats from finite-size scaling ....See Entry 105262

Commensurate-incommensurate crossover in quantum sine-Gordon model ....
....See Entry 105267

The critical dynamics and the real-space renormalization group ....
....See Entry 105269

Exact solution of a directed-site animals-enumeration problem in three dimensions .... See Entry 105273

Algebraic investigations in Landau model of structural phase transitions. III. Extended integrity bases and thermodynamic potential ....See Entry 107860

Eight-vertex model of two-dimensional domain walls .... See Entry 107866

Thermodynamics of hard dumbell mixtures ....See Entry 107987

Thermodynamic properties of a hard-sphere fluid near a hard wall at low temperatures .... See Entry 108120

A continued fraction expansion of thermodynamic quantities using high-temperature expansions ....See Entry 108715

An approximate method for the free energy ....See Entry 108718

Entropy changes during an ideal gas chromatographic separation ....
....See Entry 109823

06.00 MEASUREMENT SCIENCE, GENERAL LABORATORY TECHNIQUES, AND INSTRUMENTATION SYSTEMS

06.20 METROLOGY

Applied Radionuclide Metrology ....See Entry 105019

06.20D Measurement and error theory

105297 **Deconvolution of noisy experimental data.** G.A.Baker,Jr., J.E.Brolley (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
J. Comput. Phys. (USA), vol.51, no.2, p.227-40 (Aug. 1983).
For a given impulse function, which describes the influence of apparatus on a data stream, the authors deconvolved the noisy data by two procedures. The first method develops an iterative scheme that searches for a solution that simultaneously is a best least-squares fit to the data and has minimum length. The second procedure applies the method of circulants to obtain a very fast approximation to the first. Good results are obtained for a synthetic problem utilizing a digital computer. (13 refs.)

The limiting accuracy of measurement of the second derivatives of the gravitational potential ....See Entry 105212

Measurement of heat transfer in closed hot water systems [errors evaluation] ...
....See Entry 105320

Systematic errors in cross-correlation velocity measurements ....
....See Entry 107299

Vortex signal analysis ....See Entry 107300

Error simulation experiments. The virial equation in the absorption of isobutene on Aerosil ....See Entry 109802

06.20H Measurement standards and calibration

105298 **Rubidium oscillator emerges as time and frequency standard.**
Microwaves & RF (USA), vol.22, no.5, p.155 (May 1983).
A frequency standard developed to provide an extremely stable 10-MHz reference signal for use in navigation, communications, and instrumentation is described. Model AQT-10 makes use of optical pumping, which reuses source atoms instead of depleting them. The ground-state energy level differences of the atoms of rubidium isotope Rb87, which has a resonant frequency of approximately 6.835 GHz, are employed as a frequency discriminator to control the frequency of a voltage-controlled 10-MHz quartz crystal oscillator. An Rb spectral lamp's plasma discharge light is directed through an absorption cell containing Rb vapor to illuminate a photocell detector. A synthesized 6.835-GHz signal derived from the VCO is simultaneously applied to the absorption cell with a resulting drop in light throughput when this signal exactly matches the cell resonant frequency. The consequence is a 10-MHz sine wave with a long-term stability of better than 3×10^{-11} per month, and a short-term stability of better than 2×10^{-12} at a time reference of $\tau=100$ s. (no refs.)

105299 **Multicalibrator—calibrated automatically.** P.Muhlenbroich.
Elektronik (Germany), vol.32, no.15, p.29-32 (29 July 1983). In German.
The Datron 4000/4000 A multicalibrators are described. Both model are based on the use of precision diodes as reference elements and the adoption of pulse width modulation for the reference divider. The 4000 A model can be used over a temperature range of 23±5°C, thereby allowing the calibration of equipment on-site rather than simply in a temperature-controlled calibration laboratory. The Autocal system permits the automatic calibration of the calibrator itself by mathematically compensating for errors such as offset, amplification and nonlinearity introduced by analogue components. (no refs.) *C.C.B.*

105300 **Standardization of radionuclides at the Hungarian National Office of Measures.** A.Szorenyi, J.Vagvòlgyi (Nat. Office of Measures, Budapest, Hungary).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1133-44 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
In the last two decades various radionuclides have been standardised at the National Office of Measures (OMH) and at the present time OMH offers radioactive standard-reference materials for over 50 radionuclides. Suitable direct and relative methods and equipment have been developed for measuring the activity of radionuclides in different forms (e.g. solution, solid sources and standards of large surface area). A short review is given of these systems and of the authors' present research work. OMH cooperative international activity in the field of radionuclide metrology is also outlined. (15 refs.)

105301 Standardization by the efficiency-extrapolation method. L.Grigorescu (Inst. de Fizica si Inginerie Nucleara, Bucuresti, Rumania).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1151-8 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
The efficiency-extrapolation method is widely used in coincidence standardization of radionuclides with complex decay schemes. A theoretical analysis is given which indicates that: the (4πsr/2πsr) method for checking the fulfilment of linearity conditions of the gamma-ray channel is sensitive and useful; the systematic error of the extrapolation method is represented by the quantity 'g'; the accurate fulfilment of the linearity conditions is advantageous especially for eliminating the systematic error g. (11 refs.)

105302 Standardization of ^{137}Cs—some remarks on the efficiency function. C.Ballaux (Dept. of Nuclear Metrology, SCK/CEN, Mol, Belgium).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1159-66 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
A solution of ^{127}Cs has been standardized by means of $4\pi\gamma$[NaI(Tl)] integral counting and by 4π(PC)-γ efficiency tracing and extrapolation with ^{134}Cs as tracer. Both methods giving nearly equal results, a γ-ray-emission probability per decay of 0.8516 ± 0.0020 is deduced for the 661.6-keV transition of ^{137m}Ba. The β-ray spectra of both cesium isotopes have been calculated in order to attempt to interpret the efficiency function. (42 refs.)

105303 Survey of standardization possibilities with a NaI(Tl) well-type detector. A.Pavlik, G.Winkler (Univ. Wien, Wien, Austria).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1167-74 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
The standardization capabilities of a 12.7-cm×12.7-cm NaI(Tl) well-type detector were investigated for a series of 27 radionuclides of practical interest with different decay scheme complexities. Total detection efficiencies and their uncertainties were calculated for low-mass point-like sources, for 1-cm^3 aqueous solutions, and also for nuclides homogeneously incorporated in a 1-g solid sample of 20-mm diameter. Correlations amongst decay data and partial efficiencies for β- and γ-ray transitions were taken into account. The physical consistency of the chosen decay schemes was tested within their limits of uncertainty by calculating the balance and its uncertainty for the β branches. This enabled tightening of the efficiency-uncertainty limits by taking a choice among different versions of the decay-scheme data. Special attention was paid to the possible calibration accuracy for multigamma-ray sources such as ^{56}Co, ^{75}Se, ^{82}Br, ^{110m}Ag, ^{124}Sb, ^{134}Cs, ^{133}Ba, ^{152}Eu, ^{182}Ta and ^{192}Ir, achieving accuracies in the range $\leq 0.1\%$ to 0.7% by employing special features of a $4\pi\gamma$-detector system. (19 refs.)

X-ray interferometer calibration of microdisplacement transducers .... See Entry 105308

Scattering and absorption of turbid materials determined from reflection measurements. II. Measuring method and calibration .... See Entry 105364

Longitudinal Ramsey-Fringe spectroscopy in a calcium beam .... See Entry 105378

A readily portable source unit for the calibration of Dobson ozone spectrophotometer wedges .... See Entry 105383

An atomic standard to calibrate analyser modulation in AES .... See Entry 105427

Calibration of an X-ray photoelectron spectrometer by means of noble metals .... See Entry 105430

Operational quantities for use in external radiation protection measurements. An investigation of concepts and principles .... See Entry 106177

A multichannel detector system for small-angle neutron scattering investigations .... See Entry 106234

Needs for radioactivity standards and measurements .... See Entry 106253

The International Reference System for activity measurements of γ-ray emitting nuclides .... See Entry 106254

Metrological features of a laser device with a single-mirror deflecting unit .... See Entry 106775

Calibration of rolling ball viscometer in the intermediate Reynolds number region .... See Entry 107277

Calibration of hot-wire probes and determination of their directional sensitivity by numerical methods .... See Entry 107284

Comparison of triple point temperatures realized in two different types of sealed cells .... See Entry 107871

Calibration of Micromatter Co. standards used for the calibration of PIXE analysis systems .... See Entry 109830

Quantitative autoradiography of semiconductor materials with phosphorus diffusion standards .... See Entry 109832

ESCA studies on silicon compounds using an internal standard for calibration .... See Entry 109837

The spectral factor in noise-induced hearing loss: a case for retaining the A-weighting .... See Entry 110056

06.30 MEASUREMENT OF BASIC VARIABLES

Wall effects in du Nouy ring tensiometry. Theory and experiment .... See Entry 108118

06.30C Spatial variables measurement

(inc. measurement of all variables extending in space e.g. diameter, height, thickness, displacement, surface topography, particle size, area of disperse systems)

105304 Diameters and number densities of soot particles in premixed laminar flat flame propane/oxygen. M.E.Weill, P.Flament, G.Gouesbet (Lab. de Thermodynamique, Univ. de Rouen, Mont-Saint-Aignan, France).
Appl. Opt. (USA), vol.22, no.16, p.2407-9 (15 Aug. 1983).
Submicron particle sizing by means of diffusion broadening spectroscopy (DBS) was first extensively used in liquid suspensions, and then the method was extended to the study of particles in moving and (or) hostile environments, thanks mainly to technical improvements in spectrum analyzer and photocorrelator designs. In particular, Penner et al. (1976) pioneered the study of soot growth in flames by means of DBS. Following their work, other similar experiments have been carried out showing that DBS is able to provide reliable results in this field. The authors present soot diameters and number density measurements in a premixed propane/oxygen flat flame. These data are validated by comparison with results obtained by more classical method. (13 refs.)

105305 Apparatus for quick evaluation of surface area.
Instrum. India, p.6-7 (July-Aug. 1982). [received: Aug. 1983]
Describes an instrument which measures the total surface area of finely divided or porous materials. It utilises a unique concept modified from the classical BET low temperature nitrogen adsorption technique. Analysis is accomplished without employing a vacuum system and consequently it is fast and simple to operate. (no refs.)

105306 A water-level sensor using a capacitance to frequency converter. P.J.Ross (Div. of Soils, CSIRO, St. Lucia, Queensland, Australia).
J. Phys. E (GB), vol.16, no.9, p.827-8 (Sept. 1983).
A capacitive water-level sensor using PTFE-insulated wire and a capacitance to frequency converter is described. Construction is simple, yet overall linearity is 0.1%. Temperature drift of the sensor is $-0.05\%\mathrm{K}^{-1}$ and that of the converter is $<0.01\%\mathrm{K}^{-1}$. Long-term stability of the sensor appears excellent. The converter draws only 150 μA from a 5 V supply and is insensitive to supply voltage variations. (1 ref.)

105307 Film thickness monitor based on white light interference. J.R.Sandercock (Labs. RCA Ltd., Zurich, Switzerland).
J. Phys. E (GB), vol.16, no.9, p.866-70 (Sept. 1983).
A simple instrument is described which allows accurate and rapid measurements of thin films having optical thickness in the range 200 nm to 10 μm. A direct readout of either optical or actual thickness is achieved. The instrument operates on the principle that the intensity of white light successively reflected from two thin films reaches an extremum when the optical thickness of the two films are equal. The instrument has found wide spread use within the semiconductor industry. (6 refs.)

105308 X-ray interferometer calibration of microdisplacement transducers. D.G.Chetwynd (Dept. of Engng., Univ. of Warwick, Coventry, England), D.P.Siddons, D.K.Bowen.
J. Phys. E (GB), vol.16, no.9, p.871-4 (Sept. 1983).
A Rank-Taylor-Hobson-Talystep transducer has been coupled to an X-ray interferometer in order to assess the possibility of calibration of very high-resolution transducers down to sub-nm displacements, using an X-ray interferometer, which has ~10 pm resolution traceable to absolute length standards to 1 in 10^6. It is demonstrated that the two instruments can be simultaneously operated at their full precision, and that absolute metrological measurement down to 10 pm should be feasible. The mounting of the available X-ray interferometer introduced parasitic deflections in this application, which were fully evaluated. A design is proposed for a metrological X-ray interferometer that eliminates these errors and also provides a quadrature output for sensing the direction of displacement. (11 refs.)

105309 Use of light diffraction in dimensional gauging. U.Breitmeier (Hommelwerke GmbH, Schwenningen, Germany).
Mess. & Pruef. (Germany), vol.19, no.6, p.329-35 (June 1983). In German.
Recent developments in semiconductors—and in particular in light-sensitive semiconductor device technology have opened new practical possibilities of using light diffraction in the measurements of length, relying on the availability of computers for processing of the signal information. The article introduces the physical principles of the method and its theoretical foundations, describing practical arrangements of the apparatus. The advantages and limitations of the method and its sensitivity are considered in comparison with classical length-gauging method. (7 refs.) *S.R.*

105310 Displacement measurement by coincidence of random-pattern-images using crosscorrelation. T.Idogawa, K.Nagai, H.Akazawa (Inst. of Appl. Phys., Univ. of Tsukuba, Ibaraki, Japan).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.129-38 vol.2
A method of displacement determination by correlation techniques is presented. The method is pertinent to determination of low speed (including zero) to which conventional correlation techniques based on delay determination are not appropriate. Experiments on determinations of displacement and length using experimental devices are described. Main sources of error are investigated. (3 refs.)

An instrument for measuring the curvature of reflecting surfaces .... See Entry 105366

Radiometric design of the level control instruments based on gamma photon backscattering .... See Entry 105376

Measurement of subatomic displacements for Mossbauer spectroscopy .... See Entry 105434

A review of proposed instrumentation for measurement of inadequate core cooling in light water reactors .... See Entry 106103

Axis-alignment method for arc-fusion splice of single-mode fiber using a beam splitter .... See Entry 106882

Scatter ratio test for lens surface quality measurement .... See Entry 106903

Determination of the incidence and azimuth angles in LEED experiments .... See Entry 107495

Mesure continue de l'epaisseur des revetements sur les toles (Continuous measurement of the thickness of coatings on metal sheets) .... See Entry 109603

A radioactive tracer method for measuring the relative surface areas of small samples .... See Entry 109636

Feasibility of coating inspection by gamma-albedo method .... See Entry 109671

Automatic devices for the electromagnetic inspection of the thickness of the coating on small components .... See Entry 109688

Method for determining the effectiveness of dispersants for magnetic oxide .... See Entry 109810

Three-dimensional stereometric measurement system using optical scanners, cylindrical lenses, and line sensors .... See Entry 110121

Contouring of tooth imprints by means of a fluorescence technique adapted to a spatially filtered moire illumination .... See Entry 110122

Automatic topography using high precision digital moire methods .... See Entry 110123

Studying abdomen size and shape variations during pregnancy: an application of moire topography .... See Entry 110124

Reconstruction of anatomical shapes from moire contourographs .... See Entry 110126

Measurement of kyphosis using moire topography .... See Entry 110127

Analysis of scoliosis by back shape topography .... See Entry 110128

Automatic measurement of body surfaces using rasterstereography .... See Entry 110130

A microprocessor based system for real time volume measurement of the instrumented, beating canine left ventricle [using ultrasound] .... See Entry 110271

06.30F Time and frequency measurement

(for astronomical aspects see 95.70)

A microcomputer air-track timer .... See Entry 105081

Rubidium oscillator emerges as time and frequency standard .... See Entry 105298

06.30G Velocity, acceleration and rotation measurement

(for flow velocity measurement see 47.80)

105311 Real-time measurements of spatial velocity distribution with a laser Doppler imaging system. T.Yoshimura, H.Sakashita, N.Wakabayashi (Dept. of Instrumentation Engng., Kobe Univ., Kobe, Japan).
Appl. Opt. (USA), vol.22, no.16, p.2448-52 (15 Aug. 1983).
A new laser Doppler imaging system with a TV camera has been constructed, which brightly displays 1-D velocity distribution on a monitor. Some characteristics of this system have been experimentally investigated from measurements of simple velocity distribution on a constantly rotating ground glass disk. From an adaptation to fluid flow, it has been shown that the measurements of spatial velocity distribution can be achieved in real time. (12 refs.)

Applications of fiber optics in sensors .... See Entry 105370

Effect of wall scattering on SNR in off-axis differential-type laser Doppler velocimetry .... See Entry 107285

Laser-induced fluorescence technique for velocity field measurements in subsonic gas flows .... See Entry 107286

06.30L Measurement of basic electromagnetic variables

(see also 07.50 Electrical instruments and techniques)

105312 X-band measurements of the dielectric constant of dust. S.M.Sharief, S.I.Ghobrial (Dept. of Electrical Engng., Univ. of Khartoum, Khartoum, Sudan).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.143-7
Measurement of the dielectric constant of dust were conducted under different conditions to determine the effect of hygroscopic water, chemical composition, and frequency. Hygroscopic water was found to increase both real and imaginary parts of the dielectric constant. Water contents as low as 4.8% by wt cause the real part to increase by 48% and imaginary part by over 600%. However, moisture affects different samples differently. Chemical analysis showed that the major constituents of dust are SiO_2, Al_2O_3 and Fe_2O_3. Of these SiO_2 was found to be the major contributor to the real part while Al_2O_3 has the greatest effect on the imaginary part. The changes in both the real and imaginary parts of the dielectric constant with frequency were found to be small. (6 refs.)

105313 Measurements of the complex refractive index of soils and airborne particles. S.J.Al-Bader, M.M.Dawoud (Univ. of Petroleum & Minerals, Dhahran, Saudi Arabia).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.149-52
The results of measurements of the dielectric constant and loss tangent of soils and airborne particles are given for the 8-10 GHz frequency band. The technique utilizes the network analyser by measuring the relative effect on the amplitude and phase of the microwave signal produced by a specimen of soil. Two parent samples are decomposed in accordance with the size of the constituent particles and the complex refractive index of each size interval measured over the frequency band. The results indicate a correlation between the size and density on one hand and the dielectric constant and loss tangent on the other. This correlation is also observed for samples isolated by sieving when compared with airborne samples of similar density and size distribution. (3 refs.)

Effects of dust/sandstorm on some aspects of microwave propagation .... See Entry 106671

06.50 DATA HANDLING AND COMPUTATION

(see also 02.70 Computational techniques; 29.80 Nuclear information processing; for optical data processing, storage and retrieval see 42.30; for geophysical data acquisition and storage see 93.65)

105314 Some remarks on the statistical correlation of Mossbauer spectra. A.Delunas, V.Maxia, S.Serci (Istituto di Fisica Superiore, Univ. di Cagliari, Cagliari, Italy).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.2-3, p.563-4 (1 Aug. 1983).
It is shown that the comparison of Mossbauer spectra can be performed unrestrictedly by means of the statistical correlation method. (9 refs.)

105315 Computer assessment of thermodynamic data. J.B.Pedley, E.M.Marshall (School of Chem. & Molecular Sci., Univ. of Sussex, Brighton, England).
High Temp.-High Pressures (GB), vol.14, no.6, p.641-8 (1982). [received: June 1983] (International Conference on Chemistry of Materials at High Temperatures, Harwell, Oxon., England, 7-10 Sept. 1981).
The thermodynamic data for gaseous oxides (predominantly monoxides) are being collected, assessed, and processed as part of an international collaborative effort in which computer techniques will be used to store, exchange, and assess critically thermodynamic data. Special features involve the establishment of computer files containing data both for Gibbs energy and for thermal functions, which can be continuously updated, and the development of programs to identify inconsistent data, enabling critical assessment to be carried out more effectively. Other programs are used to present the assessed data and to process it to give standard thermodynamic functions. (5 refs.)

A 35 and 70 mm stereoanalytic compilation-graphic system .... See Entry 105393

UHV-SEM studies of surface processes: recent progress .... See Entry 107501

Characterisation of computer differentiation of spectra in AES and its relation to differentiation by the modulation technique .... See Entry 109064

Four-dimensional processing and display system for cardiovascular data .... See Entry 110213

A microprocessor-controlled multichannel counter for a digital autocorrelator [radioastronomical application] .... See Entry 110913

06.60 LABORATORY TECHNIQUES

105316 Microfabrication as a scientific tool. R.E.Howard, P.F.Liao, W.J.Stocpol, L.D.Jackel, H.G.Craighead (Bell Labs., Holmdel, NJ, USA).
Science (USA), vol.221, no.4606, p.117-21 (8 July 1983).
Research in microfabrication not only serves the microelectronics industry but also can provide research tools for studying the behavior of matter at submicrometer dimensions. A variety of techniques including optical, X-ray, and electron beam lithography and reactive ion etching can be used to make structures, devices, and arrays only hundreds of atoms across. Microfabrication techniques have been applied to experiments on surface-enhanced Raman scattering, transport in one-dimensional conductors, and macroscopic quantum tunneling. Recent progress is extending these techniques to scales of less than 100 angstroms. (39 refs.)

The generation of ultrashort laser pulses .... See Entry 106789

06.70 GENERAL INSTRUMENTATION

105317 Enhancement of gas sensitivity by controlling microstructure of α-Fe_2O_3 ceramics. Y.Nakatani, M.Sakai, M.Matsuoka (Wireless Res. Lab., Matsushita Electric Industrial Co. Ltd., Osaka, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.6, p.912-16 (June 1983).
The authors have found that the gas sensitivity of α-Fe_2O_3 ceramics can be greatly enhanced by controlling its microstructure by adding quadrivalent Ti, Zr or Sn. These metals have the effect on suppressing the grain growth and crystallization, and consequently increasing the specific surface area of the sensing element. With Sn in particular, the sensing element consists of ultrafine grains as small as about 100 Å and has an extremely large specific surface area of 125 m^2/g. However, the additives are effective only in the presence of the sulfate ion, which is considered to localize mainly on the surface of the α-Fe_2O_3 grains. Thus the surface of the grains, which is fairly amorphous, is thought to play an essential role in the gas sensitive mechanism. (7 refs.)

105318 Pulsed strain-gauge system. L.S.Poleshchuk (Inst. of Geology & Geophys., Acad. of Sci., Novosibirsk, Ukrainian SSR).
Instrum. & Exp. Tech. (USA), vol.25, no.6, pt.2, p.1487-9 (Nov.-Dec. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.6, p.156-8 (Nov.-Dec. 1982).
A pulsed strain-gauge system is described that uses series 176 and 544 integrated circuits. The bridge is supplied with stabilized current pulses with exponential leading edges and steep trailing ones. The range in strain measurement is 10^{-2}-10^{-6}. The error of measurement in the frequency range 0-100 Hz is not more than 1-2%. (5 refs.)

A water-level sensor using a capacitance to frequency converter .... See Entry 105306

Optimization of design parameters of eddy-current feedthrough transducer .... See Entry 105337

Applications of fiber optics in sensors .... See Entry 105370

Spectropolarimeter with electromechanical compensation .... See Entry 105381

Measurement of subatomic displacements for Mossbauer spectroscopy .... See Entry 105434

Applications of fibre-optic waveguides in the measuring art .. See Entry 106892

PRIZ-1 set of ultrasonic measurement transducers .... See Entry 106955

A lithium sulfate pulse-pressure transducer in a gasdynamic experiment .... See Entry 107276

Capacitive sensors for solids flow measurement by correlation methods .... See Entry 107297

Surface study of a Ag electrode on a solid electrolyte used as oxygen sensor .... See Entry 108130

A scanning induction transducer for the inspection of flat surfaces .... See Entry 109687

Fabrication of a low cost controlled potential coulometer ..... See Entry 109839

07.00 SPECIFIC INSTRUMENTATION AND TECHNIQUES OF GENERAL USE IN PHYSICS

(see also within each subdiscipline for specialized instrumentation and techniques)

07.10 MECHANICAL INSTRUMENTS AND MEASUREMENT METHODS

(for measurement in the mechanics of solids and rheology, see 46.30R; for materials testing, see 81.70)

An extensometer for axial strain measurement at high temperature .... See Entry 107081

Wall effects in du Nouy ring tensiometry. Theory and experiment .... See Entry 108118

07.20 THERMAL INSTRUMENTS AND TECHNIQUES

(see also 44.50 Thermal properties of matter, 44.60 Thermodynamic processes; for radiometry and detection of thermal radiation see 07.60D and 07.62)

105319 Spatial resolution of thermal wave microscopes. L.J.Inglehart, K.R.Grice, L.D.Favro, P.K.Kuo, R.L.Thomas (Dept. of Phys., Wayne State Univ., Detroit, MI, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.446-8 (1 Sept. 1983).
It is demonstrated theoretically and confirmed experimentally that the intrinsic spatial resolution of a thermal wave microscope in the extreme near field limit is independent of thermal wavelength and is determined by the depth of the thermal scatterer beneath the surface of the specimen. (15 refs.)

105320 Measurement of heat transfer in closed hot water systems [errors evaluation]. C.Meisser (Landis & Gyr AG, Zug, Switzerland), K.Ellinghaus.
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.289-98 vol.2
The error characteristics of a heat meter utilizing platinum resistance thermometers depend on four factors. Models are described for errors associated with the k-value, the temperature difference and multiplication. For the determination of errors due to the measurement of volume flow, an analytical formula is presented, based on extensive measurements of the WSA & WSB ultrasonic heat meters. The total measurement error of such a meter can thus be simply predicted. (5 refs.)

Remote sensing applications of pulsed photothermal radiometry .... See Entry 105356

Application of infrared thermography to the study of the thermal behavior of solar-powered generators .... See Entry 109895

07.20D Thermometry

105321 A temperature measuring instrument with digitally adjustable comparator. J.Thomann.
Elektron. Appl. (Germany), vol.15, no.7, p.36-7 (July 1983). In German.
Designed for the Intersil Datel temperature sensor AD 590 a circuit is described for temperature measurement and indication in the range −55°C to +128°C. Temperature to voltage conversion uses an operational amplifier to give output of 10 mV/°C, and a further operational amplifier and CMOS convertor IC ADC-EK-8B provide digital conversion of the temperature voltage analogue. The 8-bit temperature representation operates into a comparator comprising integrsted circuits and encoding switches, to give indications of temperature outside and between uper and lower limit values digitally adjustable with the encoding switches. The a/d convertor and comparator are applicable with devices other than temperature sensors. Some instrument constructional hints are given. (no refs.) *H.V.H.*

105322 Room-hydrogen temperature and room-nitrogen temperature semiconductor resistance thermometers for measuring hydrogen and nitrogen temperatures. A.B.Aleinikov, L.I.Zarubin, I.Yu.Nemish.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.1, p.93-5 (1982). In Russian.
The feasibility of using room-hydrogen (RH) and room-nitrogen (RN) thermometers for the temperature of the hydrogen and nitrogen regions in magnetic fields up to 6 T is studied, the errors introduced by the magnetic field are assessed, and a simple method of introducing corrections which significantly decrease the error is proposed. The curves show that the error introduced by the magnetic field is directly proportional to temperature, which can be explained by the increase in the slope of the thermometric characteristic at the end of the thermometer's working range. It is shown that in using RN thermometers with parallel orientation relative to the magnetic field it is generally possible to obtain at least 1% accuracy for nitrogen temperatures in fields up to 6 T. In the case of hydrogen temperatures, for any orientation of the thermometer the error in the same fields can rise as high as 3%, but the introduction of certain corrections decreases the error to 0.5%. (4 refs.) *N.F.S.*

105323 A method to determine and reduce the response time of resistance thermometers under practical conditions. H.R.Taylor (Dept. of Electrical Engng. & Electronics, Univ. of Manchester Inst. of Sci. & Technol., Manchester, England), H.A.Navarro.
J. Phys. E (GB), vol.16, no.9, p.916-18 (Sept. 1983).
An analogue model of a resistance thermometer immersed in a fluid is proposed. It is shown how measurements of the self-heating effect can be used to determine the parameters of the model, and hence the time response of the thermometer under working conditions. These parameters reveal important information about the thermometer and its environment and make it possible to design a compensating filter. A significant improvement has been achieved by this method. (1 ref.)

105324 Thermometry by CARS in an automobile engine. G.C.Alessandretti, P.Violino (Fiat Res. Centre, Orbassano, Italy).
J. Phys. D (GB), vol.16, no.9, p.1583-94 (14 Sept. 1983).
Temperature measurements in an automobile engine running in normal operating conditions have been obtained by observing the CARS spectra of molecular nitrogen. Pulsed lasers and a broad-band technique have been used to allow the single-pulse measurements necessary for studying combustion behaviour and cycle-to-cycle fluctuations. A fitting technique has been used to determine temperatures from the experimental data, with an uncertainty of about 50 to 100K. The authors discuss the problems that are still unresolved in order to achieve better accuracy: beside experimental refinements a further knowledge of molecular parameters seems to be required. (35 refs.)

105325 High resolution quartz temperature sensors. U.Priess.
Qualite Rev. Prat. Controle Ind. (France), vol.22, no.120, p.76-8 (April 1983). In French.
By suitable cutting of a quartz crystal it is possible to obtain a linear relationship between temperature and frequency. Suitable angles of cut are given for frequencies between 1.65 and 13.56 MHz. Suggested applications are (a) flowmeters, where the rate of flow produces a fall in temperature of a heated quartz crystal, and the resulting change in frequency is a measure of the rate of flow; (b) measurement of low gas pressures from the heat of loss of the crystal. (7 refs.) *N.C.*

Determination of high melting points of metals and slags by a contact method .... See Entry 105328

Remote method for measuring the temperature of objects irradiated by lateral sources .... See Entry 105374

Comparison of triple point temperatures realized in two different types of sealed cells .... See Entry 107871

Coaxial nonmetallic thermocouple with electronic ice point for dosimetric use in electromagnetic environments .... See Entry 109973

Experimental validation of a spectral direct solar radiation model .... See Entry 110602

07.20F Calorimetry

105326 Modifications to a commercial flow microcalorimeter system. I.R.Tasker, R.H.Wood, H.J.Albert (Dept. of Chem., Univ. of Delaware, Newark, DE, USA).
J. Chem. Technol. & Biotechnol. (GB), vol.33A, no.3, p.137-9 (April 1983).
Commercially available calorimetry systems now account for the major portion of thermochemical research. A number of simple modifications to one such calorimeter have been found to maintain the accuracy and precision of the data obtained while achieving increased efficiency and reduced cost. (24 refs.)

Thermal diagnostics of pulsed 0-2 MeV electron beams and bremsstrahlung .... See Entry 105425

Precise measurement of laser power using calorimetric method .... See Entry 106791

07.20H Furnaces

105327 An automatic monoellipsoidal mirror furnace facility for long-term crystal growth on EURECA. J.Stapelmann (Dornier System GmbH, Friedrichshafen, Germany).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.117-19
The concept of an automatic mirror heating facility representing a new generation of these facilities is outlined. Significant concept changes as compared to existing furnaces are described. A brief summary of performance data is provided. (2 refs.)

Development of an acoustic levitation device with a mirror furnace .... See Entry 106957

07.20K High-temperature techniques and instrumentation; pyrometry

105328 Determination of high melting points of metals and slags by a contact method. N.P.Lyakishev, A.G.Semin (I.P. Bardin Central Sci.-Res. Inst. of Ferrous Metall., Moscow, USSR).
Ind. Lab. (USA), vol.48, no.11, p.1103-6 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.44-6 (Nov. 1982).
A device for determining the melting point of metals and slags of up to 2273K and which is based on the thermo-optical method is described. The device includes a microfurnace with a molybdenum or tantalum heating element, an electric power unit with automatic and manual regulation, a binocular magnifier (×2-10), and a VR 5/20 tungsten-rhenium thermocouple with a PP-63 potentiometer. The mains voltage is 127/220 V. The maximum load current 24/40 A, frequency 50 Hz, regulated voltage 0-250 V. A reducing gear with a 150 W electric motor (20 rpm) is connected to the device for automatic regulation. The distinguishing feature of the device is the design of the heating element and positioning of the specimen above the hot junction of the thermocouple. (8 refs.)

Infrared sensor for remote temperature monitoring of solar thermal central receivers .... See Entry 105372

Remote method for measuring the temperature of objects irradiated by lateral sources .... See Entry 105374

An extensometer for axial strain measurement at high temperature .... See Entry 107081

Fusion in phosphate systems at temperatures up to 2970K .... See Entry 107877

07.20M Cryogenics

105329 Microminiature refrigerators for cooling detectors. R.Wolfe, R.M.Duboc,Jr. (MMR Technol., Mountain View, CA, USA).
Photonics Spectra (USA), vol.17, no.7, p.52-5 (July 1983).
Miniature Joule Thomson refrigerators provide a new detector cooling alternative for both commercial and military applications. Although these microminiature refrigerators use the same thermodynamic principles of operation as the traditional J-T cryostats, the similarities stop there. In many applications, they offer significant advantages in size, weight, and often in cost and performance. The solution to the scaling problem is to use photolithographic techniques, similar to those used in semiconductor manufacturing, to define very precise, small channels in low thermally conductive substrates (typically glass). Etched in this way, they form a network of encapsulated channels, which by design form a Joule-Thomson refrigerator. In mass production, a step-and-repeat process is used to produce a mask of many duplicate images of channel pattern. With this mask one can produce multiple copies of the refrigerator on one large substrate, which is later diced to produce the individual units. This fabrication process has proved to be reliable and consistent, leading to low unit costs in high-unit-volume applications. (3 refs.)

105330 Alternate approaches to cryogenic cooling [spaceborne IR detectors]. W.Atkinson, A.DeVilliers, R.Kappesser (Riverside Res. Inst., Arlington, VA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.366, p.130-8 (1983). (Modern Utilization of Infrared Technology VIII, San Diego, CA, USA, 26-27 Aug. 1982).
Cryogenic cooling techniques for spaceborne infrared detectors are surveyed. An alternative class of cooling cycles is defined, and four practical cycles described. A general overview of operating efficiency for the whole class is developed. One of these cycles, the isobaric absorption cycle (Servel cycle), is explored in some detail. (8 refs.)

Static and buckling analysis of a cryostat outer wall (Bell-Jar) for the whole magnetic system of the INTOR-NET fusion reactor .... See Entry 106167

07.30 VACUUM PRODUCTION AND TECHNIQUES

(inc. pressures below 1 atmosphere; see also 47.45 Rarefied gas dynamics; 81.15G Vacuum deposition)

Ultrahigh vacuum system for a scanning Auger microprobe .. See Entry 105432

07.35 HIGH PRESSURE PRODUCTION AND TECHNIQUES

(inc. pressures above 1 atmosphere)

A simple high-pressure sample cell for diffusion coefficient measurements by the spin-echo technique .... See Entry 105347

Development of Ti-6A1-4V gas bottle for satellite applications ....See Entry 109436

Apparatus for high-pressure studies in chemical kinetics in liquid ammonia from −40°C+150°C (233-423K) ....See Entry 109731

07.50 ELECTRICAL INSTRUMENTS AND TECHNIQUES

105331 Four-point magnetoresistivity measurements. R.H.Norton (Magnetic Bubble Memory Dept. Nat. Semiconductor Corp., Santa Clara, CA, USA).
IEEE Trans. Magn. (USA), vol.MAG-19, no.4, p.1579-80 (July 1983).
The standard four-point resistivity probe for unpatterned thin films is not suitable for saturation magnetoresistivity measurements. Modifying the geometry of the four points, however, gives a simple and reliable measurement. (no refs.)

105332 Apparatus for the investigation of deep level parameters in semiconductors. V.B.Barkov, L.V.Lebedeva, I.A.Fomin.
Instrum. & Exp. Tech. (USA), vol.25, no.6, pt.2, p.1513-17 (Nov.-Dec. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.6, p.178-81 (Nov.-Dec. 1982).
An apparatus is decreased for which the method of recording the relaxation of the capacitance of a p-n junction or a Schottky barrier, proposed by Lang (1974) underlies the operation. Utilization of a two-channel stroboscopic integrator in the apparatus permitted complete automation of the process of recording the temperature spectrum of a signal, and execution of the recording of the deep-level concentration profile in the semiautomatic regime. The apparatus permits investigation of diverse traps in semiconductors with the activation energies 0.15-0.9 eV by measuring rapid (5 μsec-1 sec) relaxations of the specimen capacitance during temperature scanning in the 100-423 K band. The apparatus contains a circuit for automatic calibration. (8 refs.)

105333 Spark-discharge energy meter. S.K.Gil', E.N.Dolgov (Leningrad Technol. Inst., Leningrad, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.6, pt.2, p.1520-2 (Nov.-Dec. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.6, p.184-5 (Nov.-Dec 1982).
An instrument for remote measurement of the energy of spark discharges which occur when static electricity builds up in dielectric media is described. The operation of the instrument is based on registration of the electromagnetic radiation of the spark. The repetition rate of spark discharges is up to 100 Hz at a minimum pulse duration of 5 μsec. The sensitivity of the instrument is 10^{-8} J/mA. (5 refs.)

105334 A method of digital loss angle measurement. A.Krzywaznia, P.Madej, J.Ociepka (Inst. of Electrical Metrology, Tech. Univ. of Wroclaw, Wroclaw, Poland).
J. Phys. E (GB), vol.16, no.9, p.823-5 (Sept. 1983).
Describes the principle and the main measurement errors of a loss angle meter based on digital pulse time width measurement. The concept of measuring the loss angle by using a time measurement technique has many advantages. Particularly, it eliminates material capacity standards and requires a frequency standard only. The main limitations on the accuracy are due to analogue signal processing. The achieved accuracy of the instrument is comparable with that of automatic transformer bridges, but the resolution of measurement is much better, and the measuring voltage is smaller than that of automatic bridges operating in the same frequency region. (1 ref.)

105335 An instrument to measure Hall voltages in low-mobility, high-resistivity irregularly shaped samples. D.Marioli, V.Varoli (Centro Studi Nucleari Enrico Fermi (CESNEF),,Milano. Politecnico di Milano,Italy).
J. Phys. E (GB), vol.16, no.9, p.892-5 (Sept. 1983).
The instrument described employs a zeroing technique to measure the Hall voltage in low-mobility, high-resistivity and irregularly shaped samples of semiconductor materials. The measurement is performed following the Van der Pauw method. The zeroing technique permits the reduction of the large errors introduced by the conventional methods when the Hall voltage is only a small fraction of the unbalance voltage existing between the measuring points of the asymmetrical sample in the absence of magnetic field. Using this instrument Hall voltages as low as a few microvolts are detectable even in samples which have hundreds of millivolts of offset voltage, and mobility values lower than 10^{-4} m^2 V^{-1} s^{-1} have been successfully measured. (5 refs.)

105336 An automatic digital electrometer. D.Dosen.
Rev. Telegr. Electron. (Argentina), vol.71, no.838, p.170-2 (March 1983). In Spanish.
Describes an electrometer designed for the automatic measurement of very low ion currents (10^{-13} A) when determining very high vacuum pressures (10^{-10} Torr) with a conventional Boyard Alpert type ionisation manometer. As a result of the decision to use the simplest possible design permitting the use of components available within Argentina and permitting digital operation for the ultimate use of computer control, it was decided that the technique known as charge sampling should be adopted. After giving the reasons for this choice, the author explains the charge sampling technique, gives an analysis of the inherent errors and finally describes the operating principles of the amplifiers used to amplify the signal from the charge sampler. (9 refs.) *G.W.*

105337 Optimization of design parameters of eddy-current feedthrough transducer. V.K.Zhukov, V.F.Bulgakov (Sci.-Res. Inst. of Electronic Introscopy, Tomsk, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.10, p.787-95 (Oct. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.10, p.39-49 (Oct. 1982). [received: Sept. 1983]
A mathematical model is proposed for describing a short defect. The design of a triple-winding eddy-current feedthrough transducer is optimized taking into account the effect of interference factors attributable to axial nonuniformity of electromagnetic properties and to radial displacements, and also the effect of 50 Hz industrial-frequency pickup. (6 refs.)

105338 Measurement of transmission bandwidth for optical fibres. W.A.Steffen, W.Kotyczka.
Tech. Mitt. PTT (Switzerland), vol.61, no.8, p.249-58 (1983).
The authors deal with the complex area of measurement of transmission bandwidth for optical fibres. At first, the article outlines the specific problems of optical fibres and the requirements of the practical measurement techniques. It then proceeds to the hardware and software construction of a set-up for optical sweep measurements of high dynamic range qualified for fieldwork. The measurements performed with this set-up on the optical fibre installation of Altdorf-Erstfeld are commented in a special section. (4 refs.)

105339 Experimental facility to measure conductivity of liquid metals and semiconductors.. H.-U.Tschirner (Sektion Phys., Tech. Hochschule Karl-Marx-Stadt, Karl-Marx-Stadt, Germany).
Wiss. Z. Tech. Hochsch. Karl-Marx-Stadt (Germany), vol.25, no.2, p.204-18 (1983). In German.
A survey of conventional and new methods is given. The well known 'Two to four point method', the electrodeless method and others are reviewed. All contactless methods rely on the induction of eddy currents in the probe as a result of changes in the magnetic field. These eddy currents are directly proportional to the conductivity of the material in question. Another method is the rotating field, i.e. three phase field, in which the relationship of torque and the conductivity has been expressed in the form of an equation. Curves show electrical conductivity of liquid In-Te alloys as a function of concentration and the dependence of electrical conductivity of the alloys on temperature. A sketch of the measuring arrangement and a drawing of measuring cells by Davies and Leach (1969), Nakamura and Shimoji (1969) are given. (62 refs.) *G.R.S.*

105340 Electromagnetic stirred mode cavities (SMCs). R.N.Clarke.
Report NPL-DES-75, Nat. Phys. Lab., Teddington, England (Aug. 1982), 41 pp.
This survey seeks to draw together from a wide range of areas in electromagnetic metrology those aspects of the theory and use of the stirred mode cavity which should be of relevance in all of its applications. Short descriptions of four types of application are included in which relevant aspects of stirred mode cavity performance are highlighted, chiefly with a view to explaining their relevance to microwave or millimetre wave metrology. The areas covered are power measurements, dosimetry, electromagnetic compatibility studies and dielectric measurements. Aspects of the latter are discussed in some depth. (49 refs.)

Evaluation of an electrostatically-collimated ion source in an isotopic-ratio mass spectrometer ....See Entry 105414

Electrometer designs for use in an unbound-quark search ..... See Entry 105707

A Couette cell with fixed stator alignment for the measurement of flow modified permittivity and electroviscosity ....See Entry 107280

A non-invasive flowmeter based on electrical conductivity measurements ....See Entry 107306

Characterization of metals and alloys by electrical resistivity measurements ....See Entry 109642

Measurement of mutual impedance in eddy current testing coils ....See Entry 109696

Fabrication of a low cost controlled potential coulometer ..... See Entry 109839

Limitations on solar cell open-circuit voltage and efficiency . See Entry 109890

07.55 MAGNETIC INSTRUMENTS AND TECHNIQUES

105341 Determination of the magnetic permeability of a complex-shape body using magnetic field measurements. II. I.P.Stadnik, V.V.Milyukov, G.P.Kozik.
Izv. VUZ Elektromekh. (USSR), no.7, p.14-17 (July 1983). In Russian.
In the first part of this contribution (see ibid., no.6, p.17-22, 1983), two methods for the determination of the magnetic permeability of bodies of complex shape were proposed and analysed. In this part, this problem is considered in greater detail. Thus, for the first method, an expression is derived and a graph constructed, for the magnetic permeability of bodies, using measurements of the resultant field component at a point. In the second method, based on a solution of the reverse case of magnetostatics, the permeability is found by measuring the resultant scalar magnetic potential on the outer surface of the magnetic body. The application of the two methods is illustrated by examples. (2 refs.) *Z.F.V.*

105342 General-purpose superposed transducer for inspecting the magnetic permeability of products made from weakly magnetic materials. A.A.Avramenko, V.A.Drunov, V.P.Sebko, V.I.Tyupa (V.I. Lenin Kharkov Polytech. Inst., Kharkov, Ukrainian SSR).
Ind. Lab. (USA), vol.48, no.11, p.1113-16 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.51-2 (Nov. 1982).
A general-purpose superposed transducer is discussed that can measure the characteristics of weakly magnetic products having plane and cylindrical surfaces. The device uses the transducer in a differential circuit based on a pulsed-induction method of measurement with DC. The magnetizing windings of operating and compensating transducers are connected in series aiding, but the measuring windings are connected in series opposing. The difference between the flux linkages of the measuring windings is measured with a flux meter during switching of the current. The magnetizing current is indicated on an ammeter. By means of a magnetic shunt on the compensating transducer the circuit is balanced. (6 refs.)

New developments in magnetic flow measurement in partly filled open channels ....See Entry 107289

Automatic AF-demagnetiser using a two-axis spin magnetometer ....See Entry 110718

07.58 MAGNETIC RESONANCE SPECTROMETERS, AUXILIARY INSTRUMENTS AND TECHNIQUES

(see also 61.16N EPR and NMR determinations)

105343 Portable NMR sample localization method using inhomogeneous RF irradiation coils. M.R.Bendall (School of Sci., Griffith Univ., Nathan, Queensland, Australia).
Chem. Phys. Lett. (Netherlands), vol.99, no.4, p.310-15 (12 Aug. 1983).
In NMR spectroscopy, a phase-cycled multipulse scheme has been shown to discriminate against sample regions where pulse angles differ markedly from ideal $\pi/2$ and π angles. Potentially, the method may be used with multiple inhomogeneous RF coils to obtain a spectrum from a localized region of a large sample, and this is illustrated by a first attempt with a double surface coil. (10 refs.)

105344 Superconducting solenoid for an ESR spectrometer. V.I.Kurochkin, A.Ya.Laptienko, N.V.Taryanik, V.V.Sukhoi, V.V.Shaparenko (Special Designs Office, Donets Tech. Phys. Inst., Donet, Ukrainian SSR).
Instrum. & Exp. Tech. (USA), vol.25, no.6, pt.2, p.1485-7 (Nov.-Dec. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.6, p.154-5 (Nov.-Dec. 1982).
A superconducting solenoid is described for a 2 mm ESR spectrometer, which has internal and external slots and which produces a magnetic field of 7.5 T with a homogeneity of about 10^{-5} per cm. The field modulation of 0.05 T at 10 Hz and sweep of ±0.1 T are provided by a superconducting winding within the solenoid. (3 refs.)

105345 Experimental verification of depth pulses applied with surface coils. M.R.Bendall (School of Sci., Griffith Univ., Nathan, Queensland, Australia), W.P.Aue.
J. Magn. Resonance (USA), vol.54, no.1, p.149-52 (Aug. 1983).
Recently it was shown that phase cycling of pulses in multipulse sequences in the manner of Bodenhausen et al. (ibid., vol.27, p.511, 1977) and Demco et al. (ibid., vol.16, p.467, 1974) enables use of these sequences with surface coils to partially localize the sample region. These multipulse sequences, which were called 'depth pulses' when used for sample localization, were introduced by a theoretical discussion and were established experimentally using a normal high-resolution spectrometer. These experiments involved using a normal irradiation coil (saddle) of high RF homogeneity, and varying the pulse lengths to mimic the behavior of sample regions at varying distances from a surface coil. The recent availability of a 300 mm bore 80 MHz (proton) Oxford magnet equipped with a Brukerk CXP console, to provide high-power programmable RF pulses, has enabled direct experimental verification of these depth pulses when used with surface coils. (5 refs.)

105346 Overcoupling NMR probes to improve transient response. G.C.Chingas (Chem. Div., Naval Res. Lab., Washington, DC, USA).
J. Magn. Resonance (USA), vol.54, no.1, p.153-7 (Aug. 1983).
When excessively long probe ringing after a radio frequency (RF) pulse interferes with receiver operation, the probe coil must be damped to reduce the lifetime of the transient. Although a popular approach involves using auxiliary resistance to lower the effective coil Q, it is also possible to achieve the same end by coupling a high Q coil to the transmission line more strongly than the matched condition prescribes. Overcoupling a coil by tuning it to mismatch offers several benefits. From a practical viewpoint, the tradeoff between performance and ringdown can be selected simply by 'tweaking' the probe tuning capacitors. (6 refs.)

105347 A simple high-pressure sample cell for diffusion coefficient measurements by the spin-echo technique. A.J.Easteal, L.A.Woolf, F.L.Wilson (Res. School of Phys. Sci., Australian Nat. Univ., Canberra, Australia).
J. Magn. Resonance (USA), vol.54, no.1, p.158-60 (Aug. 1983).
A sample cell similar to that described by Jonas (Rev. Sci. Instrum., vol.43, p.643, 1972) has been used successfully in the authors' laboratory for several years for diffusion coefficient measurements on liquids over extended pressure and temperature ranges. The cell is esentially a glass sample tube joined with a glass/metal seal to a 0.1 mm wall thickness stainless steel bellows which transmits pressure to the sample. The cell has the limitations that (a) it cannot be used for samples which corrode glass or stainless steel and (b) the glass breaks and/or the bellows is severely distorted if the sample should freeze during measurements. The authors describe a sample cell that does not have these limitations. The cell is constructed in such a way that the sample is in contact only with PTFE. Pressure is transmitted via a collapsible thin-wall (0.25 mm) PTFE 'bellows'. (4 refs.)

105348 The influence of the waveform of the time-dependent magnetic field gradient on the spatial localization in the sensitive-point method of NMR imaging. S.Ljunggren (Dept. of Phys. Chem., Royal Inst. of Technol., Stockholm, Sweden).
J. Magn. Resonance (USA), vol.54, no.1, p.165-9 (Aug. 1983).
In the sensitive-point method of NMR imaging sinusoidally modulated linear-magnetic field gradients are applied in three mutually perpendicular directions. The resulting time averaged in-phase component of the signal will then originate from just a small proportion of the sample in the vicinity of the 'pivoting point' where the field remains constant. It is of interest to see whether a better localization can be obtained by using a different waveform to modulate the gradient. The author calculates the signal corresponding to an arbitrary periodically varying gradient in the x direction: $G_x(t)=G_x{}^0f(t)$ with the period $2\pi/\omega_m$. The resonance frequency at the point x of the sample will then be $\omega_A=\gamma B_z(x)=\omega_0+\omega_s f(t)$, where the author has introduced $\omega_s=\gamma G_x{}^0x$ and $\omega_0=\gamma B_0$. (4 refs.)

105349 Apodization and exact 'integration' of Fourier transform nuclear magnetic resonance spectra. S.O.Chuan, M.B.Comisarow (Chem. Dept., Univ. of British Columbia, Vancouver, British Columbia, Canada).
J. Magn. Resonance (USA), vol.54, no.2, p.201-15 (Sept. 1983).
Calculation by magnitude Lorentzian interpolation of the scaling factor for the components of the FTNMR FID has been previously shown to give a more accurate measure of the number of chemically equivalent nuclei than does the traditional procedure of digital integration. Judicious choice of a line broadening factor for the FID increases the measurement accuracy of the scaling factor determination. The reasons for the increased accuracy can be discussed in terms of changes in the discrete spectral signal to noise (S/N) ratios upon line broadening. For small values of $T/T_2{}^*$, the ratio of the acquisition time to the relaxation time of the NMR FID, line broadening may increase or decrease the signal to noise ratio of the three discrete spectral intensities used in the magnitude Lorentzian calculation. But for larger values of $T/T_2{}^*$, line broadening within a factor of 3-4 of the matched filter always increases the S/N ratio. While excessive line broadening (slightly) decreases the accuracy of the scaling factor calculations for well separated lines, it can be employed to accurately determine the total number of nuclei which give rise to overlapping lines. (9 refs.)

105350 Investigation of coupled spin networks by two-dimensional multiple-quantum coherence spectroscopy. M.A.Thomas, A.Kumar (Dept. of Phys., Indian Inst. of Sci., Bangalore, India).
J. Magn. Resonance (USA), vol.54, no.2, p.319-23 (Sept. 1983).
Recently Ernst, Bolton, and co-workers (1982) have demonstrated that the identification of groups of resonances belonging to the same network of scalar coupled spins can be achieved using a modified version of two-dimensional correlated spectroscopy and the complete coupling network identified, through relayed coherence transfer. When a nucleus A spin coupled to another nucleus M, which in turn is coupled to a third nucleus X, with the A-X coupling being vanishingly small, the cross peak between A and X is absent in the normal homonuclear two-dimensional (2D) correlated spectroscopy, yielding no conclusive evidence that these spins beong to a coupled network. Through their modified pulse scheme ($90°$-t_1-$90°$-τ-$180°$-τ-$90°$-t_2), Ernst and co-workers have shown that it is possible to correlate the nuclei A and X, where the efficiency of coherence transfer is proportional to $\sin(2\pi J_{AM}\tau)$ $\sin(2\pi J_{MX}\tau)$. A study of various multiple-quantum coherences is a more general method and leads to the identification of such coupled spins in a network. In particular, in cases where there are, accidental or otherwise, overlaps of resonances within a coupling network, a study of the multiple-quantum transitions (MQT) unambiguously yields the desired information. (6 refs.)

105351 Quadrature detection coils—a further $\sqrt{2}$ improvement in sensitivity. C.-N.Chen, D.I.Hoult, V.J.Sank (Div. of Res. Services, Nat. Inst. of Health, Bethesda, MD, USA).
J. Magn. Resonance (USA), vol.54, no.2, p.324-7 (Sept. 1983).
Several years ago, one of the authors published an article which described the use of orthogonal receiving coils for determining the sign of the gyromagnetic ratio (Hoult, 1978). The idea was by no means original, having first been communicated to the author by H.D.W. Hill in about 1968. However, the present authors have been prompted recently to examine afresh the use of 'crossed-coil' systems in the belief that they are of considerably greater value than has previously been realized. (3 refs.)

105352 Multiple-quantum relayed transfer spectroscopy. P.H.Bolton (Chem. Dept., Wesleyan Univ., Middletown, CT, USA).
J. Magn. Resonance (USA), vol.54, no.2, p.333-7 (Sept. 1983). (14 refs.)

105353 A simple graphical representation of Fourier-based imaging methods. S.Ljunggren (Dept. of Phys. Chem., Royal Inst. of Technol., Stockholm, Sweden).
J. Magn. Resonance (USA), vol.54, no.2, p.338-43 (Sept. 1983).
In the case of periodically modulated field gradients a Fourier series expansion in the time domain of the function $\exp(i\mathbf{k}(t).\mathbf{r})$ may be the best way of effecting the image reconstruction. However, the picture of the trajectory in the $\mathbf{k}$ plane may provide a more direct and visual basis for the comparison of different methods and for the construction of new variants. Some of the current NMR imaging methods are examined from this unified viewpoint. For the sake of convenience the author limits himself to two-dimensional cases. (8 refs.)

105354 Non-biological aspects of phosphorus-31 NMR spectroscopy. D.G.Gorenstein (Dept. of Chem., Univ. of Illinois, Chicago, IL, USA).
Prog. Nucl. Magn. Resonance Spectrosc. (GB), vol.16, pt.1, p.1-98 (1983). (339 refs.)

Fundamentals of molecular spectroscopy. Third edition ....See Entry 105052

Features of advanced neutron optical devices ....See Entry 106688

Dispersed liquid phase referencing of NMR spectra ....See Entry 108806

07.60 OPTICAL INSTRUMENTS AND TECHNIQUES

(for radiation detection, see 07.62; for spectroscopy and spectrometers, see 07.65; for holography, see 42.40; for optical sources and standards, see 42.72; for optical lens and mirror systems, see 42.78; for optical devices, techniques and applications, see 42.80; for optical testing and workshop techniques, see 42.85; for radiation spectrometers and spectroscopic techniques, see 29.30; for radiation measurement, detection and counting, see 29.70)

105355 A hinged prism device for alignment in hilly terrain. F.A.Ahmed (Dept. of Civil Engng., Univ. of Petroleum & Minerals, Dhahran, Saudi Arabia).
Arabian J. Sci. & Eng. (GB), vol.8, no.2, p.123-8 (April 1983).
Discusses the development of a hand-held device which facilitates alignment in hilly terrain. The device is used to establish points between two existing but not intervisible points. Furthermore, if existing targets are intervisible, but a large vertical angle is involved in setting any of the points, the new optical aligner may be used. It consists basically of two right-angled pentagonal prisms that can turn on a vertical plane to face the nonintervisible points. Hence the two points can be observed simultaneously despite the differences in height. Experiments with the prototype developed show that a standard deviation of ±1 cm per 100 m is obtainable in setting a point. The procedure takes less than one minute. Thus, the instrument is both simple and efficient. (3 refs.)

Use of light diffraction in dimensional gauging ....See Entry 105309

A variable-temperature vacuum sensitometer for studying the temperature dependence of photographic sensitivity ....See Entry 105405

Mode matching for a passive resonant ring laser gyroscope .. See Entry 106787

07.60D Photometry and radiometry

(inc. colorimetry; see also 07.62 Detection of radiation)

105356 Remote sensing applications of pulsed photothermal radiometry. A.C.Tam, B.Sullivan (IBM Res. Lab., San Jose, CA, USA).
Appl. Phys. Lett. (USA), vol.43, no.4, p.333-5 (15 Aug. 1983).
The technique of pulsed photothermal radiometry (PPTR) (i.e. detection of the transient infrared thermal radiation from a condensed matter sample heated by a short-pulsed radiation) is useful for single-ended remote sensing applications. The authors demonstrate for the first time such applications for spectroscopic detection, measurement of absolute absorption coefficients in opaque materials, and sensing of dimensions or thermal properties in inhomogeneous materials. Theory of the PPTR technique in the simple case of a semi-infinite homogeneous material is described. (10 refs.)

105357 A portable densitometer with digital indication. M.E.Shul'man, I.F.Shchedrin, V.A.Kazintsev (Design and Technol. Inst. Energomontazhproekt, Moscow, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.10, p.775-7 (Oct. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.10, p.28-9 (Oct. 1982). [received: Sept. 1983]
To increase the resolving power and accuracy of measurements of the density of blackening of radiographs, a portable densitometer with the digital indication of measurement results was developed. The method of determining the density of blackening of the radiographs, employed in this device, is based on the conversion of the light flux passed through the photograph into a current or voltage, with the subsequent conversion of electrical signals into a digital code equivalent to the density of blackening. (2 refs.)

105358 Evaluation of an effective medium temperature from radiometric-satellite beacons comparisons. P.Sobieski, M.Van Schingen, A.Laloux (Lab. de Telecommunications, Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium), G.Brussaard.
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.225-31
Radiometric calibration by OTS beacons is analyzed for the propagation data base produced by the European Space Agency SCTS station and four fluxmeters, for the three first years of the satellite. An effective medium temperature model is proposed in order to improve the prediction method of attenuation from radiometric statistics. An analysis of the predictor is also performed in terms of static error and standard deviation for the proposed model. (11 refs.)

105359 Influence of surface type on the brightness temperature of snow-covered terrain. M.T.Hallikainen (Radio Lab., Helsinki Univ. of Technol., Espoo, Finland), M.C.Dobson, S.Moezzi.
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.273-9
The effect of various surface types on the satellite-derived brightness temperature of snow-covered terrain at 18 GHz and 37 Ghz is investigated using digitized surface type maps of Finland. From the Nimbus-7 SMMR data for numerous test areas with mixed surface types, the response of each major surface type is derived. The results are compared with theoretical values using plane boundary and rough boundary brightness temperature models. (11 refs.)

105360 Comparison of two methods for estimating the water vapor correction to altimeter readings from radiometric measurements. A.Guissard (Lab. de Telecommunications, Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.347-54
Two methods are described for extracting the wet path length correction to altimeter's range measurements from a two-frequency radiometer. Both instruments are on-board of the same spacecraft and the wind speed is assumed known to within ±2 m/s from the altimeter readings. One method is a modification of Grody's method for the determination of water vapor and liquid from space. The other method is an extension of a method proposed by Wu for ground-based determination of the wet path length. A careful comparison of their respective performances is made by proceeding to a simulation analysis on 1080 cases. It is concluded that the extended Grody's method works the best giving, for the analysed set, a maximum standard deviation of 1.8 cm for the wet path length. (47 refs.)

Radiometric design of the level control instruments based on gamma photon backscattering .... See Entry 105376

A readily portable source unit for the calibration of Dobson ozone spectrophotometer wedges .... See Entry 105383

A simplified photometric method of measuring granularity spectra for X-ray pictures .... See Entry 105438

The transition layer method in the problem of thermal radiation from a rough surface .... See Entry 106664

Radiative transfer in size-limited bodies .... See Entry 106978

A standard photometric method of determining beam sizes of defects .... See Entry 109672

Apparatus for high-pressure studies in chemical kinetics in liquid ammonia from −40°C+150°C (233-423K) .... See Entry 109731

Mesopheric water vapour measured with an airborne sensor .. See Entry 110735

Radiometric sensing of the atmospheric boundary layer .... See Entry 110736

Meteorological satellite and its image processing techniques .... See Entry 110852

07.60F Polarimetry and ellipsometry

105361 High-speed retardation modulation ellipsometer. A.Moritani, Y.Okuda, H.Kubo, J.Nakai (Dept. of Electronic Engng., Osaka Univ., Osaka, Japan).
Appl. Opt. (USA), vol.22, no.16, p.2429-36 (15 Aug. 1983).
Construction and performance of a high-speed retardation modulation ellipsometer are described. An ADP four-crystal electrooptic modulator is used for the retardation modulation and a high-speed digitizer for the simultaneous detection of the transmitted light intensity and the modulation voltage. The ellipsometer can acquire the necessary data for determining a data point (Ψ,Δ) in 4 μsec and repeat the data acquisition for fifty data points at intervals of 4 μsec-160 msec. In such conditions, precision represented in terms of an average of root mean squares is 0.05° in Ψ and 0.15° in Δ when a BaK1 standard optical glass is used as a sample at the present stage. An example is given of the application to rapid growth of anodic films on a semiconductor GaAs wafer. (38 refs.)

105362 Highly sensitive instrument for measuring optical birefringence. Y.Shindo, H.Hanabusa (Res. Inst. for Material Sci. & Engng., Faculty of Engng., Fukui Univ., Fukui, Japan).
Polym. Commun. (GB), vol.24, no.8, p.240-4 (Aug. 1983).
A highly sensitive instrument for the measurement of optical birefringence, utilising a photoelastic modulator and a phase-sensitive technique, is described and discussed. The instrument has not only the high sensitivity required to measure very small retardation but also the capability of measuring large retardation accurately. The instrument is especially suitable for detecting very small changes in birefringence. The method of calibration of the instrument is explained. The results obtained for poly(methyl methacrylate) samples are presented and compared with those obtained using a polarising microscope equipped with a Berk-compensator. (9 refs.)

105363 A method of multibeam ellipsometry. Yu.A.Kontsevoi, M.S.Finarev.
Ind. Lab. (USA), vol.48, no.11, p.1107-9 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.47-8 (Nov. 1982).
Examines the simplest variant of the multibeam ellipsometry in which the working light beam passes in the gap between the specimen and the mirror. The ellipsometric parameters of the specimen-mirror system are determined. (2 refs.)

Spectropolarimeter with electromechanical compensation ...... See Entry 105381

07.60H Refractometry and reflectometry

105364 Scattering and absorption of turbid materials determined from reflection measurements. II. Measuring method and calibration. R.A.J.Groenhuis (Lab. for Materia Tech., State Univ. Groningen, Groningen, Netherlands), J.J.Ten Bosch, H.A.Ferwerda.
Appl. Opt. (USA), vol.22, no.16, p.2463-7 (15 Aug. 1983).
For pt.I see ibid., vol.22, no.16, p.2456 (1983). A new experimental method has been developed to determine the scattering and absorption characteristics of a turbid material. Existing methods usually require transmission and reflection measurements carried out on a thin slab of the material under study; this method is based on reflection measurements carried out on bulk material. This will be of great advantage in many applications. This paper describes the measuring system and indicates the area of application of the method. Calibration measurements have been carried out to substantiate the approach. (8 refs.)

105365 Accurate method of measuring the temperature independence of the reflectance of metal mirror surfaces. V.P.Andronov, V.L.Okulov, V.P.Savelev'eva.
Instrum. & Exp. Tech. (USA), vol.25, no.6, pt.2, p.1470-3 (Nov.-Dec. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.6, p.140-2 (Nov.-Dec. 1982).
Equipment for measuring the temperature dependence of the reflectance of metal mirror surfaces is described. The multiple reflection method is used to increase the measurement accuracy. The main component of the equipment is a two-mirror multipath cuvette. One of the mirrors of the cuvette is a standard mirror, and the second can be heated to a temperature of 500°C in air or in an atmosphere of the light inert gases (He, Ne). The measurements were made simultaneously at wavelength of 0.63 μm and 10.6 μm. The error in measuring the reflectance is ±0.002 at a wavelength of 0.63 μm, and ±0.004 at a wavelength of 10.6 μm. (4 refs.)

105366 An instrument for measuring the curvature of reflecting surfaces. A.F.Foederer, J.L.M.Hagen, A.G.van Nie (Philips Res. Labs., Eindhoven, Netherlands).
Philips Tech. Rev. (Netherlands), vol.40, no.11-12, p.338-41 (1982).
An instrument is described that can be used for measuring the shape of a surface. The measurement is fully automated, and no force is exerted on the surface. The inaccuracy of the measurement is less than ±2.5% for a radius of curvature of 3 m and a test length of 50 mm. The optical system is focused on the reflecting surface by a method used in the LaserVision system. The light source is the AlGaAs semiconductor laser used in the Compact Disc system. The linear movement along the surface is guided by aerostatic air bearings with a tapered gap. These bearings are less difficult to produce than air bearings with a parallel gap, and are less sensitive to dirt and damage. (8 refs.)

07.60L Interferometry

105367 Cyclic interferometers for optical testing. A.Cordero-Davila (Univ. Autonoma de Puebla, Puebla, Mexico), J.Pedraza-Contreras, O.Cardona-Nunez, A.Cornejo-Rodriguez.
Appl. Opt. (USA), vol.22, no.16, p.2478-80 (15 Aug. 1983).
In this paper, the authors describe two compact cyclic interferometers which can be used for the testing of right-angle prisms; with some modifications they can also be used for testing convergent wavefronts. (7 refs.)

105368 Multiplexed speckle and holographic interferometry with color encoding by white-light processing. P.H.Ruterbusch, J.A.Tome, F.T.S.Yu (Electrical Engng. Dept., Pennsylvania State Univ., University Park, PA, USA).
Opt. Eng. (USA), vol.22, no.4, p.501-4 (July-Aug. 1983).
A technique for multiplexing holographic and speckle interferometric images utilizing a narrow angle holographic construction scheme is presented. The image reconstruction process utilizes a white-light processing system for color encoding of interferometric fringe patterns. The property of color encoding reveals interesting interferometric aspects of the multiplexed fringe patterns. A color video system is used to provide the advantage of displaying the output interferometric images for detailed study. Experimental results of time-averaged and double exposure interferometric processes are given. This technique is ideally suited to aid in the location of the J_0 order holographic fringe. (17 refs.)

105369 Nonlinear antiresonant ring interferometer. K.Otsuka (Musashino Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Tokyo, Japan).
Opt. Lett. (USA), vol.8, no.9, p.471-3 (Sept. 1983).
A beam-slitter ring-mirror configuration employing a Kerr-like nonlinear medium, that is a nonlinear antiresonant ring interferometer, is proposed for several optical functional devices. The basic idea behind the configuration is derived from the formation of a nonlinear refractive-index grating in a Kerr-like medium inside the unbalanced ring. (7 refs.)

105370 Applications of fiber optics in sensors. J.E.Donovan, T.G.Giallorenzi, J.A.Bucaro (Naval Res. Lab., Washington, DC, USA).
Electro/81 Conference Record, New York, USA, 7-9 April 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.8b/4/1-14
The US Navy is developing an optical technology base that, if successful, will permit detection of acoustic, magnetic, thermal, rotational, acceleration or electromagnetic fields by means of the modulation of the optical beam in a fiber. Successful prosecution of this technology will permit detection thresholds many orders of magnitude lower than is presently possible with state-of-the-art sensors. Although acousto-optic sensing is selected for the thrust of the effort, the critical aspects of the technology development are common to many sensors. (9 refs.)

Interferometric detectors for gravitational radiation .... See Entry 105213

Discussion on optical detectors of gravitational radiation ...... See Entry 105217

Electromagnetically-tracked free-mass gravitational wave antennas .... See Entry 105218

Film thickness monitor based on white light interference ...... See Entry 105307

Reconstruction by multidirectional holographic interferometry of the concentration field in a supersaturated solution near a growing $NaClO_3$ crystal .... See Entry 106735

Fine tuning of lasers by an intracavity interferometer containing an absorbing gas .... See Entry 106742

Temporal coherence characteristics of InGaAsP laser diode with single-longitudinal-mode oscillation .... See Entry 106764

Metrological features of a laser device with a single-mirror deflecting unit .... See Entry 106775

Optical performance of a diffraction-limited molded-glass biaspheric lens .... See Entry 106842

Method for subaperture testing interferogram reduction .... See Entry 106907

Moire interferometry for damage analysis of composites .... See Entry 107082

Experimental determination of frequencies and shapes of natural oscillations of small bracket plate using holographic interferometry .... See Entry 107083

Determination of the stress state of bodies with flaws by the method of holographic photoelasticity .... See Entry 107086

Contouring of tooth imprints by means of a fluorescence technique adapted to a spatially filtered moire illumination .... See Entry 110122

Automatic topography using high precision digital moire methods .... See Entry 110123

Studying abdomen size and shape variations during pregnancy: an application of moire topography .... See Entry 110124

Moire techniques in biomedical case studies .... See Entry 110125

Reconstruction of anatomical shapes from moire contourographs .... See Entry 110126

Measurement of kyphosis using moire topography .... See Entry 110127

Analysis of scoliosis by back shape topography .... See Entry 110128

07.60P Optical microscopy

Rotating microscope for Landsat photography of vertebrate embryos .... See Entry 110246

07.62 DETECTION OF RADIATION (BOLOMETERS, PHOTOELECTRIC CELLS, I.R. AND SUBMILLIMETRE WAVES DETECTION)

105371 Modulation-doped $Ga_{0.47}In_{0.53}As/Al_{0.48}In_{0.52}As$ planar photoconductive detectors for 1.0-1.55-μm applications. C.Y.Chen, Y.M.Pang, P.A.Garbinski, A.Y.Cho, K.Alavi (Bell Labs., Murray Hill, NY, USA).
Appl. Phys. Lett. (USA), vol.43, no.3, p.308-10 (1 Aug. 1983).
The authors demonstrate a $Ga_{0.47}In_{0.53}As/Al_{0.48}In_{0.52}As$ modulation-doped photoconductive detector. The detector has a built-in electric field to separate photogenerated electron-hole pairs. This allows the electron lifetime to be precisely determined by electrode spacings. When tested by a 100-ps, $\lambda=1.3$ μm laser pulse, the detector shows an internal gain of 18, a peak external quantum efficiency of 300%, a rise time of 80 ps, a full width at half-maximum of 250 ps, and an internal gain-bandwidth product of 72 GHz. Typical devices have 4-μm spacings between electrodes and 94-μm widths. The detector has a spectral response between 0.6 and 1.65 μm with a dip at 0.86 μm. The authors also measured the noise power of the detector at room temperature. With its capability to be integrated with a modulation-doped field-effect transistor, this detector can be useful in a monolithic integrated photoreceiver. (17 refs.)

105372 Infrared sensor for remote temperature monitoring of solar thermal central receivers. D.W.Warren (Aerospace Corp., Los Angeles, CA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.366, p.112-21 (1983). (Modern Utilization of Infrared Technology VIII, San Diego, CA, USA, 26-27 Aug. 1982).
At the Barstow 10 MW Solar Thermal Pilot Plant, water is converted to high pressure steam by concentrated solar radiation. The design of the elements in which the boiling takes place makes them vulnerable to blockage by particulates contaminating the circulating water. Concern over the potential for heat damage to blocked boiler elements has led to the development of a remote optical monitoring system for use at the Pilot Plant. The system employs a telescope and infrared vidicon to detect the increased blackbody radiant emittance produced by an overheated element. An image is provided with spatial and thermal resolution sufficient to detect and identify a single blocked element. Design considerations for such a system are discussed, as are performance at the Pilot Plant and possible extensions of the system to more sophisticated pyrometric tasks. (no refs.)

105373 Detection range computation by convolution for infrared detectors. K.Tomiyama (Dept. of Electrical Engng., Pennsylvania State Univ., University Park, PA, USA), J.H.Pierluissi, J.T.Hall.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.366, p.157-64 (1983). (Modern Utilization of Infrared Technology VIII, San Diego, CA, USA, 26-27 Aug. 1982).
A detection range computation code which utilizes the Newton's recursive algorithm and the spectral convolution of the target and background emissions with atmospheric transmittance and detector sensitivity was developed and verified using near infrared laboratory measurements. (5 refs.)

105374 Remote method for measuring the temperature of objects irradiated by lateral sources. N.K.Belozerov (All-Union Sci.-Res. Inst. of Complex Problems of Polygraphy, Moscow, USSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1275-9 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.811-17 (Nov. 1982). [received: Sept. 1983]
Relations are proposed for calculating the true temperature of bodies from indications of radiation pyrometers sited on a reference object and the object being measured, and the possibilities for efficient use of these relations are analyzed. (9 refs.)

105375 Measuring unmodulated and modulated optical radiation using large-area photoelements. K.W.Bonfig, E.Kramp (Inst. fur Messtech., Univ. Gesamthochschule, Siegen, Germany).
Mess. & Pruef. (Germany), vol.19, no.6, p.324-7 (June 1983). In German.
The behaviour of large-area Si-photoelements is analysed, considering their response to unmodulated and modulated radiation in the visible wavelength region. It is shown that with suitable operational amplifiers, the output signal for unmodulated light is proportional to the incident radiation intensity, whereas for modulated (e.g. pulsed) light the circuits exhibit a band-pass behaviour, caused by the large capacity of the barrier-layers of the detectors. Circuit designs optimising the band-pass quality are discussed. (6 refs.) *S.R.*

105376 Radiometric design of the level control instruments based on gamma photon backscattering. G.Ochiana, M.Oncescu, C.Popescu (Central Inst. of Phys., Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.6, p.489-97 (1983).
A mathematical modelling method for radiometric design of the level control devices based on gamma backscattering is presented. A Monte Carlo treatment of the detection probability components has been applied to obtain a formula for the source activity prediction. For the investigated geometry, the tank wall and the contained liquid were approximated as plane parallel layers. The calculations performed by the elaborated computer program have been made for a point source considering the following variable parameters: initial photon energy, tank wall thickness, source-detector distance. From the obtained results an optimization study of the source detector arrangement in the form convenient for practical use can be achieved. (6 refs.)

Use of light diffraction in dimensional gauging .... See Entry 105309

Microminiature refrigerators for cooling detectors .... See Entry 105329

Alternate approaches to cryogenic cooling [spaceborne IR detectors] .... See Entry 105330

Thermal diagnostics of pulsed 0-2 MeV electron beams and bremsstrahlung .... See Entry 105425

Internal photoemission from quantum well heterojunction superlattices by phononless free-carrier absorption .... See Entry 108528

Effects of the atmosphere on image resolution in microwave radiometry .... See Entry 110734

Advanced low altitude infrared Earth sensors .... See Entry 110847

07.65 OPTICAL SPECTROSCOPY AND SPECTROMETERS

(inc. photoacoustic spectroscopy)

105377 System analysis and time delay spectrometry. II. H.Biering, O.Z.Pedersen.
Bruel & Kjaer Tech. Rev. (Denmark), no.2, p.3-45 (1983).
For pt.I see ibid., no.1 (1983). Time Delay Spectrometry (TDS) is a relatively new method for measurement of system response. Based on a linear sine sweep it optimizes measurement performance eliminating some earlier drawbacks of swept measurements. By its nature this method tempts one to adopt an identical complex description in the time and frequency domains. The present part deals specifically with the TDS technique and its practical implementation in the B&K Time Delay Spectrometry System Type 9550. It is shown that the analysis carried out is similar, although not identical to standard correlation analysis techniques. The theoretical limitations of the techniques are evaluated from an intuitive point of view and are confirmed by a more rigorous mathematical approach. (2 refs.)

105378 Longitudinal Ramsey-Fringe spectroscopy in a calcium beam. J.J.Snyder, J.Helmcke, D.Zevgolis (Phys.-Tech. Bundesanstalt, Braunschweig, Germany).
Appl. Phys. B (Germany), vol.B32, no.1, p.25-31 (Sept. 1983).
For ultra-high resolution spectroscopic applications such as optical frequency standards, the value of thermal sources such as atomic beams is currently limited by second-order Doppler broadening. The use of a longitudinal interaction geometry in which an atomic beam crosses the counter-propagating laser fields at a small angle is able to reduce second-order Doppler broadening to an insignificant level as well as to provide long interaction times without the necessity of large-diameter optical beams. The authors have analyzed this geometry for the case of the long-lived calcium intercombination line, and conclude that when combined with pulsed (Ramsey) excitation, the longitudinal interaction geometry could be used with a thermal calcium beam to create an optical frequency standard with a reproducibility of the order of 10^{-14} for a few seconds averaging time. The authors' initial experimental results have demonstrated the first use of the longitudinal geometry. (29 refs.)

105379 A new probe of the optical properties of surfaces. M.A.Olmstead, N.M.Amer (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.751-3 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The authors have developed a new technique, photothermal displacement spectroscopy, for studying the optical and thermal properties of surfaces. The ability to distinguish surface and bulk optical absorptions is demonstrated. The signal is directly proportional to the surface absorption coefficient and is insensitive to variations in the real part of the dielectric constant. (7 refs.)

105380 LAS-02 laser dispersed-phase photoelectric analyzer. Yu.V.Zhulanov, P.Yu.Makaveev, O.N.Nikitin, I.A.Nevskii, V.V.Vetrov.
Instrum. & Exp. Tech. (USA), vol.25, no.6, pt.2, p.1478-81 (Nov.-Dec. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.6, p.147-50 (Nov.-Dec. 1982).
A laser photoelectric spectrometer is described for analyzing a dispersed phase in a gas. The basic parameters have been improved by using the beam within the cavity of an LG-78 small He+Ne laser. When the spectrometer has been calibrated with monodisperse latex particles, it is possible to record particles of diameter down to 0.1 μm. The resolving power is 3.5-40%. The maximum particle concentration is 2×10^4 cm^{-3}. (9 refs.)

105381 Spectropolarimeter with electromechanical compensation. A.A.Leksikov, Yu.M.Fedorov, A.E.Aksenov (Inst. of Phys., Academy of Sci., Krasnoyarsk, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.6, pt.2, p.1522-4 (Nov.-Dec. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.6, p.186-7 (Nov.-Dec. 1982).
The automatic spectropolarimeter, with electromechanical compensation of the rotation of the polarization plane of the light, is based on a KSP-4 recording potentiometer. Because of the application of stabilizing feedback, introduced from the rotation sensor, a sensitivity of 0.005° has been achieved. (7 refs.)

105382 Spring-loaded parallelogram for the scanning mirror of a low-resolution Fourier spectrometer. A.I.Andreev, V.V.Arkhipov, G.G.Gorbunov.
Instrum. & Exp. Tech. (USA), vol.25, no.6, pt.2, p.1524-6 (Nov.-Dec. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.6, p.187-9 (Nov.-Dec. 1982).
Describes a spring-loaded precision guide of the parallelogram type for a fast-scanning Fourier spectrometer. During translational motion of the scanning mirror by 3-4 mm this guide ensures that the mirror orientation is maintained with an accuracy no worse than 2″. (4 refs.)

105383 A readily portable source unit for the calibration of Dobson ozone spectrophotometer wedges. E.L.Simmons, J.M.Regan (Meteorological Office, Bracknell, England).
J. Phys. E (GB), vol.16, no.9, p.825-6 (Sept. 1983).
The calibration source unit makes use of a single 24 V, 10 A, DC power supply which many operators of the Dobson ozone spectrophotometer will have at each station. It provides a stable, high-intensity, easily adjusted illumination such that the wedge is uniformly illuminated and the distribution of light on the photomultiplier cathode of the spectrophotometer remains practically unchanged throughout the calibration cycle. Its mass is 2.5 kg. (1 ref.)

105384 Zeeman atomic absorption spectroscopy. E.L.Al'tman, G.B.Sveshnikov, Yu.I.Turkin, S.E.Sholupov.
J. Appl. Spectrosc. (USA), vol.37, no.5, p.1209-19 (Nov. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.709-22 (Nov. 1982). [received: Sept. 1983]
Further development of atomic absorption spectroscopy (AAS) as a powerful tool for physical investigations and as an analytical method involves, in particular, elimination of the preliminary chemical preparation of specimens and improving methods for including nonselective absorption. Exact compensation of nonselective noise will increase the effectiveness of the analysis and will permit reaching the detection limits characteristic of correction-free methods. Various methods have been developed in the past for including nonselective absorption: using close-lying nonresonant lines, using a source of continuous spectrum wavelength modulation of the radiation from the light source, using the wings of a self-reversed emission line, scanning the absorption line contour with a narrow laser line, and using two isotopes of a single element. The use of the Zeeman effect is well known in atomic spectroscopy. This effect permits solving these problems most simply. (76 refs.)

105385 Aberrations in off-plane spectrometers. M.A.Gil, J.M.Simon (Dept. de Fisica, Univ. de Buenos Aires, Buenos Aires, Argentina).
Opt. Acta (GB), vol.30, no.9, p.1287-301 (Sept. 1983).
The aberrations of two off-plane spectrometers that used parabolic mirrors, the Ebert and the Littrow, are calculated. This completes a comparative study undertaken by the authors of all the plane grating spectrometers with one mirror in the camera and another in the collimator, which makes it possible to establish clearly the optimal field of application for each design. (19 refs.)

105386 Wide-band acoustooptical spectral analyzer of the autocollimation type. I.A.Vodovatov, M.G.Vysotskii, S.A.Rogov (M.I. Kalinin Polytech. Inst., Leningrad, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.28, no.2, p.256-7 (Feb. 1983). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.53, no.2, p.408-10 (Feb. 1983). [received: Sept. 1983]
Acoustooptical spectral analyzers are among the most promising coherent-optical devices. Their great bandwidth, high speed, and capability of simultaneously recording the spectra of many signals often make them superior to purely electronic spectral analyzers. Autocollimating spectral analyzers form a class apart among the acoustooptical spectral analyzers. In these devices, a reflecting mirror is mounted beyond the acoustooptical modulator and the collimating objective also serves to integrate the light beams. Autocollimating systems are used because of their reduced size and cost, and also because the acoustooptical interaction length is doubled. However, it must be remembered when designing autocollimating spectral analyzers that the output signal is a sum of the two beams produced by light diffraction by the modulator in both the forward and backward directions of the incident light beam. The bandwidth is limited by the interference of these two beams. (2 refs.)

105387 Raman difference spectroscopy. J.Laane (Dept. of Chem., Texas A&M Univ., College Station, TX, USA).
In book: *Vibrational spectra and structure. A series of advances. Vol.12*, J.R.Durig [Ed.], p.405-67. Amsterdam, Netherlands: Elsevier (1983), xvi+497 pp. [0 444 42197 1]
Raman difference spectroscopy (RDS) allows the recording of difference spectra resulting from spectral subtraction. In addition to allowing the cancellation of unwanted components of the spectra, RDS also has utility for (at least) two other purposes. It can greatly simplify polarization measurements so that the isotropic and anisotropic components of the Raman signals may be recorded directly. Furthermore, RDS may be used to measure very precisely small frequency or bandwidth differences between similar samples. For example, solvent shifts and isotopically induced frequency shifts may be measured from the analysis of the difference spectra. In this review the instrumentation developed for RDS will first be described. The theory necessary for determining the frequency shifts and bandwidth changes and for analyzing polarization effects will be developed, and some of the applications described. The latter section will emphasize the measurements utilizing the theoretical principles. (50 refs.)

Vibrational spectra and structure. A series of advances. Vol.12 .... See Entry 105049

Fundamentals of molecular spectroscopy. Third edition .... See Entry 105052

Photoelectric detection of absorption spectra in studies of the Shpolskii effect .... See Entry 106393

Grazing incidence toroidal mirror pairs in imaging and spectroscopic applications .... See Entry 106843

Proposal for the measuring molecular velocity vector with single-pulse coherent Raman spectroscopy .... See Entry 107272

Investigation of the temporal development of an electrical discharge localized by laser radiation .... See Entry 107468

Apparatus for high-pressure studies in chemical kinetics in liquid ammonia from −40°C+150°C (233-423K) .... See Entry 109731

Multi-object spectroscopy with optical fibres .... See Entry 110925

07.65E UV and visible spectroscopy and spectrometers

105388 Time-resolved nonlinear luminescence spectroscopy by picosecond excitation correlation. M.Jorgensen, J.M.Hvam (Fysisk Inst., Odense Univ., Odense, Denmark).
Appl. Phys. Lett. (USA), vol.43, no.5, p.460-2 (1 Sept. 1983).
A time-resolved nonlinear luminescence spectroscopy based on a picosecond excitation correlation technique is described. It has been used to determine the recombination lifetimes of free and bound excitons in CdSe at low temperature and low exciton density. (10 refs.)

07.65G IR spectroscopy and spectrometers

Diode-laser spectroscopy of supersonic free jets .... See Entry 106399

Near-infrared mapping spectrometer for investigation of Jupiter and its satellites .... See Entry 110909

07.68 PHOTOGRAPHY, PHOTOGRAPHIC INSTRUMENTS AND TECHNIQUES

(for light sensitive materials see also 42.70)

105389 Chemographic images of silicon surfaces. I.A.Blech (Palo Alto Res. Center, Xerox Corp., Palo Alto, CA, USA), E.S.Meieran.
Appl. Phys. Lett. (USA), vol.43, no.4, p.396-8 (15 Aug. 1983).
Images are obtained when freshly etched or abraded silicon wafers are placed in contact with photographic plates. Based on the study of the images it was concluded that the images form due to a neutral chemical species, probably atomic hydrogen, that is emitted from the silicon surface during the initial stage of oxidation. These chemographic images are a chemical parallel to normal autoradiographs. This letter describes experimental verification of the model and discusses possible uses of the technique. (19 refs.)

105390 Hypersensitization of Kodak IIIa-J plates by baking in forming gas in a sealed tube. T.Sasaki (Dept. of Astron., Univ. of Kyoto, Kyoto, Japan).
AAS Photo-Bull. (USA), no.32, p.3-7 (1983).
Kodak spectroscopic plates, type IIIa-J, were hypersensitized by baking in forming gas (92% N_2, 8% H_2) in a sealed tube. Various temperatures and times were tested to find the optimum baking conditions as indicated by relative detective quantum efficiency measurements. If a number of plates were baked simultaneously in the sealed tube, the speed gain decreased and the fog increased. Effects of lapsed time between baking and exposure, and also of different developers, were examined. (16 refs.)

105391 An investigation into latent image and hypersensitization decay of Kodak IIIa-J and IIIa-F photographic plates. S.A.Butchins (Dept. of Astrophys., Univ. of Oxford, Oxford, England).
AAS Photo-Bull. (USA), no.32, p.8-13 (1983).
In critical work such as photographic surface photometry, significant errors can be introduced by latent image decay and/or decay of hypersensitization. The present paper investigates such errors for Kodak spectroscopic plates, types IIIa-J and IIIa-F, and suggests methods of mitigating them. (5 refs.)

105392 The variation with wavelength of the response of Kodak emulsion, IIIa-J. R.G.Clowes (Dept. of Phys., Univ. of Durham, Durham, England).
AAS Photo-Bull. (USA), no.32, p.14-15 (1983).
The variation with wavelength of the response of hypersensitized and unhypersensitized Kodak emulsion, type IIIa-J, has been studied using UK Schmidt Telescope calibration spectrograms for five emulsion batches. (4 refs.)

105393 A 35 and 70 mm stereoanalytic compilation-graphic system. H.Dell Foster (H. Dell Foster Assoc., San Antonio, TX, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.53-8 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
Photogrammetry in conventional practice requires the use of fixed focus cameras of high precision and calibrated internal geometry. The largest historical application of programmetry is aerial topographic mapping. Serious efforts have been made to apply photogrammetry for non topographic purposes (terrestrial photogrammetry) by utilisation of conventional or scaled down cameras and stereo compilation instruments with various hardware and applications schemes. Success has been limited, at best, and the solutions have not been economical enough to warrant broad application. With the advent of digital computers, the evolution of numerical photogrammetry in general and the analytic stereo compiler in particular the technical tools are available for a truly comprehensive universal system. With miniaturisation and new mathematical techniques small commercial non-precision cameras can be utilised and the photogrammetric process can be greatly simplified and extended to broader application. (2 refs.)

105394 Color facsimile and color copying machine. K.Kubota (Faculty of Engng., Seikei Univ., Tokyo, Japan).
J. Inst. Telev. Eng. Jpn. (Japan), vol.37, no.3, p.178-85 (March 1983). In Japanese.
Growing attention has been given to color facsimile reception. A new color recording method is that using a color ink-jet printer. Ink is fed under pressure to nozzles excited with an ultrasonic signal. Ultrasonic excitation produces a standing wave on the stream of ink issuing from each nozzle, breaking it up into individual drops. Writing signals on the electrode pair are timed to charge the microdrops. The drops deflected by a constant-voltage difference between the electrodes, clear a gutter, and strike the paper. The uncharged microdrops are collected and recycled. In color ink-jet facsimile reception, the printer uses four ink jets, one for each of the three process colours—yellow, magenta, and cyan—and a fourth for black. Some other printers and color facsimile transmission are described in this paper. (21 refs.) *K.B.*

105395 Motion-picture test signals for subjective evaluation of high efficiency coding of TV signals. H.Murakami (Kokusai Denshin Denwa Co. Ltd., Tokyo, Japan), T.Shimizu.
J. Inst. Telev. Eng. Jpn. (Japan), vol.37, no.3, p.195-200 (March 1983). In Japanese.
Animated-image test pattern signals for evaluating encoding of TV signals were prepared jointly by KDD (Kokusai Denshin Denwa) and TBS (Tokyo Broadcasting System). Fundamentally, parameters characterizing animated images include: (1) movement rate, (2) camera operation mode, (3) pattern roughness, (4) signal-to-noise ratio, and (5) color hue. By combining these parameters, 26 evaluation images were chosen, which may be used to evaluate most of the image patterns in ordinary TV programs. Their typical applications are given in this paper. (9 refs.) *K.B.*

105396 The theoretical influence of Gaussian grain size distributions on the characteristic curve of photographic film. K.Nakamura (Dept. of Electro Photo-Optics, Tokai Univ., Kanagawa, Japan).
J. Appl. Photogr. Eng. (USA), vol.9, no.4, p.113-16 (Aug. 1983).
The characteristic sensitivity curves of silver halide emulsions are obtained by a theoretical calculation. The grain size distribution of the emulsion is assumed to be Gaussian. An advantage of the present calculation is that a value of sensitivity of a film can be derived as a reverse of the exposure unit (lux-sec), which corresponds with the conventional ASA sensitivity. A typical emulsion film whose Gaussian distribution constant is 10 μ^{-4} and a peak grain size of 0.5 μ has a sensitivity of 1200 assuming the present standard DQE loss factor. It is an appropriate way to adopt a double Gaussian distribution emulsion in order to control the γ-value in the characteristic curve. (13 refs.)

105397 Silver dye-bleach colour microfilm. A.Meyer (Ilford AG, Fribourg, Switzerland).
J. Appl. Photogr. Eng. (USA), vol.9, no.4, p.117-20 (Aug. 1983).
Silver dye-bleach materials offer the advantages of high sharpness, simple three-solution direct-positive processing, and very good stability of the azo image dyes. Based on these features various models of microfilm with very

thin layers have been developed. The light scattering effects in the imaging layers were investigated, and based on these findings the layer structure was modified in order to improve acutance. The layer and image structure, processing, and photographic properties including resolving power, colour reproduction and permanence in dark and light storage are discussed. (7 refs.)

105398 The stability and permanence of Cibachrome images. A.Meyer, D.Bermane (Ilford AG, Fribourg, Switzerland).
J. Appl. Photogr. Eng. (USA), vol.9, no.4, p.121-5 (Aug. 1983).
Factors influencing the fading of Cibachrome materials in the dark and upon exposure to light are discussed. Very long testing periods are required to study the dark fading process at temperatures up to 77°C and 60% relative humidity (RH). After 112 days at 77°C/40% RH hardly significant density changes could be observed. Above 80°C and 70% RH the absorption spectra of the Cibachrome azo dyes change noticeably within a week. This is mainly due to partial deaggregation of the azo dyes into monomers. This deaggregating process is reversible, as shown by experiments. Even at 91°C/90% RH the irreversible chemical degradation is very slow. Comparative data regarding the light fading properties are also given. They prove the excellent stability of the azo dyes toward photo-oxidation. (7 refs.)

105399 High-speed shutter for single lens reflex cameras. Y.Nakano, H.Kato, T.Tsuda, E.Tanaka (Nippon Kogaku KK, Tokyo, Japan).
J. Appl. Photogr. Eng. (USA), vol.9, no.4, p.126-8 (Aug. 1983).
A focal-plane shutter having high-speed travelling blades has been designed and incorporated with Nikon FE2 cameras. This new shutter offers a top shutter speed of ${}^{1}/_{4000}$ sec and a maximum electronic flash sync speed of ${}^{1}/_{250}$ sec. The shutter has been realised by selection of an effective travelling system of the blades and use of lightweight material. A blade using titanium has a honeycomb-like pattern by chemical etching and has only ${}^{2}/_{5}$ weight of a conventional steel one. This blade maintains both rigidity and tenacity by nitriding of titanium surface. (3 refs.)

105400 Use of charge injection device components in still cameras. J.Carbone, D.Hunter (General Electric Co., Syracuse, NY, USA).
J. Appl. Photogr. Eng. (USA), vol.9, no.4, p.129-31 (Aug. 1983).
Recent breakthroughs in charge injection device (CID) imaging technology have resulted in the fabrication and operation of a new generation of CID imagers and ancillary LSI based subsystems. The imagers are highly sensitive low temporal noise devices featuring electro optical quantum efficiencies of 44-55% in the visible spectrum (400 through 600 nm). Coupled with the many structural and flexible readout advantages of CID imagers, these subsystems may be combined to fabricate high performance, low cost, light weight, and rugged monochrome and colour solid state camera modules which are suitable for application in the fields of: still photography, professional and/or consumer video, and automation. (5 refs.)

105401 A review of the application of UV-absorbers in colour recording materials. H.Langen (Agfa-Gevaert AG, Leverkusen, Germany).
J. Appl. Photogr. Eng. (USA), vol.9, no.4, p.132-4 (Aug. 1983).
It is well known that UV-absorbers improve the light fastness of photographic colour papers, however, it is less known that they are also of great importance in camera original colour recording materials. There are many ways that UV absorbing layers can cause an improvement in image quality. The benefits obtained through the presence of UV-protection in the different stages of producing photographs from exposure to the final image are discussed. (11 refs.)

105402 Gilding and sealing daguerreotypes. M.S.Barger, R.Messier, W.B.White (Materials Res. Lab., Pennsylvania State University, University Park, PA, USA).
Photogr. Sci. & Eng. (USA), vol.27, no.4, p.141-6 (July-Aug. 1983).
The gilding step was added to the daguerreotype process in 1840 by Fizeau who discovered that when a daguerreotype was treated in a solution of hot gold chloride and sodium thiosulfate, both its mechanical and optical properties were improved. This improvement in properties is due to the accelerated hardening of the amalgam image particles that make up the image and to the slight alteration of the daguerreian microstructure that results from the gilding process. In the gilding process gold preferentially replaces mercury over silver, resulting in an uneven dispersion of gold over the daguerreotype surface with a concentration of gold in areas of high image particle density. Although a protective function has gradually been implied for the gilding process in daguerreotypes, gilding does not protect daguerreotypes from silver sulfide corrosion. While gold toning, the modern outgrowth of gilding, does prevent sulfiding, the daguerreotype presents other problems not found in conventional silver halide systems. The entire daguerreotype may act as an electrode in the silver sulfide corrosion so partial covering of the silver electrolyte by the nonuniform gold layer is not effective in prevention of corrosion. A uniform coating of gold is a good choice for the sealing of a daguerreotype from silver sulfide corrosion and its use is described. (14 refs.)

105403 Dry etching of polymer coatings by deep ultraviolet irradiation. K.Sugita, N.Ueno, S.Konishi, Y.Suzuki (Dept. of Image Sci. & Technol., Chiba Univ., Chiba, Japan).
Photogr. Sci. & Eng. (USA), vol.27, no.4, p.146-9 (July-Aug. 1983).
Various commercially available positive working resists were irradiated in air with a deuterium discharge lamp which emitted continuous light of wavelength longer than 1800 A. It was found that most resist films studied were etched by UV irradiation without any subsequent processing, and that the etching rate was highest with poly-(2,2,3,4,4,4-hexafluorobutyl methacrylate). PFHMA [poly-(3,3,4,4,5,5,6,6,6-nonafluorohexyl methacrylate)] and copolymers with methyl methacrylate were prepared, and the etching rate was observed for changes of temperature and pressure of the ambient gas. When resist films of 30 or 50 mol % FHMA copolymer were irradiated at 60°C in a vacuum of 0.4 torr, the etching depth was 1300 Å after 5 min and 2400 Å after 10 min. This UV-etching is suitable as a dry method for resist patterning or descumming as well as for resist stripping. A line-and-space pattern of 1 μm width was clearly transferred to the resist film. (8 refs.)

105404 Thermophotographic characteristics of phenanthrene. P.K.C.Pillai, A.K.Tripathi (Dept. of Phys., Indian Inst. of Technol., New Delhi, India).
Photogr. Sci. & Eng. (USA), vol.27, no.4, p.150-2 (July-Aug. 1983).
Solution cast films of phenanthrene, using polystyrene allyl alcohol as binder have been tested for electrothermophotographic use. It has been observed that a 40:60 weight ratio of phenanthrene and binder is suitable for electrothermophotography. The acceptance potential for this ratio is found to be 1200 v and the contrast potential is 800 v. (10 refs.)

105405 A variable-temperature vacuum sensitometer for studying the temperature dependence of photographic sensitivity. R.K.Hailstone (Res. Lab., Eastman Kodak Co., Rochester, NY, USA).
Photogr. Sci. & Eng. (USA), vol.27, no.4, p.152-5 (July-Aug. 1983).
The design and operation of a variable-temperature vacuum sensitometer are described. Up to 12 film strips can be exposed sequentially during a cycle of operation. Temperature of the film at the time of exposure can be varied from −196 to 100°C with temperature regulation of ±1°C. A calibrated light source allows quantum sensitivities to be determined. Provisions for Herschel-effect experiments were also included in the design of the sensitometer. Results for the dye 5,5′-dichloro-3,3′,9-triethylthiacarbocyanine bromide on a 0.2-μm iridium-doped Ag(I)Br emulsion suggest that dye-promoted secondary processes are negligible in this dye-emulsion system after vacuum outgassing. (11 refs.)

105406 Researching and restoring pioneer talking pictures: the 70th anniversary of the theatrical release of Kinetophone. A.Shifrin (Abekas Video Systems Inc., San Carlos, CA, USA).
SMPTE J. (USA), vol.92, no.7, p.739-51 (July 1983).
This article attempts to clarify some of the obscure beginnings of sound motion pictures, utilizing new information recently uncovered about Edison's work in this medium. Two technical perspectives are pursued. One describes Kinetophone, and the other explains the use of modern audio, film, and video technologies to generate picture and sound with qualities much better than are presumed possible for productions of this vintage. (53 refs.)

105407 Today's photographic imaging technology for tomorrow's HDTV system. M.A.Kriss, J.Liang (Eastman Kodak Co., Rochester, NY, USA).
SMPTE J. (USA), vol.92, no.8, p.804-18 (Aug. 1983).
Film and television have been partners for more than 35 years. During this time great improvements have been made in both media, with the public receiving most of the benefits. With high-definition television (HDTV) now possible, film as an originating medium is more important than ever. Eastman color negative film 5247, the 35-mm motion-picture format, will support HDTV systems up to 1400 lines at 50 MHz and may support up to a 2000-line HDTV system; it will provide an input signal with a signal-to-noise ratio >50 dB (unweighted). High-speed digital image processing makes film an even more valuable origination source because of its wide exposure latitude and the manufacturers' ability to manipulate film speed, exposure, latitude, sharpness, and granularity to provide an optimum recording medium for all forms of television and motion-picture production. (9 refs.)

105408 Film stocks used for optical special effects. R.Field, T.Iles.
SMPTE J. (USA), vol.92, no.8, p.819-23 (Aug. 1983).
Describes the wide range of film stocks used for optical special effects work in motion pictures. The use of traveling mattes and painted mattes is discussed, as well as the problems of matching contemporary work with that from archival sources. The properties of the various films used are described, together with reasons for their selection and application. The article is illustrated with examples from various films employing optical trick photography. (1 ref.)

105409 EBU activity in the standardization of films for television and television film-scanners. M.Rotthaler (Inst. fur Rundfunktech., Munich, Germany).
SMPTE J. (USA), vol.92, no.8, p.849-55 (Aug. 1983).
Reports on the work being done by the European Broadcasting Union (EBU) to promote optimum technical standards for television programs exchanged in the form of films between broadcasting organizations in different countries. It discusses the characteristics of the films used in the programs, and recommends practices for the technical operation, alignment, and measurement of television film-scanners. (12 refs.)

105410 Some SEM studies on photographic emulsions. G.Bast, G.Haase, F.Zorgiebel (Inst. fur Wissenschaftliche Photographie, Tech. Univ. Munchen, Garching, Germany).
Scanning (Germany), vol.5, no.2, p.84-90 (1983).
The SEM micrographs of small silver halide crystals in photographic emulsions, previously published by Platzer and Greenhut (1976) and by Furman et al. (1981) show only a very restricted resolution of morphological details. The aim of the present investigation was to obtain SEM micrographs of a high quality to reveal the fine structure of silver halide grains. Examples are given of photographic model emulsions both fresh and developed, manufactured in the authors' laboratory, and of morphological studies on the chemical and physical development of commercially available photographic films. (8 refs.)

105411 A new halide lamp for film printers. I.D.Belova, S.K.Nazarov, V.F.Piyavskii, I.O.Yavno.
Tekh. Kino & Telev. (USSR), no.6, p.28-32 (June 1983). In Russian.
The technical specifications of a new domestic-designed halide lamp KTM 120-1200 are briefly outlined. (5 refs.)

A simplified photometric method of measuring granularity spectra for X-ray pictures .... See Entry 105438

White-light pseudocolor density encoding by means of one photographic step .... See Entry 106713

White light optical pseudocolor upon the difference between two photographs .... See Entry 106715

Photolithographic method for producing originals of small-base grids .... See Entry 109626

A standard photometric method of determining beam sizes of defects .... See Entry 109672

The effect of gold salts on the chemical mechanisms of photographic sulfur sensitization of silver halide photoemulsions: stabilization of adsorbed sulfide at the crystal surface .... See Entry 109773

Redistribution of development centers after sulfur sensitization .... See Entry 109774

Influence of chemical sensitization on photographic response: a computer modeling study .... See Entry 109775

Efficiency modulated sensitization .... See Entry 109776

Study of craniofacial anomalies with a portable stereo camera .... See Entry 110117

Family of calibrated stereometric cameras for direct intraoral use .... See Entry 110118

Automated system for stereometric analysis of the human face .... See Entry 110119

Automatic measurement of body surfaces using rasterstereography .... See Entry 110130

Close-range photogrammetry in predicting animal weight ...... See Entry 110245

Rotating microscope for Landsat photography of vertebrate embryos .... See Entry 110246

07.75 MASS SPECTROMETERS AND MASS SPECTROMETRY TECHNIQUES

(for mass spectroscopic chemical analysis, see 82.80)

105412 A ^{252}Cf fission fragment-induced desorption mass spectrometer: design, operation and performance. H.Danigel, H.Jungclas, L.Schmidt (Fachbereich Phys. Chem., Philipps-Univ., Margburg, Germany).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.223-40 (1 Sept. 1983).
This time-of-flight mass spectrometer utilizes the ^{252}Cf fission fragment induced ionization of organic solids and electrostatic desorption. It is designed for the high sensitivity needed in the quantitative analysis of pharmaceuticals and can be combined with a high-performance liquid chromatograph. The solute emerges into a rough vacuum stage sampling up to twelve fractions in a vacuum-drying process. Samples with low vapor pressure are introduced periodically into the ion source by means of an interfacing disk and analysed successively. The sensitivity of ion detection employing conversion electrons and microchannel plates is investigated. The performance of the mass spectrometer is discussed in terms of mass resolution, efficiency and reproducibility. (23 refs.)

105413 Membrane inlet for ion mobility spectrometry (plasma chromatography). G.E.Spangler, J.P.Carrico (Bendix EPID, Baltimore, USA).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.267-87 (1 Sept. 1983).
Reactant-ion distributions in ion mobility spectrometry (IMS) with a membrane inlet system have been studied using ion mobility spectrometry/mass spectrometry (IMS/MS). The membrane was able to exclude the water and ammonia components of laboratory air from the carrier gas of the instrument, but not carbon dioxide. Nonporous dimethylsilicone membranes exclude these components more effectively than microporous polypropylene membranes. (35 refs.)

105414 Evaluation of an electrostatically-collimated ion source in an isotopic-ratio mass spectrometer. V.V.K.Rama Rao, C.K.Nazare, B.S.Prahallada Rao (Tech. Phys. Div., Bhabha Atomic Res. Centre, Bombay, India).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.289-98 (1 Sept. 1983).
Electrostatic collimation or focusing of the electron beam has been used in the ion source of an isotope-ratio mass spectrometer and its performance evaluated. The design details of the ion source and the mass spectrometer are given. The sensitivity is comparable to that in the magnetic collimation mode. The reproducibility of the sensitivity with electrostatic collimation for various filament assemblies is good. The output vs. pressure curves determined for electrostatic collimation, magnetic collimation and a combined electrostatic and magnetic collimation show good linearity. This combined field collimation is also found to give good sensitivity, comparable to the conventional source, but at a much lower electron emission. The electrostatically-collimated ion source was used for precision isotope ratio determinations of nitrogen gas samples collected from a cylinder. The relative internal standard deviation on a single sample ratio was better than 0.025%. The relative external standard deviation for repeated analysis of 19 samples drawn from the same cylinder over an 8-hour period was 0.08%. The advantages of using such an ion source are listed. (9 refs.)

105415 Improved performance in angle-resolved mass spectrometry. S.Verma, J.D.Ciupek, R.G.Cooks (Dept. of Chem., Purdue Univ., West Lafayette, IN, USA), A.E.Schoen, P.Dobberstein.
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.311-18 (1 Sept. 1983).
A new experimental arrangement for angle-resolved mass spectrometry is described featuring a needle which delivers collision gas to the source slit of a reversed geometry mass spectrometer. In this experiment the scattering angle is defined by pre-collision electrical deflection of the parent ion beam, as contrasted with post-collision selection of the direction of the daughter ion beam. Advantages are rapid access to any desired angle, coupled with an improvement in ion intensity and in angular resolution evident from measured breakdown curves. Collision-induced dissociation spectra of the methanol molecular ion, recorded over a range of scattering angles, agree well with previous results. Experiments which record ions that survive collisions, i.e. scatter without fragmentation, indicate that scattering of polyatomic ions through substantial angles (0-6°) makes a significant contribution to the phenomena underlying angle-resolved mass spectrometry. (19 refs.)

105416 A general approach to calculating isotopic distributions for mass spectrometry. J.A.Yergey (Middle Atlantic Mass Spectrometry Facility, Johns Hopkins School of Medicine, Baltimore, MD, USA).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.337-49 (1 Sept. 1983).
Fundamental principles for obtaining mass spectral isotopic distributions are applied to a general computer program which can be used to calculate and present in tabular and graphic form the isotopic contributions for any molecular formula. A unique feature is the retention of the isotopic distribution, exact mass, and absolute abundance for all individual peaks at each mass. Special considerations have been made for the large number of isotopic combinations which occur for many higher mass compounds. The computer program accepts the input of a molecular formula followed by interactive input of a number of parameters which affect the final presentation of the theoretical distribution profile. (21 refs.)

Ion microscopy using electron-desorbed ions ....See Entry 105421

Gas-phase thermochemical information from triple quadrupole mass spectrometers: relative proton affinities of amines ....See Entry 106333

Reactions of Group Ib metal ions with selected hydrocarbons in the source of a spark source mass spectrometer ....See Entry 107334

An electrodynamic coaxial spectrometer for multichannel plasma pulse analysis ....See Entry 107442

Studies of the mixing of glycerol in glycerol at the glycerol-vacuum interface using secondary ion mass spectrometry ....See Entry 107941

Study of helium diffusion in calcium fluoride using a mass spectrometer under static conditions ....See Entry 108061

07.77 PARTICLE BEAM PRODUCTION AND HANDLING; TARGETS

(see also 29.25 in elementary-particle and nuclear physics, 41.80 Particle beams and particle optics)

105417 Electron-beam guiding and phase-mix damping by an electrostatically charged wire. D.S.Prono, G.J.Caporaso, A.G.Cole, R.J.Briggs, Y.P.Chong, J.C.Clark, R.E.Hester, E.J.Lauer, R.L.Spoerlein, K.W.Struve (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
Phys. Rev. Lett. (USA), vol.51, no.9, p.723-6 (29 Aug. 1983).
A new and relatively simple method has been developed to focus and guide electron beams without the use of a magnetic field. The scheme relies on the electrostatic charging of a highly resistive wire in the presence of a beam. The beam is then strongly guided and focused by the oppositely charged wire. In addition, the highly anharmonic nature of the wire potential leads to rapid phase-mix damping of transverse beam displacements and radial pulsations. (8 refs.)

105418 Curved neutron mirror system as an improved polariser. M.Th.Rekveldt, W.H.Kraan (Interuniv. Reactor Inst., Delft, Netherlands).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.81-5 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
A new neutron mirror system has been developed using Si-single crystal platelets of 200 μm thickness and area 25×50 mm^2. Layers of 0.1 μm $Fe_{85}Co_{15}$, 1 μm $Gd_{40}Ti_{60}$ and 0.1 μm $Fe_{50}Co_{50}$ have successively been deposited on the highly polished surfaces of the crystals. A stack of such Si-crystals alternated with air using 200 μm spacers at the edges of the crystals serves as a neutron soller slit mirror system. The mirrors are bent in such a way that the tangent to one mirror in the middle cuts the next mirror under an angle of β radians at the ends. An analytic expression has been derived for the intensity reflected by such a system. For $\beta \ll \theta_c$ this system reflects an angular region of $2\theta_c$ from the initial beam and for $\beta \gtrsim \theta_c$ the intensity is proportional to θ_c^3, which guarantees a much improved polarising power in comparison with a plane mirror system. Test measurements have been carried out using neutrons of wavelength 1 Å. (8 refs.)

105419 Vertically focusing Heusler alloy monochromators for polarised neutrons. A.Freund, R.Pynn, W.G.Stirling, C.M.E.Zeyen (Inst. Laue-Langevin, Grenoble, France).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.86-90 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Several vertically focusing neutron monochromators have been constructed using single crystals of Heusler alloy (Cu_2MnAl). A typical monochromator is composed of five or eight crystals, each of which measures 75×15×7 mm^3, mounted on a flexible titanium backing plate between the poles of a horizontal-field, permanent $SmCo_5$ magnet. Spatial focusing of the monochromatic beam is achieved by curving the backing plate. Neutron rocking curves of the (111) reflections of the crystals used for monochromator construction display single, symmetric peaks of about 20′ FWHM. For neutrons of wavelength $\lambda = 4$ Å the magnetised monochromator has a peak reflectivity of 73% for neutrons of the desired spin state and a measured polarising efficiency which is in excess of 95%. At $\lambda = 2.36$ Å the polarising efficiency is essentially unchanged but the peak reflectivity falls to ~50%. (15 refs.)

Features of advanced neutron optical devices ....See Entry 106688

Thermophysical target properties in ion collection measurements on TEA-CO_2 laser produced high-Z plasmas ....See Entry 107417

Confinement of ions for collision studies ....See Entry 107435

07.80 ELECTRON AND ION MICROSCOPES AND TECHNIQUES

(see also in condensed matter 61.16D Electron microscopy, 61.16F Field ion microscopy)

105420 Simulation of backscattered electrons by reflection of primary electrons applied to optimization of detector designs. M.Brunner (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Appl. Phys. Lett. (USA), vol.43, no.4, p.391-3 (15 Aug. 1983).
A method has been developed to minimize the background signal of retarding field analyzers. It uses a negative electrode or negative charge on an insulator to reflect the beam of a scanning electron microscope towards the detector. This beam simulates backscattered electrons so that the response of the detector can be studied and optimized. (2 refs.)

105421 Ion microscopy using electron-desorbed ions. P.Williams, D.A.Reed (Materials Res. Lab., Univ. of Illinois, Urbana, IL, USA), A.E.Morgan.
Appl. Surf. Sci. (Netherlands), vol.16, no.3-4, p.345-50 (July-Aug. 1983).
Electron-stimulated desorption can be used as a (quasi-)non-destructive technique in the ion microscope. This allows precise sample location for subsequent sputtering analysis and also may offer a new approach to chemical imaging of surfaces. (6 refs.)

105422 Apparatus for probing electric fields in dielectric films by the albedo method. O.V.Andreev, Yu.I.Sapozhkov, O.B.Evdokimov, B.A.Kononov, N.I.Yagushkin (Sci.-Res. Inst. of Introscopy, S.M. Kirov Polytechnic Inst., Tomsk, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.6, pt.2, p.1510-12 (Nov.-Dec. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.6, p.175-7 (Nov.-Dec. 1982).
Describes a method and apparatus for probing electric fields in dielectric films to a depth ≤ 10 mg/cm^2 with electrons possessing an energy of up to 100 keV. The method is based on the influence of the electric field on the factor of electron backscattering from a dielectric film and makes use of the UEMV-100 electron microscope. (2 refs.)

105423 Thermal chamber for physicochemical experiments in the electron microscope. N.V.Rozhanskii, V.N.Rozhanskii (Inst. of Crystallography, Acad. of Sci., Moscow, USSR).
Ind. Lab. (USA), vol.48, no.11, p.1124-6 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.58-60 (Nov. 1982).
The described chamber was used to observe the growth of crystals from the vapor state in the electron microscope and to observe oxidation. (3 refs.)

105424 Improvements in the design of time-delay correlators. L.Basano, P.Ottonello, E.Schiavi (Istituto de Sci. Fisiche, Univ. di Genova, Genova, Italy).
J. Phys. E (GB), vol.16, no.9, p.840-3 (Sept. 1983).
Two versions of low-cost correlators, based on the principle of recording the times of arrival of photoelectron pulses, have been proposed by different

authors (Basano and Ottonello 1981, Friberg et al., 1982). Each of the proposed instruments presents its own advantages. The authors describe a correlator (in two versions) that combines in a single instrument the most interesting features of the new correlators. (10 refs.)

105425 Thermal diagnostics of pulsed 0-2 MeV electron beams and bremsstrahlung. R.Bailly-Salins (CEA-DAM, Centre d'Etudes de Valduc, Is-sur-Tille, France).

J. Phys. E (GB), vol.16, no.9, p.909-15 (Sept. 1983).

Usual calorimetric methods are set up to measure energy profiles injected into solids by irradiation with a 100 ns burst of electrons or photons. The spectral distribution of the radiations considered is spread between 0 and 2 MeV. They are absorbed by cylinders, discs or filaments made of carbon, tantalum or platinum which are connected to thermoelectrical converters. The shapes of these calorimeters and the conditions of irradiation allow one to deal with a roughly one-dimensional heat flux, despite possible thermal losses through conduction, convection and radiation. A complete set of equations is given for every calorimeter and numerical examples are performed with a calculator to help to interpret the experimental recordings. (19 refs.)

105426 Intensity and energy calibration in AES: the effect of analyser modulation. M.T.Anthony, M.P.Seah (Div. of Materials Applications, NPL, Teddington, England).

J. Electron Spectrosc. & Relat. Phenom. (Netherlands), vol.32, no.1, p.73-86 (Aug. 1983).

To a large extent, Auger electron spectra (AES) are recorded and portrayed in the differential mode using the potential-modulation method with a phase-sensitive detector. The precise intensities of the peaks and their energy positions depend on the modulation amplitude in a nonlinear manner. This dependence, in turn, is also a function of the resolution and detailed construction of the analyser. Thus, accurate quantification and accurate assignments of peak energies depend on a detailed knowledge of the effect of analyser modulation in AES. The theoretical response of spectrometers to a Gaussian line is analysed and compared with measurements for 'singlet' peaks using several different commercial spectrometers. This shows that, in certain circumstances, the traditional methods of intensity and energy measurement can be transferred with accuracies as high as 3% and 0.05 eV, respectively. (22 refs.)

105427 An atomic standard to calibrate analyser modulation in AES. M.P.Seah, M.T.Anthony (Div. of Materials Applications, NPL, Teddington, England).

J. Electron Spectrosc. & Relat. Phenom. (Netherlands), vol.32, no.1, p.87-97 (Aug. 1983).

For the comparison of differentiated AES spectral data produced using the potential-modulation technique and recorded under different conditions of modulation, or for the transfer of data from laboratory to laboratory, or for the quantification of spectra, the magnitude of the effective energy modulation of the analyser must be known. Even for simple analysers the modulation may differ from the generally accepted value obtained as the product of the measured modulation and the spectrometer constant. A rapid and simple method is therefore presented using the shape of the Ag $M_{4,5}NN$ doublet which enables the true analyser energy modulation to be determined to within 3%. The method is tested on a range of instruments and shows that, whilst for some CMA's the generally accepted approach works, for the Varian 10 keV beam CMA, the true modulation deduced from the atomic standard gives a value which is lower by a factor of 1.2 than that assumed previously. The method may also be used to show that the true energy modulation is 1.6 times higher than indicated throughout McGuire's Reference Manual. (11 refs.)

105428 Theory of the increase of spatial resolution efficiency of the scanning electron microscope in the beta-conductivity regime. G.V.Saparin, V.V.Filimonov, A.V.Chivilev (Dept. of Electronics, Moscow Univ., Moscow, USSR).

Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.76-83 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.66-72 (1982).

The authors consider a problem aimed at increasing the resolution of the scanning electron microscope in the beta-conductivity regime. By using a number of assumptions, the authors analyse the equations for the diffusion of carriers, calculate the concentration for various values of the E field and surface recombination rate during the pulse of electron current. It is shown that the volume taken up by the electron-hole pairs (the signal volume) depends strongly on the values of the E field and the surface recombination rate. It is noted that, by using the stroboscopic regime in the scanning electron microscope, one can increase the resolution in the case of beta-conductivity by a factor of 2-3. (22 refs.)

105429 Monochromatized Ag Lα X-rays as a source for higher energy XPS. K.Yates, R.H.West (V.G. Scientific Ltd., East Grinstead, England).

Surf. & Interface Anal. (GB), vol.5, no.4, p.133-8 (Aug. 1983). (International Conference on Quantitative Surface Analysis, Teddington, England, 24-25 Nov. 1981).

Monochromatization of Ag Lα X-rays is achieved by fitting an Ag anode to a conventional AlKα monochromator. Many new XPS lines are generated by this high energy source including the 1s and KLL Auger series from Al to Cl. Chemical state determination by means of the Auger parameter for these elements is greatly assisted by the reduced X-ray linewidth after monochromatization. Three glass fibre samples with different surface pre-treatments were studied to show that chemical state information could be extracted from even these complex, rough and insulating surfaces by using this novel X-ray source. (14 refs.)

105430 Calibration of an X-ray photoelectron spectrometer by means of noble metals. M.F.Ebel, H.Ebel, G.Zuba, J.Wernisch (Inst. fur Angewandte & Tech. Phys., Tech. Univ. Wien, Wien, Austria).

Surf. & Interface Anal. (GB), vol.5, no.4, p.170-1 (Aug. 1983). (International Conference on Quantitative Surface Analysis, Teddington, England, 24-25 Nov. 1981).

A review of the literature concerning binding energies of noble metal core levels has been carried out. From this data values for energy calibration in electron spectroscopy are recommended. (19 refs.)

105431 A single crystal of $YAlO_3$:Ce^{3+} as a fast scintillator in SEM. R.Autrata (Inst. of Sci. Instruments, Czechoslovak Acad. of Sci., Brno, Czechoslovakia), P.Schauer, J.Kvapil, J.Kvapil.

Scanning (Germany), vol.5, no.2, p.91-6 (1983).

Presents a new single-crystal scintillator intended for applications in a scanning electron microscope (SEM). It is a single-crystal disc of yttrium aluminium perovskite activated by trivalent cerium free of traces of Fe ions. The single crystals of $YAlO_3$:Ce^{3+} (YAP:Ce^{3+}) were prepared by the Czochralski method in a reducing atmosphere of Ar and H_2 with an excess amount of Y^{3+} ions. Effective methods of purification and purity control of the raw material are described. The highest achievable concentration of Ce^{3+} ions in as grown crystals amounted to 0.3 wt%, concentration in the melt was 8-9 times higher. The best properties were found with samples of the maximum possible concentration of Ce^{3+}. Compared with the previous aluminate $Y_3Al_5O_{12}$:Ce^{3+} (YAG:Ce^{3+}) these samples showed higher efficiency, a shorter decay time of luminescence (40 ns) and an emission band in a more advantageous spectral region (378 nm). Because of high resistance to radiation damage, high chemical resistance and applicability to ultra-high vacuum it is also suitable for detection of other kinds of ionizing radiation. (18 refs.)

105432 Ultrahigh vacuum system for a scanning Auger microprobe. A.V.Korgaonkar, C.P.Gopalaraman, W.C.J.Carvalho (Tech. Phys. Div., Bhabha Atomic Res. Centre, Bombay, India).

Vac News (India), vol.13, no.2, p.16-19 (June 1982). [received: Aug. 1983]

Describes a UHV system built for scanning Auger microprobe (SAM), in which samples can be treated separately in a sample preparation chamber and then transferred to the spectrometer chamber maintained at a lower pressure. The ultimate pressure obtained in spectrometer chamber is 5×10^{-10} Torr and in the sample preparation chamber is 2×10^{-9} Torr. (2 refs.)

Some SEM studies on photographic emulsions ....See Entry 105410

An electrodynamic coaxial spectrometer for multichannel plasma pulse analysis ....See Entry 107442

Determination of the incidence and azimuth angles in LEED experiments ....See Entry 107495

Reconstruction of the shape of small particles ....See Entry 107498

UHV-SEM studies of surface processes: recent progress ....See Entry 107501

Achievements and perspectives in positron physics ....See Entry 109041

Calibration of Micromatter Co. standards used for the calibration of PIXE analysis systems ....See Entry 109830

Estimation of the mean size of spheres from the profiles in ulthrathin sections: a stereological method ....See Entry 110259

07.85 X-RAY, GAMMA-RAY INSTRUMENTS AND TECHNIQUES

105433 The interference and diffraction of X-rays in dependence of their polarization. P.A.Bezirganyan, A.P.Bezirganyan.

Izv. Akad. Nauk Arm. SSR Fiz. (USSR), vol.17, no.1, p.9-15 (1982). In Russian.

The internal structure of a polarized natural X-ray characteristic wave is considered. With the formation of a phase difference between mutually perpendicular components of the unpolarized radiation there arises an inhomogeneous angular distribution of amplitudes. (6 refs.)

105434 Measurement of subatomic displacements for Mossbauer spectroscopy. E.Ikonen (Dept. of Tech. Phys., Helsinki Univ. of Technol., Espoo, Finland), P.Karp, T.Katila, K.Riski.

J. Phys. E (GB), vol.16, no.9, p.875-8 (Sept. 1983).

A SQUID-based sensor capable of measuring displacements with a resolution of 8 fm/$\sqrt{\text{Hz}}$ in the frequency band from DC to 10 kHz was constructed. Calibration of the sensor was performed with the aid of ^{67}Zn-Mossbauer spectroscopy. The sensor was used to determine the linearity and hysteresis of a piezoelectric PZT-4 transducer at very small displacement amplitudes. The performance of the transducer at a temperature of 4.2K was found adequate for a high-precision Mossbauer velocity drive. (12 refs.)

105435 X-rays from synchrotron: new challenge for neutron scattering. G.Shirane (Brookhaven Nat. Lab., Upton, NY, USA).

Physica B & C (Netherlands), vol.120B+C, no.1-3, p.108-13 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).

A brief review is given of current developments in X-ray scattering techniques at synchrotron radiation facilities. Highly collimated, intense source of white radiation open up new areas of research in condensed matter physics and challenge the traditional domains of neutron scattering. These include energy dispersive scattering, the use of anomalous dispersion, magnetic diffraction and direct energy analysis by backscattering. The relative merits of X-ray and neutron scattering techniques are discussed. The unique advantage of neutron scattering is the capability of performing polarization analysis. The author discusses in some detail the current developments at Brookhaven in inelastic scattering of polarized neutrons. In addition, special technical problems associated with the search for phasons utilizing a high-resolution triple axis spectrometer are discussed. (18 refs.)

105436 Gamma photon backscattering in gauging. C.Popescu, M.Oncescu (Central Inst. of Phys., Bucharest, Rumania).

Rev. Roum. Phys. (Rumania), vol.28, no.5, p.439-49 (1983).

A mathematical expression of the probability that a photon, emitted by a point source and backscattered from a material layer, will arrive in a detector placed in a given position is proposed. The radial probability distribution parameter of the exit points of the backscatered photons has been determined by the Monte Carlo method. The dependence of this parameter on the layer thickness has been studied. Six different materials and two photon energies have been investigated. The probability expression can be used in the radiometric design of the gauges based on the photon backscattering; it allows the radiometric assembly optimization and the computation of the radioactive source minimum activity to be used in a given investigation. An application to a density gauge and comparison with the experimental data are presented. (13 refs.)

105437 Design and software of the RED-4 four-circle diffractometer. N.K.Bukhardinov, V.I.Gusev, B.T.Golovchenko, V.V.Dombrovskii, V.I.Koryashkin, A.V.Mirenskii, P.P.Reznikov, D.M.Kheiker (Inst. of Crystallography, Acad. of Sci., USSR).

Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.86-90 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.156-63 (Jan.-Feb. 1983). [received: Sept. 1983]

The authors describe the design and software for a computer-controlled automatic four-circle single-crystal diffractometer. The use of absolute contactless transducers for the angles of rotation, developed specially for this instrument and installed directly on the working shafts, ensures high precision (±0.005°) and reliability of the angular setting of the crystal and detector with no blind zone. Since the beginning of 1981 the diffractometer has been successfully used at the Institute of Crystallography of the Academy of Sciences of the USSR for routine and precision structural investigations. (12 refs.)

105438 A simplified photometric method of measuring granularity spectra for X-ray pictures. M.Wolf, A.M.Gurvich, M.A.Il'ina, R.V.Katomina.

Sov. J. Nondestr. Test. (USA), vol.18, no.10, p.760-4 (Oct. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.10, p.8-14 (Oct. 1982). [received: Sept. 1983]

A simplified photometric method has been devised for measuring the granularity of an X-ray picture, which enables one to determine the granularity factors for intensifying screens and X-ray films, together with the Wiener spectra. The method involves measuring the mean-square fluctuation in the density, the modulation transfer function for the screen, and the gradient of the characteristic curve for a film. These measurements are compared with those made by two other methods (visual and photometric using a computer), and it is found that the proposed method gives satisfactory results. (12 refs.)

105439 X-ray flaw-detection apparatus. P.A.Aleev, E.A.Gusev, B.I.Leonov (Flaw-Detection Res. Inst., Moscow, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.10, p.770-3 (Oct. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.10, p.21-5 (Oct. 1982). [received: Sept. 1983]
The design features of X-ray sets, which are basic penetrating X-radiating sources for industrial flaw detection, are considered. A classification is given of X-ray equipment, whose applications are discussed along with development prospects. (13 refs.)

X-ray interferometer calibration of microdisplacement transducers .... See Entry 105308

A portable densitometer with digital indication .... See Entry 105357

Monochromatized Ag Lα X-rays as a source for higher energy XPS .... See Entry 105429

Progress in energy resolution of mercuric iodide (HgI_2) X-ray spectrometers .... See Entry 106201

Gamma-ray spectrometry with thick mercuric iodide detectors .... See Entry 106202

Search for improved surface treatment procedures in fabrication of HgI_2 X-ray spectrometers .... See Entry 106222

Rise time study of mercuric iodide detectors .... See Entry 106228

Mercuric iodide imaging detectors .... See Entry 106229

Larger volumes of HgI_2 used as portable gamma-ray counters .... See Entry 106230

Gamma-ray spectrometry with solid-state detectors by current pulse height analysis .... See Entry 106231

Scintillation spectrometry with HgI_2 as the photodetector ..... See Entry 106232

High-frequency power transistor as a pulsed X-ray detector . See Entry 106241

Formation and observation of Moire distribution of X-ray waves in bicrystal interferometers .... See Entry 107483

Sensitivity of plane wave topography to microdefects .... See Entry 107484

Measurement of the integrated reflection coefficients of gypsum, quartz, and mica crystals for soft X-rays .... See Entry 109045

Conductivity measurement of an X-ray absorption spectrum: Re L_{III} near-edge structure of $Re_2(CO)_{10}$ in 2,2,4-trimethylpentane .... See Entry 109047

Feasibility of coating inspection by gamma-albedo method ....See Entry 109671

A standard photometric method of determining beam sizes of defects .... See Entry 109672

Calibration of Micromatter Co. standards used for the calibration of PIXE analysis systems .... See Entry 109830

512-channel X-ray DARK-2.0 diffractometer with a mosaic detector for investigating protein single crystals .... See Entry 110256

A mercuric iodide detector system for X-ray astronomy I. Design considerations and predictions of background and sensitivity .... See Entry 110907

A mercuric iodide detector system for X-ray astronomy. II. Results from flight tests of a balloon borne instrument .... See Entry 110908

07.90 OTHER TOPICS IN SPECIALISED INSTRUMENTATION

105440 Surface imaging by scanning tunnelling microscopy. G.Binnig, H.Rohrer (IBM Zurich Res. Lab., Ruschlikon, Switzerland).
Ultramicroscopy (Netherlands), vol.11, no.2-3, p.157-60 (1983). (Surface Imaging and Analysis with High Spatial Resolution, Wickenburg Inn, AZ, USA, 12-15 Jan. 1983).
Discusses the potential of a new technique for surface imaging on an atomic scale: scanning tunnelling microscopy. Examples for 3D topographies of surfaces and work-function profiles are given. (9 refs.)

10.00 THE PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

(for cosmic rays, see 94.40; for high energy-experimental techniques and instrumentation, see 29.)

11.00 GENERAL THEORY OF FIELDS AND PARTICLES

(see also 03.65 Quantum mechanics, 03.70 Theory of quantized fields, 03.80 General theory of scattering)

11.10 FIELD THEORY

105441 An effective potential for classical Yang-Mills fields as outline for bifurcation on gauge orbit space. F.Nill (Max-Planck-Inst. fur Phys. und Astrophys., Munich, Germany).
Ann. Phys. (USA), vol.149, no.1, p.179-202 (Aug. 1983).
Classical Yang-Mills (YM) equations with static external sources are formulated as a Hamiltonian system with gauge symmetry in $A_0=0$ gauge. Using the concept of a 'momentum mapping' (J. Marsden and A. Weinstein, 1974) on symplectic manifolds with symmetry, an analogue of centrifugal potential of a mass point in a spherically symmetric potential is derived. This gives rise to an effective potential $V_{\rm eff}$, whose critical points are rigorously proved to be in one-to-one correspondence with static YM solutions. $V_{\rm eff}$ additionally depends on the prescribed external source ρ, which is as a constant of motion analogous to angular moment of the mass point. Thus bifurcation of static solutions is caused by bifurcation of critical points of $V_{\rm eff}$ under variation of the external parameter ρ. Some closing remarks on dynamics and stability on gauge orbit space are added. (24 refs.)

105442 Static solutions of the Yang-Mills system coupled to a scalar field. E.Malec (Inst. of Phys., Silesian Univ., Katowice, Poland).
Acta Phys. Pol. B (Poland), vol.B14, no.8, p.581-8 (Aug. 1983).
It is proven that the linear Schrodinger (Klein-Gordon) field coupled to Yang-Mills fields has no non-zero static, finite energy, solutions. The case of nonlinear scalar fields is discussed, and necessary criteria for existence of nonzero solutions are given. (7 refs.)

105443 The finite lattice renormalization group and the antiferromagnetic square lattice: a new weight function. N.Jan, L.L.Moseley (Phys. Dept., Univ. of the West Indies, St. Augustin, Trinidad), B.Nienhuis, A.Ramdss-Singh.
Rev. Colomb. Fis. (Colombia), vol.15, no.1, p.83-94 (1981). [received: Aug. 1983]
A generalized weight function is introduced and included within the finite lattice approximation. The rules required for the implementation of this function are given and results are obtained for the ferromagnet and antiferromagnet 2-d square which satisfy the expected symmetry requirements. There is close agreement between the calculated exponents and the exact values. The critical surface obtained in non-zero field agrees quite well with the conjectured surface of Muller-Hartmann and Zittartz. (14 refs.)

105444 Critical dynamics of the sine-Gordon model in $d=2-\epsilon$ dimensions. B.Neudecker (Inst. fur Theoretische Phys., Dusseldorf Univ., Dusseldorf, Germany).
Z. Phys. B (Germany), vol.52, no.2, p.145-9 (1983).
The renormalization scheme of Amit, Goldschmidt and Grinstein (1980) is extended to $d=2-\epsilon$ dimensions. The exponent ν of the correlation length $\nu^{-1}=2\epsilon+O(\epsilon^2)$ is in agreement with the result of Kosterlitz (1977) for the Coulomb gas. The exponent η of the correlation function of the sine-Gordon field is $\eta=\epsilon+O(\epsilon^2)$. The scaling form of the dynamical structure factor $S(q,\omega)$ of the dynamic sine-Gordon Model A is studied in $d=2-\epsilon$ dimensions. (17 refs.)

105445 BPHZ renormalization and surface terms in one loop diagrams. G.McKeon (Dept. of Appl. Maths., Univ. of Western Ontario, London, Ontario, Canada).
Can. J. Phys. (Canada), vol.61, no.9, p.1328-33 (Sept. 1983).
The application of the Bogoliubov-Parasiuk-Hepp-Zimmermann renormalization scheme to one loop diagrams is discussed. A catalogue of useful integrals is presented. Anomalies induced by radiative corrections are examined from this point of view. (21 refs.)

105446 The role of the Froissart-Martin bound in high-energy correlations of scattering quantities. J.Rames (Inst. of Phys., Czechosl. Acad. Sci., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.8, p.870-6 (1983).
It is shown that the form of correlations between the total cross section and the phase of the amplitude is not sensitive to replacing the Froissart bound by a more general one. Physical consequences of this fact are discussed afterwards. (6 refs.)

105447 Local relativistic invariant flows for quantum fields. S.Albeverio (Math. Inst., Ruhr-Univ., Bochum, Germany), P.Blanchard, P.Combe, R.Hoegh-Krohn, M.Sirugue.
Commun. Math. Phys. (Germany), vol.90, no.3, p.329-51 (1983).
For quantum fields with trigonometric interaction in arbitrary space dimension the authors construct a representation of the Lorentz group by automorphisms on a Banach space generated by the Weyl algebra. (48 refs.)

105448 Infrared and ultraviolet dimensional meromorphy of Feynman amplitudes. C.de Calan, A.P.C.Malbouisson (Centre de Physique Theorique, Ecole Polytechnique, Palaiseau, France).
Commun. Math. Phys. (Germany), vol.90, no.3, p.413-16 (1983).
By the concurrent use of dimensional and analytical regularizations with the complete Mellin representation, the authors find in a direct way the ultraviolet and infrared poles in space-time dimension, for any Feynman amplitude with an arbitrary subset of vanishing masses. (5 refs.)

105449 Does a generic connection depend continuously on its curvature?. M.A.Mostow (Dept. of Math., North Carolina State Univ., Raleigh, NC, USA), S.Shnider.
Commun. Math. Phys. (Germany), vol.90, no.3, p.417-32 (1983).
For a principal bundle with semi-simple structure group over a smooth four-dimensional base manifold the set of connections (gauge potentials) A which are uniquely determined by their curvature (field or field strength) F is generic in the set of potentials, endowed with the Whitney topology. However, the operator taking each such field F to its potential A is not continuous. Partial negative results are given concerning the existence of a smaller generic set on which this operator is continuous. (25 refs.)

105450 Ten-dimensional supersymmetric Yang-Mills theory with SO(8)-covariant light-cone superfields. I.Brink (Inst. of Theoretical Phys., Goteborg, Sweden), M.B.Green, J.H.Schwarz.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.1, p.125-34 (15 Aug. 1983).
The ten-dimensional supersymmetric Yang-Mills theory is formulated in terms of light-cone superfields that transform as vectors the group of transverse Lorentz transformations (SO(8)). These superfields are constrained by a projection condition, which is solved explicitly. The superfield action is obtained by comparing its component expansion with the usual light-cone gauge component action. (7 refs.)

105451 The axial anomaly and anti-symmetric tensor fields. T.E.Clark, S.T.Love (Dept. Phys., Purdue Univ., West Lafayette, IN, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.1, p.135-43 (15 Aug. 1983).
Spin-$^1/_2$ fermions are coupled to external axial vector and rank-2 anti-symmetric tensor fields. The chiral U(1) Ward identity is shown to have anomalous structure given by $F_{\mu\nu}\tilde{F}^{\mu\nu}$ only with $F_{\mu\nu}$ the axial vector field strength tensor. No additional axial anomalies are introduced due to the presence of the anti-symmetric tensor fields. (9 refs.)

105452 A computation of $Tr(-1)^F$ in supersymmetric gauge theories with matter. E.Cohen, C.Gomez (Lyman Lab. of Phys., Harvard Univ., Cambridge, MA, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.1, p.183-90 (15 Aug. 1983).
Introduces 'multi-twisted' boundary conditions (MTBC) for gauge theories in a finite volume. MTBC can be applied for a class of gauge theories with non-trivial centers and allow the existence of some matter multiplets which transform non-trivially under the center group. The Witten index for the supersymmetric extension of the gauge theory can be calculated when global

Abelian symmetries exist and turns out to be non-zero and independent of the matter representations. (5 refs.)

105453 On the renormalization of the quantum field theory of point-like monopoles and charges. G.Calucci (Istituto di Fisica Teorica, Univ. di Trieste, Trieste, Italy), R.Jengo.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.2, p.501-24 (22 Aug. 1983).
The quantum field theory of point-like monopoles and charges is first formulated on a euclidean lattice for a convenient regularization. The regularization preserves the peculiar features of the theory, namely those related to the invariance and to the quantization condition. The partition function is expressed as a path integral over the particle's closed paths and the action is constructed in terms of arbitrary surfaces having those paths as boundaries. The possible divergences of the continuum limit are discussed, in particular the vacuum polarization ones. It is found that, although both the electric charge Q and the magnetic charge G are renormalized as $Q=Z_QQ_R$ and $G=Z_GG_R$, the quantization condition is preserved by the renormalization i.e. $Z_QZ_G=1$ so that $QG=Q_RG_R=2\pi n$. Due to the dual symmetry of the theory, then, for $Q=-G$ one gets $Z_Q=Z_G=1$. (21 refs.)

105454 Schwinger-Dyson approach to large-*N* gauge theory at finite temperature. A.Gocksch (Dept. of Phys., New York Univ., New York, NY, USA), F.Neri.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.1, p.81-92 (29 Aug. 1983).
The authors show how the Schwinger-Dyson equations can be used to extract useful information about gauge theories at finite temperature and infinite N. They derive equations for both the Wilson loop and the connected part of the correlation of 2 loops. In next-to-leading order the correlation between 2 loops has the temperature dependence of a generalized free field theory. The authors discuss the thermodynamic consequences of the previously obtained result that the Wilson loop is independent of the temperature in the confining phase. (9 refs.)

105455 Study of the lepton-violating (μ^-,e$^+$) reaction in modern gauge theories. G.K.Leontaris, J.D.Vergados (Phys. Dept., Univ. of Ioannina, Ioannina, Greece).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.1, p.137-58 (29 Aug. 1983).
The lepton-violating (μ^-,e$^+$) reaction has been studied in the context of modern gauge theories. Both left-handed and right-left symmetric models have been examined. Special attention has been paid to the following mechanisms: (i) those mediated by massive neutrinos (light or heavy); (ii) those accompanied by massless or light physical Higgs particles (majoron); (iii) those involving more exotic intermediate Higgs particles, e.g. singly charged isosinglets (Zee model) and doubly charged isotriplets; (iv) right-handed currents. The formalism has been applied to the experimentally interesting process $\mu^-+{}^{58}\mathrm{Ni}\rightarrow{}^{58}\mathrm{Fe(gs)}+e^+$. The branching ratio is computed using realistic nuclear wave functions. It is found to be $\lesssim 10^{-27}$ in all models, i.e. too small to be measurable in the foreseeable future. The branching ratio for the (μ^-, e$^+$) reaction to all nuclear states is estimated to be $\lesssim 10^{-20}$, i.e. beyond the goals of planned experiments. (29 refs.)

105456 Ten-dimensional supersymmetric Yang-Mills theory in terms of four-dimensional superfields. N.Marcus, A.Sagnotti, W.Siegel (California Inst. of Technol., Pasadena, CA, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.1, p.159-79 (29 Aug. 1983).
The authors show that the usual formulation of the $N=4$ supersymmetric Yang-Mills theory in terms of $N=1$ superfields can be generalized to describe the full ten-dimensional theory. (21 refs.)

105457 Topological geometrodynamics. M.J.Pitkanen (Lab. of Phys., Helsinki Univ. of Technol., Otaniemi, Finland).
Int. J. Theor. Phys. (USA), vol.22, no.7, p.575-651 (July 1983).
An elementary particle model is proposed drawn from the string model and Yang-Mills theory. Instead of describing a particle as a mathematical point, the author identifies it as three-dimensional submanifold of some metric space H. This generalization leads to a topological classification of particles and their interaction vertices. A topological explanation for the generation degeneracy is proposed. The dynamics of the theory is based on the following assumptions. First, the theory should have the formal structure of the Einstein-Yang-Mills theory defined on a 4-surface describing the 'orbits' of particles. Second, the boundary components of the 3-manifold should carry various elementary particle characteristics. Finally, only the natural geometric structures associated with space H should be used in the construction of the dynamics. The isometry group of CP_2 is $SU(3)$ and is interpreted as a color group. Since color is related to CP_2 translational degrees of freedom and CP_2 has 'radius' of order $G^{1/2}$, the uncertainty principle suggests the mass scale $G^{-1/2}$ for colored states. A unified semiclassical description of hadrons as stringlike objects is proposed and gluons are identified as topologically nontrivial excitations of these objects. Finally, semiclassical considerations suggest that the theory is also capable of describing gravitational phenomena and a topological mechanism generating the classical space-time is proposed. (43 refs.)

105458 Finite quantum field theory and neutrinodynamics. P.Bandyopadhyay (Indian Statistical Inst., Calcutta, India), B.Bhattacharya, H.Sarkar.
Int. J. Theor. Phys. (USA), vol.22, no.8, p.677-89 (Aug. 1983).
In quantum neutrinodynamics (photon-neutrino weak coupling) all the renormalization constants vanish and therefore the field equations cannot be expressed in terms of unrenormalized field quantities. This helps one to formulate quantum neutrinodynamics as a convergent quantum field theory. It is also pointed out that from the viewpoint of the unified model of weak and electromagnetic interaction as developed on the basis of the photon-neutrino weak coupling by Bandyopadhyay, quantum electrodynamics also manifests itself as a convergent field theory. (15 refs.)

105459 On N-soliton solutions of coupled Higgs field equation. M.Tajiri (Dept. of Math. Sci., Univ. of Osaka Prefecture, Osaka, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2277-80 (July 1983).
N-soliton solutions of the coupled Higgs field equation are obtained by the Hirota bilinear method. The author gives the multi-soliton solutions of the equation.

105460 Structural instability and the massless $\lambda\phi^4$ theory. P.Ghose (British Council, Div. of the British High Commission, Calcutta, India).
J. Phys. A (GB), vol.16, no.13, p.L461-6 (11 Sept. 1983).
It is shown that the massless $\lambda\phi^4$ theory is structurally unstable, and quantum fluctuations cause symmetry breaking and the unfolding of the cusp catastrophe. (5 refs.)

105461 Implications of the non-uniqueness in the solution of the gauge identities for the Schwinger-Dyson equation. B.K.Jennings, R.M.Woloshyn (Triumf, Vancouver, BC, Canada).
J. Phys. G (GB), vol.9, no.9, p.997-1000 (Sept. 1983).
It is shown that the Slavnov-Taylor identity does not put enough constraint on the longitudinal vertex function to allow the unambiguous construction of an approximate Schwinger-Dyson equation for the gluon propagator. (17 refs.)

105462 Are gauge symmetry and phase invariance identical?. J.P.Hsu, T.Y.Shi (Phys. Dept., Southeastern Massachusetts Univ., North Dartmouth, MA, USA).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.14, p.509-12 (6 Aug. 1983).
The authors discuss the difference between Yang-Mills gauge symmetry and phase invariance in a class of gauge group $SL_{\mathrm{N,c}}$. In order to quantize the $SL_{\mathrm{N,c}}$ fields $b_\mu{}^A$, one must insist on the principle of phase invariance rather than the usual gauge symmetry. As a result, the independent components of $b_\mu{}^A$ are reduced by half. The physics of such a theory turns out to be identical with that of the SU_{N} Yang-Mills theory. (8 refs.)

105463 Quantization of the tensor gauge field of second rank in any gauge. C.Di Bartolo (Dept. de Fisica, Univ. Simon Bolivar, Caracas, Venezuela).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.17, p.583-7 (27 Aug. 1983).
The author discusses the quantization of the Abelian free field $\phi_{\alpha\beta}$ in a general gauge family using a quantization procedure recently developed for the electromagnetic theory. This method leads to manifestly covariant reduced Lagrangian and commutation relations. Previous results for the Coulomb gauge and the radiation gauge are reobtained as particular cases. (13 refs.)

105464 A nonlinear two-dimensional sigma-model in relativistic string theory. V.V.Nesterenko (Lab. of Theoretical Phys., JINR, Dubna, USSR).
Lett. Math. Phys. (Netherlands), vol.7, no.4, p.287-93 (July 1983).
It is shown in what way the nonlinear two-dimensional SO(1,2)/SO(1,1)-sigma model appears in the theory of a relativistic string moving in three-dimensional space-time. (12 refs.)

105465 New meron-type solutions. K.G.Akdeniz (Phys. Dept., Trakya Univ., Edirne, Turkey), M.Hortacsu.
Lett. Math. Phys. (Netherlands), vol.7, no.4, p.295-9 (July 1983).
New meron-type solutions are constructed to the Thirring model. (7 refs.)

105466 Geometrical aspects of gauge conditions. J.Lewandowski, J.Tafel, A.Trautman (Inst. of Theoretical Phys., Warsaw Univ., Warsaw, Poland).
Lett. Math. Phys. (Netherlands), vol.7, no.4, p.347-52 (July 1983).
The Lorentz gauge condition is related to harmonic sections of the principal U(1)-bundle underlying a classical electromagnetic configuration. Minimal sections are shown to correspond to a nonlinear modification of the Lorentz condition. Generalizations to Yang-Mills theory are indicated and harmonic coordinates, in the sense of De Donder (1921) and Fock (1959), are related to Hodge's harmonic 1-forms (1952). (17 refs.)

105467 Quasiclassical theory of spin. I.M.Ternov, V.A.Bordovitsyn (Dept. of Quantum Theory, Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.84-8 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.72-6 (1982).
The proper-time Dirac equation (τ equation) is used to develop a quasi-classical theory of spin of the Dirac particles. (11 refs.)

105468 The effective potential method for two-dimensional $SU(2)\times SU(2)$ lattice sigma model with the fundamental-adjoint action. K.Nokura (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1753-63 (June 1983).
The effective potential method for the $SU(2)\times SU(2)$ lattice sigma model is extended to the fundamental-adjoint action. It is found that, in the intermediate temperature region, the adjoint action term greatly affects the minimum of the effective potential and leads to a first order phase transition. This is essentially due to the F^4 term of the action, where F is the pitch of the sinusoidal spin configuration. When this term is eliminated by choosing a suitable ratio $G=\beta_A/\beta$, the system goes rather smoothly from the low to the high temperature region. (8 refs.)

105469 Phase diagram of the $SU(2)$ lattice gauge theory with a mixed action. K.Ghoroku (Dept. of Phys., Fukuoka Inst. of Technol., Fukuoka, Japan), Y.Myojyo, H.Nagai.
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1823-6 (June 1983).
The phase structure of the $SU(2)$ lattice gauge theory with a mixed action of $j=1/2$ and 3/2 has been studied by Monte Carlo simulations. A first-order transition line is found and the transition is related to the condensation of the vortex and the monopole of the size of the lattice spacing. (8 refs.)

105470 Fractional charges at finite temperature. S.Midorikawa (Res. Inst. for Fundamental Phys., Kyoto Univ., Kyoto, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1831-4 (June 1983).
Quantum numbers on solitons are studied at finite temperature. It is found that the thermal expectation value of fermion number on kinks or magnetic monopoles vanishes at sufficiently high temperatures. This result can be interpreted as the decoupling of fermions from solitons at very high temperatures. (5 refs.)

105471 Topological charge in lattice gauge theory. P.Woit (Joseph Henry Labs., Princeton Univ., Princeton, NJ, USA).
Phys. Rev. Lett. (USA), vol.51, no.8, p.638-41 (22 Aug. 1983).
A useful definition of the topological charge of a lattice gauge-field configuration is given. This definition is used to calculate the topological susceptibility $\chi_t=\langle Q^2\rangle/V$ in SU(2) lattice gauge theory by means of a Monte Carlo simulation. $\chi_t=(170\pm 25\ \mathrm{MeV})^4$ is obtained, in good agreement with the current algebra prediction. Other possible uses of this operator are suggested. (13 refs.)

105472 Time delay and the dyon charge. B.Grossman (Rockefeller Univ., New York, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.11, p.959-62 (12 Sept. 1983).
The scattering of fermions from a magnetic monopole is analyzed in a theory with CP nonconservation. The dyon charge that arises can be understood as a Friedel sum rule from the theory of alloys, as the data for a Riemann-Hilbert problem in the theory of integral equations, and as a consequence of specifying Wigner's R matrix at the monopole core. (21 refs.)

105473 Restrictions on left-right symmetric gauge theories from the neutral kaon system and B decays. F.J.Gilman, M.H.Reno (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
Phys. Lett. B (Netherlands), vol.127B, no.6, p.426-8 (11 Aug. 1983).
The authors investigate the constraints imposed on the weak mixing angles by the K^0-$\bar{K}^0$ mass matrix and B meson decay in left-right symmetric gauge theories. In a class of such theories with manifest left-right symmetry the domain of Kobayashi-Maskawa angles allowed by the $K_L{}^0$-$K_S{}^0$ mass difference has no overlap with that allowed by B meson decay. (9 refs.)

105474 Simple doubling of lattice fermions. R.Stacey (Dept. of Appl. Math. & Theoretical Phys., Univ. of Liverpool, Liverpool, England).
Phys. Lett. B (Netherlands), vol.127B, no.6, p.440-2 (11 Aug. 1983).
The author shows how to reduce the number of fermion species on a d-dimensional lattice from 2^d to just 2. Locality and hermiticity are maintained, but there are problems with C, P and T. (6 refs.)

105475 Remarks on quantized Yang-Mills theory in 26 dimensions. R.I.Nepomechie (Dept. of Phys., Brandeis Univ., Waltham, MA, USA).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.177-8 (25 Aug. 1983).
Observes that Yang-Mills theory in 26 dimensions has no infinite coupling constant renormalization at one loop. The author suggests the theory may be solvable in the large-N limit. (12 refs.)

105476 The S-matrix and the effective potential for the Liouville quantum field theory. C.B.Thorn (Phys. Dept., Univ. of Florida, Gainesville, FL, USA).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.207-12 (25 Aug. 1983).
The author argues that the S-matrix for the quantum Liouville field theory is unity. He also discusses the effective potential for the Liouville theory defined on a circle, and shows that the exact result due to Goldstone (1982) is recovered in the large volume limit. (9 refs.)

105477 Analysis of instanton contribution for the periodic CP_1-model. J.L.Richard (Centre de Phys. Theorique, CNRS, Marseille, France).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.213-14 (25 Aug. 1983).
The analysis of the instanton contribution for the CP_1-model with periodic boundary conditions is performed using isospin invariance. An interpretation in terms of a neutral Coulomb gas is given. (7 refs.)

105478 A mass sum rule in softly broken $N=4$ super Yang-Mills theory. S.Rajpoot, J.G.Taylor (Dept. of Math., King's Coll. London, London, England).
Phys. Lett. B (Netherlands), vol.128B, no.5, p.299-302 (1 Sept. 1983).
It is shown that in the $N=4$ super Yang-Mills theory which contains finiteness preserving explicit supersymmetry breaking mass terms for scalars and fermions, the mass spectrum of the particles that results after tree-level spontaneous symmetry breaking satisfies the mass-squared sum rule $\Sigma_{J=0,1/2,1} (-1)^{2J+1} (2J+1)m_J{}^2=0$. (6 refs.)

105479 Operator quantisation of relativistic dynamical systems subject to first class constraints. I.A.Batalin, E.S.Fradkin (Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Phys. Lett. B (Netherlands), vol.128B, no.5, p.303-8 (1 Sept. 1983).
The operator quantisation is carried out of relativistic dynamical systems subjected to first class bosonic and fermionic constraints that generate an open any-rank irreducible gauge algebra. (5 refs.)

105480 On the topological structure of the vacuum in SU(2) and SU(3) lattice gauge theories. K.Ishikawa (City Coll., City Univ. of New York, New York, NY, USA), G.Schierholz, H.Schneider, M.Teper.
Phys. Lett. B (Netherlands), vol.128B, no.5, p.309-15 (1 Sept. 1983).
The authors present Monte Carlo measurements of the net topological charge of the vacuum in SU(2) and SU(3) lattice gauge theories. In both cases there is no evidence of any topological structure, and the values obtained are a factor of O(100) smaller than expectations based on analyses of the U(1) problem. Moreover they find a strong sensitivity to the lattice size and to the boundary conditions imposed on the lattice. They comment on the physical significance of these results, establish criteria for the reliable performance of such calculations, and remark on the possibly detrimental impact of these findings on the calculation of hadron spectra. (24 refs.)

105481 U(∞) lattice gauge theory as a free lattice string theory. V.A.Kazakov (L.D. Landau Inst. for Theoretical Phys., Acad. of Sci., Moscow, USSR).
Phys. Lett. B (Netherlands), vol.128B, no.5, p.316-20 (1 Sept. 1983).
The strong coupling expansion of the U(∞) Wilson lattice gauge theory in any number of dimensions is reformulated in terms of a sum over free lattice surfaces with local internal structure. This is a confirmation of the equivalence of multicolour QCD and some free string theory. The 1/N expansion is shown to be equivalent to the topological expansion in terms of these surfaces. (5 refs.)

105482 Photon mass in a background of thermal particles. J.F.Nieves (Dept. of Phys., Univ. of Puerto Rico, Rio Piedras, Puerto Rico), P.B.Pal, D.G.Unger.
Phys. Rev. D (USA), vol.28, no.4, p.908-14 (15 Aug. 1983).
The mass of the photon in the presence of thermal background particles is studied. The authors present a general proof that all contributions to the photon's thermal mass from low-temperature thermal backgrounds are suppressed by a huge exponential factor at least as large as $e^{m(e)/2kT}$. They explicitly show that there is no contribution to the photon's thermal mass of order $(\alpha G_F)^{1/2}(kT_\nu)^2$ from two-loop diagrams involving thermal neutrinos at temperature T_ν. The largest contribution to the photon's thermal mass from the observed 3K background is also calculated. (16 refs.)

105483 Strong-coupling expansion for off-axis glueball masses in lattice gauge theories. R.Nakayama (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
Phys. Rev. D (USA), vol.28, no.4, p.922-35 (15 Aug. 1983).
A method for computing the off-axis glueball masses by a strong-coupling expansion is presented. The calculation is carried out up to order β^4 for Z_2, Z_3, SU(2), and SU(3) theories in four-dimensional space-time. The method may be useful for studying the restoration of Lorentz invariance in the continuum limit of lattice gauge theories. The estimates for glueball masses in SU(2) and SU(3) gauge theories in the continuum limit are obtained by using the 'tangent method'. (14 refs.)

105484 Large-order behavior of lattice strong-coupling expansions. C.M.Bender, L.R.Mead (Dept. of Phys., Washington Univ., St. Louis, MO, USA), L.M.Simmons,Jr..
Phys. Rev. D (USA), vol.28, no.4, p.936-52 (15 Aug. 1983).
The authors examine the lattice strong-coupling expansion for the ground-state energy of the quantum-mechanical Hamiltonian ${}^1/_2p^2+g|x|^\alpha$, $\alpha>0$. They are interested in the large-order behavior of this series for various values of α. Treated as a quantum field theory, this simple model provides a laboratory for investigating the fascinating subtleties that arise when there are cancellations among graphs. The parameter α distinguishes between regions in which these cancellations occur with varying degrees of complexity. This paper considers various approaches to this very difficult problem and presents a partial solution. (9 refs.)

105485 Exact fermion-dyon scattering solutions. W.J.Marciano, I.J.Muzinich (Dept. of Phys., Brookhaven Nat. Lab., Upton, NY, USA).
Phys. Rev. D (USA), vol.28, no.4, p.973-6 (15 Aug. 1983).
The authors analyze the Dirac equation for an $I={}^1/_2$ fermion in the field of an SU(2) Julia-Zee dyon. In the Prasad-Sommerfield limit they obtain exact $J=0$ partial-wave solutions for massless fermions. These solutions describe charge-exchange scattering as well as dyon decay via charged-fermion-pair emission. When the initial fermion-dyon Coulomb interaction is repulsive, low-momentum single-particle $J=0$ scattering is prohibited. Implications of the results for proton decay catalysis by SU(5) dyons are briefly discussed. (17 refs.)

105486 Fermion-monopole system reexamined. II. H.Yamagishi (Joseph Henry Lab. of Phys., Princeton Univ., Princeton, NJ, USA).
Phys. Rev. D (USA), vol.28, no.4, p.977-88 (15 Aug. 1983).
For pt.I see ibid., vol.27, p.2383 (1983). Following a preceding paper, the author reexamines the interaction of magnetic monopoles (dyons) with Dirac particles. For an infinitely heavy SU(2) dyon with one isodoublet fermion, it is shown that the vacuum angle in the original theory may be incorporated as a boundary condition in an effective one-particle Hamiltonian, which allows one to determine the charge distribution and the fermionic structure of the stable dyons. The resulting boundary conditions turn out to be Abelian and charge conserving, in contrast to that of previous authors. In particular, the dyon degree of freedom is essentially frozen, and there is no charge-exchange scattering off the dyon. With a Dirac mass term for the fermion, the author also finds that the ground state is twofold degenerate, owing to a spontaneous breakdown of fermion-number conjugation. For a Higgs mass, it is found that the conjugation symmetry is unbroken, as in the original analyis of Jackiw and Rebbi. However, because of the changed boundary condition, the characteristic zero mode ceases to exist, and the ground state is nondegenerate with zero fermion number. (45 refs.)

105487 Instanton chains with multimonopole limits: Lax pairs for non-axially-symmetric cases. A.Chakrabarti (Centre de Phys. Theorique, Ecole Polytech., Palaiseau, France).
Phys. Rev. D (USA), vol.28, no.4, p.989-1000 (15 Aug. 1983).
A formalism is proposed for constructing sequences of instantons which give, in a simple scaling limit, separable multimonopole solutions. For this purpose essentially static techniques are adapted to the construction of finite-action solutions through a trick already used before for the axially symmetric case. For going beyond axial symmetry appropriate Lax pairs are constructed. Then, in the framework of Zakharov et al. for purely solitonic solutions, pole equations are solved and a suitable seed solution $\psi_{(0)}$ obtained. The restriction to axial symmetry in this framework is presented. The corresponding results in the monopole limit are shown to emerge trivially from those for instantons. (23 refs.)

105488 Stochastic quantization and the large-N reduction of U(N) gauge theory. J.Alfaro (Phys. Dept., City Coll., City Univ. of New York, New York, NY, USA).
Phys. Rev. D (USA), vol.28, no.4, p.1001-9 (15 Aug. 1983).
The large-N reduction of U(N) gauge theory is studied using the stochastic quantization method of Parisi and Wu. The main result is that within this context the author obtains the reduction of the gauge theory without introducing extra constraints among the dynamical variables. (16 refs.)

105489 Analysis of anomalies in higher space-time dimensions. P.H.Frampton, T.W.Kephart (Dept. of Phys. & Astron., Univ. of North Carolina, Chapel Hill, NC, USA).
Phys. Rev. D (USA), vol.28, no.4, p.1010-23 (15 Aug. 1983).
The anomaly for a dimension $D=2n$ gauge theory is calculated for arbitrary $n\geq2$ from the l-agon Feynman diagram with $l=(n+1)$. The result is both finite and unique despite the nonrenormalizability of the theory. The contributions of higher polygons to the anomaly are deduced from gauge invariance and Lorentz invariance. The no-anomaly condition in $D=2n$ is the vanishing of a symmetrized trace over l generators written in the fermion representation. It is shown how to compute this trace for totally antisymmetric representations of SU(N). (15 refs.)

105490 Effective Hamiltonians in the large-N limit. O.A.Karim (Dept. of Phys., Brown Univ., Providence, RI, USA).
Phys. Rev. D (USA), vol.28, no.4, p.1036-8 (15 Aug. 1983).
Lattice gauge theories are considered in the large-N limit. Two different approaches for obtaining an effective Hamiltonian are studied and compared. The gauge-volume approach is shown to differ from the collective-field one, and therefore the two may not yield the same large-N limit. It is argued that the collective formalism is the correct one. (10 refs.)

105491 Comment on derivation of anomalous Ward-Takahashi identities in the functional integration formulation of field theory. D.W.McKay (Dept. of Phys. & Astron., Univ. of Kansas, Lawrence, KS, USA), B.-L.Young.
Phys. Rev. D (USA), vol.28, no.4, p.1039-41 (15 Aug. 1983).
The authors point out that in the calculations of the triangle anomaly there is a discrepancy between the result of the functional method applied to a chiral model by Fujikawa (1980) and the result of the conventional perturbation approach applied to this model. Possible sources for the discrepancy are briefly discussed. (21 refs.)

105492 An investigation of the infrared behaviour of the gluon propagator in the axial gauge. P.Haase Sorensen (Inst. of Phys., Univ. of Arhus, Arhus, Denmark).
Phys. Scr. (Sweden), vol.28, no.2, p.201-4 (Aug. 1983).
In the axial gauge an integral equation for the gluon propagator of a pure Yang-Mills theory is derived on the Dyson-Schwinger equation and the Slavnov-Taylor identities. Dimensional regularization is used. The solution of this equation is investigated in the case where the variable $\lambda=(n,k)^2/n^2k^2$ is different from zero and it is seen that the nice properties of the confining solution $D(k)\sim1/k^4$ are lost in this case. (10 refs.)

105493 Soliton-like solutions of some nonlinear theories and transformations among them. G.P.Malik, J.Subba Rao (School of Environmental Sci., Jawaharlal Nehru Univ., New Delhi, India), G.Johri.
Pramana (India), vol.20, no.5, p.429-38 (May 1983).
The observation that the soliton-like solutions of a given second-order differential equation define the separatrix of the equivalent autonomous system is used to obtain the one-soliton solutions for the ϕ^4 theories (the usual and the one with the wrong sign of the mass term), the ϕ^6, the ϕ^8, the sine-Gordon theories and the KdV equation. Transformations are given which transform the sine-Gordon equations into an equation belonging to the ϕ^{2n} class of theories. A procedure is evolved for obtaining the two-soliton solutions for the sine-Gordon theory without the use of Backlund transformations; it is suggested that this procedure may be useful for investigating the existence of similar solutions for theories of the polynomial type. (12 refs.)

An electrostatic example to illustrate dimensional regularization and renormalization group technique .... See Entry 105064

A family of groups generalising the Poincare group and their physical applications .... See Entry 105093

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Dynamical stability of the BRS supersymmetry and the Gribov problem ....See Entry 105495

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Renormalization of the electroweak ρ-parameter from supersymmetric particles ....See Entry 105499

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11.20 S-MATRIX THEORY

The *S*-matrix and the effective potential for the Liouville quantum field theory ....See Entry 105476

11.30 SYMMETRY AND CONSERVATION LAWS

(see also 02.20 Group theory)

105494 Chirality index and dimensional reduction of fermions. C.Wetterich (CERN, Geneva, Switzerland).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.1, p.109-24 (15 Aug. 1983).
The number of four-dimensional chiral fermions obtained from dimensional reduction of models with spinor matter fields coupled to pure gravity in $d>4$ dimensions is linked to topological properties of the internal d-4 dimensional space. This gives important restrictions on possible ground states of such models consistent with a realistic four-dimensional unified theory. Connections with spontaneous symmetry breaking and Yukawa couplings of fermions in unified theories are discussed. (16 refs.)

105495 Dynamical stability of the BRS supersymmetry and the Gribov problem. K.Fujikawa (Inst. for Nuclear Study, Univ. of Tokyo, Tanashi, Tokyo, Japan).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.1, p.218-34 (15 Aug. 1983).
The stability of the Becchi-Rouet-Stora supersymmetry is studied on the basis of a simple non-gauge model invariant under BRS supersymmetry. The Nambu-Goldstone theorem is stated and the spontaneous breakdown of the BRS supersymmetry is illustrated by the above non-gauge model. this indicates that the dynamical stability of BRS supersymmetry in non-Abelian gauge theories should also be carefully examined, if one takes the Faddeev-Popov lagrangian as a basis of the formal canonical treatment. The author shows that a better understanding of the Gribov problem is required to establish the stability of the BRS supersymmetry in non-Abelian gauge theories to non-perturbative accuracy. (25 refs.)

105496 Instantons in supersymmetric theories. V.A.Novikov, M.A.Shifman, A.I.Vainshtein, V.I.Zakharov (Inst. of Theoretical & Experimental Phys., Moscow, USSR).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.2, p.445-73 (22 Aug. 1983).
Instanton effects are considered for a sample of supersymmetric theories, namely, quantum mechanics, gluodynamics, Higgs model. The problem is how to reconcile the apparent lack of the boson-fermion symmetry in the effective instanton induced interactions with supersymmetry of the corresponding Lagrangians. It is shown that in the case of quantum mechanics and the Higgs model there is actually no conflict between supersymmetry and the instanton calculus since the Ward identities associated with the supersymmetry transformations, are satisfied. In quantum mechanics this is due to spontaneous symmetry breaking, or pole terms in matrix elements of supercharge, while in the case of the supersymmetric Higgs model the effective fermion interaction just reduces to a total derivative. In the case of supersymmetric gluodynamics, however, the standard instanton calculus explicitly violates naive Ward identities. (13 refs.)

105497 Spontaneous lepton-number violation and de-leptonization in stellar collapse. D.A.Dicus (Center for Particle Theory, Univ. of Texas, Austin, TX, USA), E.W.Kolb, D.L.Tubbs.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.2, p.532-41 (22 Aug. 1983).
The authors consider core collapse in weak interaction models where global lepton-number invariance is spontaneously broken. They find that the initial neutrino number prevents finite temperature restoration of lepton-number conservation. Assuming the lepton-number violating reactions occur rapidly, they show that the neutrino number is driven to a sufficiently small value to allow electron capture reactions to de-leptonize the core, and lead to a high-entropy collapse. (11 refs.)

105498 $\Delta B=2$ transitions. J.Basecq, L.Wolfenstein (Carnegie-Mellon Univ., Pittsburgh, PA, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.1, p.21-31 (29 Aug. 1983).
It is pointed out that, for certain $\Delta B=2$ operators, transitions of the form $N+N \rightarrow$ mesons occurring in complex nuclei provide a much more sensitive probe than do neutron-antineutron oscillations in a vacuum. (15 refs.)

105499 Renormalization of the electroweak ρ-parameter from supersymmetric particles. R.Barbieri (Dipartimento di Fisica, Univ. di Pisa, Pisa, Italy), L.Maiani.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.1, p.32-42 (29 Aug. 1983).
The authors compute the renormalization of the neutral-to-charged current Fermi constant ratio, arising from the new particles required in supersymmetric schemes. They find that ρ is insensitive to the scale of the supersymmetry mass-splitting. For a t-quark mass m_t greater than this scale, the scaler-t and scalar-b contribution increases proportionally to m_t^2 and it is essentially equal, in sign and magnitude, to the t-, b-quark contribution. Contributions from the gaugino-higgsino-Higgs boson sector are generally of the order of a few parts in 10^{-3}. For a class of models under consideration these results can be traced back to an approximate SU(2) symmetry which is also useful in the classification of the new particle spectrum. (13 refs.)

105500 Quantum versus gravitational effects in supersymmetric theories. M.Dine (Inst. for Advanced Study, Princeton, NJ, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.1, p.93-106 (29 Aug. 1983).
The author considers what happens when certain globally supersymmetric grand unified models are coupled to $N=1$ supergravity. Treating only leading (i.e. tree level) gravitational effects while treating non-gravitational effects to all orders, the author shows how the original globally supersymmetric theory is recovered as $M_p \rightarrow \infty$. This allows one to compare the importance of various gravitational and non-gravitational effects. A potentially realistic model is presented and analyzed. Possible quantum gravitational effects are mentioned. (22 refs.)

105501 Similarity reduction of modified Kadomtsev-Petviashvili equation. M.Tajiri (Dept. of Math. Sci., Univ. of Osaka Prefecture, Osaka, Japan), S.Kawamoto.
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2315-19 (July 1983).
Similarity solutions of the modified Kadomtsev-Petviashvili equation are investigated by using infinitesimal transformations of Lie's method. It is shown that the modified Kadomtsev-Petviashvili equation can be transformed, by the first reduction, to modified Boussinesq-type, the modified K-dV equations and others. (16 refs.)

105502 The dynamical symmetries of the monopole in geometric quantization. P.A.Horvathy (Faculty fur Phys., Univ. Bielefeld, Bielefeld, Germany).
Lett. Math. Phys. (Netherlands), vol.7, no.4, p.353-61 (July 1983).
The 'hidden' $o(3) \times o(2,1)$ symmetry of the magnetic monopole discovered recently by Jackiw (1980) is studied in the geometric framework of Kostant (1970) and Souriau (1970). (21 refs.)

105503 Covariance of spontaneous symmetry breaking in non-inertial frames. B.Bagchi (Dept. of Phys., Presidency Coll., Calcutta, India).
Phys. Lett. A (Netherlands), vol.97A, no.4, p.143-4 (22 Aug. 1983).
It is pointed out that contrary to a recent claim the process of symmetry breaking is covariant in a non-inertial frame. (2 refs.)

105504 Catalysis of flavor nonconservation by monopoles. V.P.Nair (Phys. Dept., Syracuse Univ., Syracuse, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.8, p.631-3 (22 Aug. 1983).
A simple argument based on current algebra is given to show how monopoles can lead to baryon decay and other flavor-changing processes. (9 refs.)

105505 Long-range behavior of nuclear forces as a manifestation of supersymmetry in nature. L.F.Urrutia, E.Hernandez (Centro de Estudios Nucleares, Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
Phys. Rev. Lett. (USA), vol.51, no.9, p.755-8 (29 Aug. 1983).
It is shown that each isospin channel in the long-range approximation to the nucleon-nucleon potential (one-pion-exchange potential) corresponds to a realization of a quantum mechanical supersymmetric Hamiltonian. A functional relation between the coordinate-dependent coefficients of the spin-spin and tensor parts of the interaction predicted by supersymmetry is exactly fulfilled. (11 refs.)

105506 Possible scalar-quark production of the proton-antiproton collider. M.Gluck, E.Reya (Inst. fur Phys., Univ. Dortmund, Dortmund, Germany).
Phys. Rev. Lett. (USA), vol.51, no.10, p.867-8 (5 Sept. 1983).
Single-jet events opposite to an electron track at the proton-antiproton collider may signal the semileptonic decay $\tilde{q} \rightarrow e\tilde{\nu}X$ of a heavy scalar quark $\tilde{q}$ with $m_q=35$ GeV. Only an observation of the opposite anti-scalar-quark or gluino jet with its typical missing-energy pattern can distinguish this possibility from the recently suggested top-quark interpretation of the 'electron plus single-jet' events. The nonobservation of the hadronic opposite-side jet, for the

experimental cut $E_T^{jet}>10$ GeV, favors a missing-energy signature as expected for supersymmetric particles. (12 refs.)

105507 Proton instability and the $SU_5 \otimes U_1$ subgroup of SO_{10}. W.Alles (Inst. di Fisica, Univ. di Bologna, Bologna, Italy).
Phys. Lett. B (Netherlands), vol.127B, no.6, p.423-5 (11 Aug. 1983).
It is shown, for the case of three generations of fermions, that for gauge interaction of the $SU_5 \otimes U_1$ subgroup of SO_{10} the nucleon can be made stable to zeroth order in the weak interactions with no restriction on the Kobayashi-Masakawa mixing matrix. (10 refs.)

105508 Gluino and photino masses in a class of locally supersymmetric models. R.Bsarbieri (Istituto di Fisica, Univ. di Pisa, Pisa, Italy), L.Girardello, A.Masiero.
Phys. Lett. B (Netherlands), vol.127B, no.6, p.429-32 (11 Aug. 1983).
The authors analyze all possible sources of radiative gaugino masses in a class of SU(3)⊗U(2)⊗U(1) locally supersymmetric models. Barring direct gaugino masses and radiative contributions from superheavy particles of grand unified theories, they find that: (i) consistently with the present bounds, gluinos with a mass of 1-1.5 GeV and relatively long lived ($c_\tau \approx 1$ cm) can be obtained from a virtual heavy top exchange (150 GeV$\lesssim m_t \lesssim$200 GeV); (ii) the photino masses are in the 100 meV range; (iii) no sizable gravitational radiative effect exists at one loop. (14 refs.)

105509 Supersymmetry and parastatistics. R.Y.Levine, Y.Tomozawa (Dept. of Phys., Univ. of Michigan, Ann Arbor, MI, USA).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.189-93 (25 Aug. 1983).
An analysis is made of the supersymmetry of parafields in Wess-Zumino-type models with two cases in which parabosons and parafermions form a supermultiplet. In case one the symmetry is realized by either the normal superalgebra or an infinite Lie algebra as in ordinary supersymmetry. In case two the infinite Lie algebra is intrinsic to the supersymmetry. With appropriate symmetry breaking, formulations of these types may be used to explain the generation problem by postulating unobserved parabosons as supersymmetric partners. The relevance to these models of an infinite Lie algebra constructed from supersymmetry is mentioned. (9 refs.)

105510 Super-b_4 coefficients. I.N.McArthur (Lyman Lab. of Phys., Harvard Univ., Cambridge, MA, USA).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.194-8 (25 Aug. 1983).
For a class of supersymmetric theories coupled to background Yang-Mills superfields and on a curved superspace background, the superfield analogue of the heat kernel is defined and the corresponding b_4 superfields are computed. In specific cases, these super-b_4 coefficients are shown to determine the one loop trace supermultiplet and the logarithmically divergent part of the effective action. (14 refs.)

105511 A supersymmetric variant of Dashen's formula. G.Veneziano (CERN, Geneva, Switzerland).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.199-202 (25 Aug. 1983).
In SUSY-QCD Dashen's formula (1969,71) is shown to be accompanied, in a SUSY vacuum, by a more useful relation giving the behaviour of $F_{\pi i}{}^{a} M_{ij} F_{\pi j}{}^{b}$ in the chiral limit. As a consequence, the previously noted properties of SUSY vacua at small mass become even more puzzling. (15 refs.)

105512 The charged current couplings and *CP*-violation in the B-meson system. E.A.Paschos, B.Stech (CERN, Geneva, Switzerland), U.Turke.
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.240-4 (25 Aug. 1983).
Considers a lifetime range for the B meson from the observed upper limit down to 0.3×10^{-12} s. Under this constraint all elements of the flavour mixing matrix are strongly restricted. By fitting the ϵ parameter in K^0-decay a relatively large *CP*-violating phase angle is required. (13 refs.)

105513 Massive superspace—a superspace with massive scalars and gauginos. K.T.Mahanthappa, G.M.Staebler (Dept. of Phys., Univ. of Colorado, Boulder, CO, USA).
Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.43-6 (15 Sept. 1983).
The authors introduce a superspace whose global metric is modified in the fermionic sector and hence does not have the canonical supersymmetry. This introduces masses for physical scalar particles and gauginos with their superpartners remaining massless. Cancellation of quadratic divergences among fermion and boson loops is exhibited at one-loop level. (12 refs.)

105514 Supersymmetric gauge fixing and the effective potential. R.D.C.Miller (CERN, Geneva, Switzerland).
Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.72-6 (15 Sept. 1983).
Supersymmetric (SUSY) covariant gauge fixing is analyzed at a component field level using the methods of Fukuda and Kugo (1976). The author finds that for all models with *D* type breaking and almost all models with *F* type breaking supersymmetric covariant gauge fixing is a 'bad gauge' choice (characterized by the unwelcome situation where the gauge multiplet picks up an *x* dependent VEV). SUSY $R\xi$ gauges avoid this problem. (5 refs.)

105515 Low energy *CP* violation in broken supersymmetry. F.del Aguila, J.A.Grifols, A.Mendez (Dept. de Fisica Teorica, Univ. Autonoma de Barcelona, Barcelona, Spain), D.V.Nanopoulos, M.Srednicki.
Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.77-9 (15 Sept. 1983).
The authors investigate the *CP* violation effects in supersymmetry broken models, due to the exchange of new fermions (gauginos and higgsinos). When the real part of the K^0-$\bar{K}^0$ amplitude is compatible with the experimental value, the possible imaginary part is too small to account for the ϵ parameter. In contrast, the experimental bounds on the ϵ' parameter and the electric dipole moments and especially the θ parameter, impose in general severe constraints on the possible *CP* violating phases. However, in some specific models there are extra suppression factors, leaving those phases essentially unconstrained except perhaps for the θ parameter. (14 refs.)

105516 Bounds on masses of Higgs boson and heavy fermions in a softly broken supersymmetric model. K.Tabata, I.Umemura, K.Yamamoto (Dept. of Nuclear Engng., Kyoto Univ., Kyoto, Japan).
Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.80-4 (15 Sept. 1983).
The authors discuss in an $SU(3)_C \times SU(2)_W \times U(1)_Y$ gauge model with softly broken supersymmetry, the upper bounds on masses of the Higgs particle (m_H) and the quark of the fourth generation (m_U), and also the lower bound on Higgs mass. Requiring that no interaction should become strong until the grand unification energy is reached, they obtain the upper bounds $m_H<220$ GeV and $m_U<150$ GeV. The lower bound on the Higgs mass is studied in detail for the case that the gaugino masses (Δm) break supersymmetry softly. The vacuum is stable for any value of Δm if $m_H \gtrsim 12$ GeV. (9 refs.)

105517 Supersymmetric S-covariant R_ξ gauge. P.Binetruy, P.Sorba, R.Stora (LAPP, Annecy-le-Vieux, France).
Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.85-9 (15 Sept. 1983).
The authors present a supersymmetric extension of a class of nonlinear gauges which respect the residual gauge invariance of spontaneously broken gauge theories. (10 refs.)

105518 Comment on the Peccei-Quinn symmetry. D.Wyler (ETH-Honggerberg, Zurich, Switzerland).
Phys. Rev. D (USA), vol.28, no.4, p.1024-7 (15 Aug. 1983).
It is shown that the U(1) symmetry of Pecci and Quinn leads to vanishing strong *CP* violation even if chiral symmetry is spontaneously broken by the strong interactions. (12 refs.)

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Absence of Goldstino decoupling in hierarchical superunified models .... See Entry 105530

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Supersymmetric grand unification and neutron-antineutron oscillations .... See Entry 105533

Patterns of local supersymmetry breaking in SUSY GUTS .. See Entry 105534

Local SUSY breaking induced by the GUT phase transition in the early Universe .... See Entry 105535

Lepton-number violation with quasi-Dirac neutrinos .... See Entry 105536

Strangeness-changing processes and the limit on the right-handed gauge-boson mass .... See Entry 105537

Dynamical generation of fermion mass differences within grand unified theories with a reduced mass-scale range of static symmetry .... See Entry 105538

Conservation laws in the monopole-induced baryon-number-violating processes .... See Entry 105540

Weak interactions in the region of the Fermi scale .... See Entry 105554

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Possible origin of a natural conservation of flavor in an interaction with neutral Higgs bosons .... See Entry 105558

Lattice QCD with light quark masses: does chiral symmetry get broken spontaneously? .... See Entry 105561

Quantum chromodynamics on a simplicial lattice .... See Entry 105563

Properties of a classical confining medium in SU_2 gluon dynamics .... See Entry 105567

Baryons as chiral solitons .... See Entry 105573

Hadron and jet production at collider energies in perturbative QCD .... See Entry 105575

Meson exchanges in the harmonic-oscillator quark model ..... See Entry 105577

New procedure for the estimation of the extended-hypercolor boson masses .... See Entry 105579

Topological soliton bag model for baryons .... See Entry 105583

Quark and gluon latent heats at the deconfinement phase transition in SU(3) gauge theory .... See Entry 105584

Search for supersymmetry in toponium decays .... See Entry 105587

Large *N* limit of composite quarks and leptons .... See Entry 105599

A supersymmetric composite model .... See Entry 105601

Hierarchy of fermion masses in supersymmetric composite models .... See Entry 105602

Unified preon models based on simple gauge groups .... See Entry 105603

Test of supersymmetry in $e^- e^-$ collisions .... See Entry 105612

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Energy dependence of the fundamental parameters of the K^0-$\bar{K}^0$ system. I. Experimental analysis .... See Entry 105634

Energy dependence of the fundamental parameters of the K^0-$\bar{K}^0$ system. II. Theoretical formalism .... See Entry 105635

D^+-D^0 mass difference .... See Entry 105636

Baryon magnetic moments .... See Entry 105640

Neutrino magnetic moment in supersymmetry .... See Entry 105644

Radiative corrections to the helicity asymmetries for the Drell-Yan process in QCD .... See Entry 105649

$\mathcal{O}(4)$ symmetry in inclusive lepton-hadron scatterings .... See Entry 105653

SU(2)×U(1) effects in e^+e^- annihilation: generalized charge asymmetry .... See Entry 105659

Signals for supersymmetric particles in three-jet events for e^+e^- annihilations .... See Entry 105660

Supersymmetric decay modes of the W and single electron production in p-$\bar{p}$ collisions .... See Entry 105686

***SU* (3) and *SU* (5) dynamical symmetries in the extended interacting boson model** .... See Entry 105761

Constraints on light particles from stellar evolution .... See Entry 110891

Problems with the new inflationary Universe .... See Entry 111288

On the possibility of a test of the cosmology of asymptotically free SU(5) theory .... See Entry 111289

11.40 CURRENTS AND THEIR PROPERTIES

105519 Global aspects of current algebra. E.Witten (Joseph Henry Lab., Princeton Univ., Princeton, NJ, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.2, p.422-32 (22 Aug. 1983).
A new mathematical framework for the Wess-Zumino chiral effective action is described. It is shown that this action obeys an a priori quantization law analogous to Dirac's quantization of magnetic change. It incorporates in current algebra both perturbative and non-perturbative anomalies. (10 refs.)

105520 Current algebra, baryons, and quark confinement. E.Witten (Joseph Henry Labs., Princeton Univ., Princeton, NJ, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.2, p.433-44 (22 Aug. 1983).
It is shown that ordinary baryons can be understood as solitons in current algebra effective Lagrangians. The formation of color flux tubes can also be seen in current algebra, under certain conditions. (12 refs.)

The axial anomaly and anti-symmetric tensor fields .... See Entry 105451

Catalysis of flavor nonconservation by monopoles .... See Entry 105504

Elementary particle states based on the Clifford algebra C_7 .... See Entry 105582

Ω^- and $\Sigma^+ \rightarrow p\gamma$ nonleptonic weak decays via current algebra, partial conservation of axial-vector current, and the quark model .... See Entry 105628

Phenomenological structure of weak lepton currents in the reactions of direct and inverse μ decay .... See Entry 105630

11.50 DISPERSION RELATIONS AND SUM RULES

105521 Constraints on K^0-$\bar{K}^0$ mixing from hadronic sum rules. B.Guberina, B.Machet, E.de Rafael (Centre de Phys. Theorique, CNRS, Marseille, France).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.269-76 (25 Aug. 1983).
It is shown how from present knowledge of strong interaction dynamics it is possible to set an upper limit to the absolute value of the K^0-$\bar{K}^0$ mixing parameter which governs the K_L-K_S mass-difference. (18 refs.)

Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions .... See Entry 105008

Time delay and the dyon charge .... See Entry 105472

A mass sum rule in softly broken $N=4$ super Yang-Mills theory .... See Entry 105478

Exotic mesons from QCD sum rules .... See Entry 105576

Quark-antiquark potential and Q^2 duality .... See Entry 105578

Confined quarks and the Weinberg sum rules .... See Entry 105586

D^+-D^0 mass difference .... See Entry 105636

Magnetic moments of the ground-state baryons .... See Entry 105643

The nuclear response function .... See Entry 105776

Sum rule approach to giant resonance states .... See Entry 105814

11.80 RELATIVISTIC SCATTERING THEORY

(see also 03.80 General theory of scattering)

105522 Lorentz invariance in relativistic potential theory. D.R.Giebink (Dept. of Phys., Texas A&M Univ., College Station, TX, USA).
Phys. Rev. C (USA), vol.28, no.2, p.818-22 (Aug. 1983).
An overview of the Lorentz-transformation properties of the potential and the off-energy-shell *T* matrix in relativistic potential theory is presented from a coordinate-space viewpoint. A formulation of relativistic potential theory that employs an energy-dependent potential in reference frames other than the center of mass is developed. It is shown that the potential and off-energy-shell *T* matrix in this formulation have simple Lorentz-transformation properties. (6 refs.)

Improved high-energy bound on the logarithmic derivative of scattering amplitudes .... See Entry 105606

12.00 SPECIFIC THEORIES AND INTERACTION MODELS; PARTICLE SYSTEMATICS

12.10 UNIFIED FIELD THEORIES AND MODELS

105523 Supersymmetric grand unified theory with soft breaking of intermediate mass scale. H.Nishino (Internat. Centre for Theoretical Phys., Trieste, Italy), S.Watamura.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.1, p.235-51 (15 Aug. 1983).
Considers a supersymmetric GUT with the soft breaking of supersymmetry at an intermediate mass scale. A realistic and natural unified model is constructed. (31 refs.)

105524 On the possibility of finding light uncolored supersymmetric partners at present and future machines. J.-M.Frere, G.L.Kane (Randall Lab. of Phys., Univ. of Michigan, Ann Arbor, MI, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.2, p.331-50 (22 Aug. 1983).
Supersymmetric models allow the possibility of finding new light spin-$^1/_2$ fermions ($m<m_W$, and perhaps $m<$10-15 GeV, charged or neutral) that are (apart from mixing effects) the supersymmetric partners of W, Z^0, and Higgs bosons. The authors provide a detailed analysis of their expected properties, production mechanisms, and signatures, with emphasis on detection at e^+e^- colliders. Although the charged, spin-$^1/_2$ particles resemble sequential leptons, it turns out that their properties differ enough that they might have been missed in the standard searches with normal cuts, and they still might be found with $m<18$ GeV. A neutral, spin-$^1/_2$ particle with m below about 30 GeV could exist with a clear decay signature and be singly produced at detectable rates at present machines (picobarn cross sections). (13 refs.)

105525 Supersymmetry-breaking through *D*-terms. M.Dine (Inst. for Advanced Study, Princeton, NJ, USA), D.Nemeschansky.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.2, p.351-65 (22 Aug. 1983).
Models in which supersymmetry is broken by the Fayet-Iliopoulos mechanism are reconsidered. The possibility that scalar quark and lepton masses might arise radiatively in such theories is explored. It is shown that in several interesting cases, these masses-squared are all negative. In grand-unified versions of these models, it is shown that the scale of SU(2)×U(1) breaking tends to be much larger than the scalar quark and lepton masses, i.e. that the hierarchy is unstable. (16 refs.)

105526 Higher-order effects and the vector boson physical parameters. M.Consoli, S.L.Presti (Istituto di Fisica, Univ. di Catania, Catania, Italy), L.Maiani.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.2, p.474-500 (22 Aug. 1983).
A detailed analysis of the higher-order effects of the vector boson masses and leptonic decay rates is presented. Previous results obtained by different authors are discussed and compared within a simple renormalization scheme. The experimental precision required for a meaningful test of the theory at the one-loop level is also discussed. (22 refs.)

105527 The possibility of new fermions with $\Delta I=0$ mass. F.Del Aguila (Phys. Dept., Univ. of Florida, Gainesville, FL, USA), M.J.Bowick.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.1, p.107-36 (29 Aug. 1983).
In the Glashow-Weinberg-Salam model the fermions have $\Delta I={}^1/_2$ masses from the breaking of the weak SU(2) gauge symmetry. In many enlarged models, such as those from grand unified and/or supersymmetric theories, there are additional fermions with undetermined $\Delta I=0$ (SU(2) invariant) masses. The authors study these new fermions. They induce flavour changing neutral currents. They show that the mixing angles of $\Delta I=0$ fermions of mass order M with normal $\Delta I={}^1/_2$ fermions of mass order $m \ll M$ are order η or η^2, where $\eta=m/M$. If $M>150\ \delta$, δ being a model-dependent mixing parameter of order a normal fermion mass, the amplitudes of all FCNC processes are below the experimental sizes and limits. Thus for $\delta \lesssim 0.1$ GeV, M can be as low as 20 GeV, close to the present experimental lower bound. δ is fixed, and less than 0.1 GeV for all relevant cases, if one assumes the mass hierarchy of the known fermions is not the result of a particular choice of $\Delta I=0$ mass parameters. If produced, $\Delta I=0$ mass fermions will be noticeable by the mass degeneracy within their isospin multiplets. There will be an enhanced ratio of neutral to charged decays over the normal fermions. Standard GUT predictions are changed little. (29 refs.)

105528 Neutrino oscillations in grand unified models with a horizontal symmetry. Z.G.Berezhiani, D.L.Chkareuli (Inst. of Phys., Acad. of Sci., Georgian SSR).
JETP Lett. (USA), vol.37, no.6, p.338-41 (20 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.6, p.285-8 (20 March 1983). [received: Sept. 1983]
A new mechanism for the generation of neutrino masses is discussed in the SU(5) grand unified model with a horizontal symmetry $SU(3)_H$ between quark-lepton generations. A strong ν_μ-ν_τ mixing is predicted in a model with tree quark generations. The primary oscillation effects in the six-generation model involve the mixing of only left-hand and right-hand neutrinos. (7 refs.)

105529 Polarization effects in the process of bremsstrahlung creation of massive mesons in a magnetic field. I.M.Ternov, V.N.Rodionov, V.G.Zhulego, A.I.Studenikin (Dept. of Quantum Theory, Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.60-4 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.53-7 (1982).
The authors obtain the probabilities of bremsstrahlung creation of the massive vector Weinberg-Salam meson in a magnetic field. They study the dependence of the total probability of the axial component of the transition current, and on the spin orientation of the initial electron. It is shown that the sign of the spin correction can change with the relative magnitude of the axial component of the current. (6 refs.)

105530 Absence of Goldstino decoupling in hierarchical superunified models. M.B.Einhorn, D.R.T.Jones (Randall Lab. of Phys., Univ. of Michigan, Ann Arbor, MI, USA).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.174-6 (25 Aug. 1983).
It is shown that there exists a class of hierarchical supersymmetric unified models in which the Goldstino field does not decouple from the light states. The authors illustrate this with an SU_N model. The phenomenology and cosmology of such models is discussed. (11 refs.)

105531 ***B-L* violation in supersymmetric SU(5).** M.J.Bowick, M.K.Chase, P.Ramond (Phys. Dept., Univ. of Florida, Gainesville, FL, USA).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.185-8 (25 Aug. 1983).
The authors examine the consequences of the *B-L* violating terms that occur in the most general superpotential of globally supersymmetric SU(5) grand unified models. They find that some of the coefficients in the *B-L* violating sector of the theory must be very small in order to satisfy the experimental bounds on neutrino masses and proton decay. Various symmetries which forbid or suppress the *B-L* violating terms are discussed. (12 refs.)

105532 An SU(5) axion model with Georgi-Jarlskog mass matrices but without domain walls. M.J.Hayashi (Dept. of Phys., Tokai Univ., Numazu, Japan), A.Murayama.
Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.47-50 (15 Sept. 1983).
An SU(5) axion model is presented which reproduces the Georgi-Jarlskog mass matrices but gives no cosmological domain walls. The assumption that $U(1)_{B-L}$ and $U(1)_{PQ}$ are spontaneously broken simultaneously at a mass scale of 10^7-10^{12} GeV leads to $m_{\nu_\tau}=10$ eV-100 KeV. The close relation between the anomalous $U(1)_{PQ}$ and the generation structure of quarks and leptons is emphasized. (17 refs.)

105533 Supersymmetric grand unification and neutron-antineutron oscillations. S.Kalara (Dept. of Phys. & Astron., Univ. of Rochester, Rochester, NY, USA), R.N.Mohapatra.
Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.57-60 (15 Sept. 1983).
The authors present an extension of the minimal supersymmetric SU(5) model which gives rise to an observable rate for neutron-antineutron oscillation without any special fine tuning of parameters. The dominant Feynman graph involves the exchange of Higgs fermions and a light right-handed Majorana neutrino with radiatively induced mass of ~10 GeV. Other phenomenological implications of the model are studied. (16 refs.)

105534 Patterns of local supersymmetry breaking in SUSY GUTS. J.Leon, M.Quiros (Inst. de Estructura de la Materia, Madrid, Spain), M.Ramon Medrano.
Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.61-6 (15 Sept. 1983).
The super-Higgs effect is analyzed in the framework of SUSY GUTS. The authors consider the cases where: (i) local SUSY is broken through a gauge singlet field, and (ii) local SUSY and the grand unification group are simultaneously broken when a non singlet field takes a non zero VEV. The second case is illustrated with the SU_5 SUSY GUT where the adjoint plays the role of the super-Higgs fields. (18 refs.)

105535 Local SUSY breaking induced by the GUT phase transition in the early Universe. C.Kounnas (CERN, Geneva, Switzerland), J.Leon, M.Quiros.
Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.67-71 (15 Sept. 1983).
The authors show that the confining properties of the grand unification theory (GUT) may induce a transition to a ground state where both local SUSY and gauge symmetry are broken. The super-Higgs field belongs to the adjoint representation which breaks gauge symmetry taking a VEV of the order of the grand unification scale M_x. A suitable class of superpotentials is proposed. They show that the critical temperature of the phase transition is 10^{10} GeV. They get an approximate relation between M_x and the gravitino mass. (24 refs.)

105536 Lepton-number violation with quasi-Dirac neutrinos. J.W.F.Valle (Theory Div., Rutherford Appleton Lab., Chilton, Didcot, England), M.Singer.
Phys. Rev. D (USA), vol.28, no.3, p.540-5 (1 Aug. 1983).
The authors investigate lepton-number violation in weak interactions with massive Dirac neutrinos. In the framework of a simple $SU(3)_L \times U(1)$ electroweak model they find that neutrinos naturally acquire only Dirac masses at tree level, and for an odd number of lepton families, one neutrino remains massless. After a spontaneous breakdown of symmetry they find that the SU(2)×U(1) effective theory has lepton-number-violating currents which couple to the standard gauge bosons. Flavor-conserving $|\Delta l|=2$ processes such as neutrinoless double-β decay are forbidden in the simplest model, but processes such as $\mu^-+(A,Z)\to e^++(A,Z-2)$ and $K^-\to\pi^+e^-\mu^-$ are allowed. (20 refs.)

105537 Strangeness-changing processes and the limit on the right-handed gauge-boson mass. R.N.Mohapatra (Phys. Dept., City Coll. of New York, New York, NY, USA), G.Senjanovic, M.D.Tran.
Phys. Rev. D (USA), vol.28, no.3, p.546-57 (1 Aug. 1983).
The authors study strangeness-changing processes, in particular, the K_L-K_S mass difference and $K\to 2\pi$ decays, in the context of left-right-symmetric gauge theories in a search for a lower bound on a scale of parity-breaking M_R. They find that the previously claimed limit on M_R is a function of Higgs-boson masses and also the top-quark mass and its mixings to lighter quarks. For the light *t* quark ($M_t \leq 30$ GeV), we get $M_R > 200$ GeV (for $m_H \simeq 100$ GeV), and the bound goes down with the increasing *t*-quark mass. Even in the case of a very heavy neutral Higgs boson ($m_H \simeq 1$ TeV), the lower limit on M_R is only ~400 GeV. They argue that the best limits on M_R must come from neutral-current phenomena. (30 refs.)

105538 Dynamical generation of fermion mass differences within grand unified theories with a reduced mass-scale range of static symmetry. V.Elias (Dept. of Appl. Maths., Univ. of Western Ontario, London, Ontario, Canada), S.Rajpoot.
Phys. Rev. D (USA), vol.28, no.3, p.580-7 (1 Aug. 1983).
The authors examine coupling-constant evolution and the proposed dynamical generation of fermion mass differences within $[SU(5)]^3$ and $[SO(10)]^3$ unification symmetry, and they show that sensible fundamental-fermion mass ratios cannot devolve perturbatively within such models. They also demonstrate how weak-angle constraints equilibrate intermediate symmetry-breaking mass scales below the grand unified mass scale within such models. (20 refs.)

105539 Environmental effects on possible *n*-*n̄* transitions. G.Costa (Istituto di Fisica Galileo Galilei, Univ. di Padova, Padova, Italy), P.Kabir.
Phys. Rev. D (USA), vol.28, no.3, p.667-8 (1 Aug. 1983).
Possible transitions of free neutrons into antineutrons can be severely inhibited by external interactions which distinguish between them. The paper compares the effect of residual gas interactions with that of a magnetic field, and shows how they could counteract each other. (14 refs.)

105540 Conservation laws in the monopole-induced baryon-number-violating processes. A.Sen (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
Phys. Rev. D (USA), vol.28, no.4, p.876-81 (15 Aug. 1983).
Monopole-induced baryon-number-violating processes are analyzed using the conservation laws for the ordinary and the chiral charge densities. It is shown that in the strictly massless limit reactions of the form $u_1+M\to u_2{}^c+d_3{}^c+e^++M$ are ruled out by these conservation laws. This, however, does not mean that the baryon-number-violating processes are suppressed, since reactions of the type $u_1+u_2+M\to d_3{}^c+e^++M$ may take place even if the incoming u_1 and u_2 do not have any appreciable overlap in their wave functions. The role of the Adler-Bell-Jackiw anomaly in the baryon-number-violating processes is investigated. It is shown that the baryon-number violation takes place because of nontrivial boundary conditions at the monopole core, and is independent of the existence of the Adler-Bell-Jackiw anomaly. One may have chirality-conserving as well as chirality-nonconserving baryon-number-violating processes. It is also shown that the inclusion of extra Coulomb energies, e.g. weak or electromagnetic Coulomb energies, cannot qualitatively change the baryon-number-violating effects. (10 refs.)

105541 Vacuum alignment in the breaking of extended hypercolor interactions. J.Leon (Inst. de Estructura de la Materia, Consejo Superior de Investigaciones Cientificas, Madrid, Spain), M.Ramon-Medrano.
Phys. Rev. D (USA), vol.28, no.4, p.915-21 (15 Aug. 1983).
The authors analyze how the search for the true vacuum at the first breaking of an extended-hypercolor-interaction theory determines the physics at energies of the order of Λ_{HC}. The effects of vacuum alignment on the light-fermion spectrum—number of families, isospin violations in fermion mass matrices, along with pseudo-Goldstone-boson and gauge-meson spectra—are explicitly shown in a $SU^L(2)\times SU^C(3)\times U^Y(1)\times SU^{EHC}(8)\times O^{HC'}(6)$ model. (14 refs.)

Spontaneous creation of almost scale-free density perturbations in an inflationary universe .... See Entry 105201

Topological geometrodynamics .... See Entry 105457

Exact fermion-dyon scattering solutions .... See Entry 105485

Fermion-monopole system reexamined. II .... See Entry 105486

Chirality index and dimensional reduction of fermions .... See Entry 105494

Renormalization of the electroweak ρ-parameter from supersymmetric particles .... See Entry 105499

Quantum versus gravitational effects in supersymmetric theories .... See Entry 105500

Bounds on masses of Higgs boson and heavy fermions in a softly broken supersymmetric model .... See Entry 105516

A test of gauge nature of the W boson in the reaction $e^+e^-\to Z\gamma$ .... See Entry 105553

Gauge-invariant effective Lagrangians for Goldstone-like particles of supersymmetric technicolor models .... See Entry 105556

Possible origin of a natural conservation of flavor in an interaction with neutral Higgs bosons .... See Entry 105558

***B*-meson decays and *t*-quark mass** .... See Entry 105594

Flavour changing neutral processes in a composite model for quarks, leptons and technifermions .... See Entry 105598

Unified preon models based on simple gauge groups .... See Entry 105603

Low-mass right-handed gauge bosons, manifest left-right symmetry, and the K_L-K_s mass difference .... See Entry 105637

Neutrino magnetic moment in supersymmetry .... See Entry 105644

***W* magnetic moment in electroweak mixing and composite models and radiation zeros in $q_i\bar{q}_j\to W\gamma$** .... See Entry 105646

***W* weak multipole moments in electroweak mixing and composite models** .... See Entry 105647

SU(2)×U(1) effects in e^+e^- annihilation: generalized charge asymmetry .... See Entry 105659

Some new contributions to neutrinoless double-β decay in an SU(2)×U(1) model .... See Entry 105795

Problems with the new inflationary Universe .... See Entry 111288

On the possibility of a test of the cosmology of asymptotically free SU(5) theory .... See Entry 111289

12.20 MODELS OF ELECTROMAGNETIC INTERACTIONS

Catalysis of flavor nonconservation by monopoles .... See Entry 105504

Color confinement and asymptotic completeness .... See Entry 105560

12.20D Specific calculations and limits of quantum electrodynamics

105542 On perturbation theory at finite temperature. D.A.Dicus, D.Down (Center for Particle Theory, Univ. of Texas, Austin, TX, USA), E.W.Kolb.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.2, p.525-31 (22 Aug. 1983).
The authors show that the largest temperature-dependent contribution to the fermion self-energy of order α^2 in QED goes as $(\alpha^2T^4/p^2)\ln[(E+p)/(E-p)]$, where p is the 3-momentum and E is the energy, and they speculate on the form of higher-order terms in the perturbation expansion. (7 refs.)

105543 On mass and charge renormalization in QED. M.Berrondo, R.Jauregui (Inst. de Fisica, Univ. of Mexico, Mexico City, Mexico).
KINAM Rev. Fis. (Mexico), vol.5, no.2, p.163-71 (1983).
It is shown that quantum electrodynamics is a consistent theory, without ultraviolet or vacuum-vacuum singularities, when proper care is taken of operator contractions evaluated at coalescing points. (13 refs.)

105544 Finite charge and field renormalizations in reciprocally invariant quantum electrodynamics. E.Prugovecki (Dept. of Math., Univ. of Toronto, Toronto, Canada).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.14, p.501-4 (6 Aug. 1983).
Electrodynamics for extended quantum space-time spin-$^1/_2$ excitons corresponding to the ground state of Born's quantum metric operators (1949) contains only finite renormalization constants. Infinities emerge only in a sharp-point limit that formally represents the limiting case of pointlike excitons. (17 refs.)

105545 Quantum-electrodynamics without renormalization. I. Evaluation of the integrals. J.J.Lodder (FOM-Inst. voor Plasmafysica, Nieuwegein, Netherlands).
Physica A (Netherlands), vol.120A, no.1-2, p.1-29 (1983).
A new theory of generalised functions is applied to the evaluation of the integrals needed in quantum electrodynamics computations. (19 refs.)

105546 Quantum-electrodynamics without renormalization. II. Evaluation of lowest order diagrams. J.J.Lodder (FOM-Inst. voor Plasmafysica, Nieuwegein, Netherlands).
Physica A (Netherlands), vol.120A, no.1-2, p.30-42 (1983).
For pt.I see ibid., vol.120A, p.1-29 (1983). A classification of divergences is given. The Casimir effect is derived and the 'serious' divergences are investigated to second order. (6 refs.)

105547 Quantum-electrodynamics without renormalization. III. Vacuum polarization and the mass of the photon. J.J.Lodder (FOM-Inst. voor Plasmafysica, Nieuwegein, Netherlands).
Physica A (Netherlands), vol.120A, no.1-2, p.566-78 (1983).
For pt.II see ibid., vol.120, p.30-42 (1983). The vacuum-polarization tensor is calculated to second order. The fourth-order photon mass is calculated. The photon mass is shown to be determinate to all orders. Putting it equal to zero may fix the value of the fine-structure constant. (7 refs.)

105548 Quantum-electrodynamics without renormalization. IV. Comparison with renormalized quantum-electrodynamics. J.J.Lodder (FOM-Inst. voor Plasmafysica, Nieuwegein, Netherlands).
Physica A (Netherlands), vol.120A, no.1-2, p.579-86 (1983).
For pt.III see ibid., vol.120, p.566-78 (1983). The generalised function method is shown to be equivalent up to a finite renormalization with standard quantum-electrodynamics (QED). The result is a theory which is complete in a physical sense. A comparison with standard renormalisation theory is given. (16 refs.)

105549 On some exact solutions of the nonlinear equations of quantum electrodynamics. W.I.Fushchich, W.M.Shtelen (Math. Inst., Kiev, USSR).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.215-17 (25 Aug. 1983).
Some exact multiparametrical solutions of the nonlinear equations of quantum electrodynamics are obtained within the framework of the group-theoretical approach. The authors present formulae which generate new solutions from known ones. (17 refs.)

105550 Classical radiation zeros in gauge-theory amplitudes. R.W.Brown (Fermi Nat. Accelerator Lab., Batavia, IL, USA), K.L.Kowalski, S.J.Brodsky.
Phys. Rev. D (USA), vol.28, no.3, p.624-49 (1 Aug. 1983).
The electromagnetic radiation from classical convection currents in relativistic n-particle collisions is shown to vanish in certain kinematical zones, due to complete destructive interference of the classical radiation patterns of the incoming and outgoing charged lines. The authors prove that quantum tree photon amplitudes vanish in the same zones, at arbitrary photon momenta including spin, seagull, and internal-line currents, provided only that the electromagnetic couplings and any other derivative couplings are as prescribed by renormalisable local gauge theory (spins ≤ 1). In particular, the existence of this new class of amplitude zeros requires the familiar gyromagnetic-ratio value $g=2$ for all particles. The location of the zeros is spin independent, depending only on the charges and momenta of the external particles. Such null zones are the relativistic generalisation of the well-known absence of electric and magnetic dipole radiation for nonrelativistic collisions involving particles with the same charge-to-mass ratio and g factor. The origin of zeros in reactions such as $u\bar{d} \to W^+\gamma$ is thus explained and examples with more particles are discussed. Conditions for the null zones to lie in physical regions are established. A new radiation representation, with the zeros manifest and of practical utility independently of whether the null zones are in physical regions is derived for the complete single-photon amplitude in tree approximation, using a gauge-invariant vertex expansion stemming from new internal-radiation decomposition identities. The question of whether amplitudes with closed loops can vanish in null zones is addressed. A low-energy theorem for general quantum amplitudes (including closed loops) is found. Important relations between the photon couplings and Poincare transformations are discovered. The null zone and these relations are discussed in terms of the Bargmann-Michel-Telegdi equation. The extension from photons to general massless gauge bosons is carried out. (61 refs.)

105551 Development of quantum electrodynamics. A.I.Akhiezer.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1121-37 (Aug. 1983). In Russian.
The paper deals with a review of development of quantum electrodynamics as an organic unification of classical electrodynamics, special theory of relativity and quantum mechanics. The importance of the method of quantum electrodynamics construction for creating other field theories is emphasized. Concrete quantum electrodynamic effects in a high-energy region are considered. The relations of quantum electrodynamics with solid-state physics are outlined. The idea of mass and charge renormalization and the Landau and Pomeranchuk zero-charge problem are explained. The further development of the quantum field theory is discussed with the key idea of relation between symmetry and interactions assumed as a basis of the unified theory of electromagnetic and weak interactions and of quantum chromodynamics. (44 refs.)

105552 Dynamic origin of the electron mass in quantum electrodynamics. M.Sh.Pevzner.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1246-51 (Aug. 1983). In Russian.
An iteration procedure is suggested for solving a nonlinear equation for the electron propagator with a cut-off in the ladder approximation. It is shown that a conclusion on instability of a massless phase in quantum electrodynamics with a coupling constant above the critical value made earlier in consideration of the Bethe-Salpeter equation for the fermion-antifermion state remains in force when considering the nonlinear equation for the electron propagator too. (19 refs.)

An electrostatic example to illustrate dimensional regularization and renormalization group technique .... See Entry 105064

Electromagnetism non-integrable phases and fibre bundles .....See Entry 105194

Finite quantum field theory and neutrinodynamics .... See Entry 105458

Role of the production of a pseudoscalar meson with an e^+e^--pair in e^+e^- collisions. ....See Entry 105609

Approximation solutions of the equations of motion of a charged particle in the field of a magnetic dipole ....See Entry 110813

12.20F Experimental tests of quantum electrodynamics

Spectroscopy of superheavy quasimolecules and quasiatoms ...See Entry 105933

12.30 MODELS OF WEAK INTERACTIONS

105553 A test of gauge nature of the W boson in the reaction $e^+e^- \to Z\gamma$. K.-i.Hikasa (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.253-6 (25 Aug. 1983).
Proposes a new method to measure the magnetic moment parameter κ of the charged intermediate weak boson. T-odd asymmetries in the angular distribution of the secondary lepton in the process $e^+e^- \to Z\gamma, Z \to l\bar{l}$ are very sensitive to κ. The asymmetries are calculated in the lowest order from the absorptive part of one-loop diagrams. (12 refs.)

105554 Weak interactions in the region of the Fermi scale. R.Barbieri (Istituto di Fisica, Univ. di Pisa, Pisa, Italy).
Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.518-24
The author discusses weak interactions in the region of the Fermi scale, with particular reference to supersymmetry breaking and gaugino mass. (no refs.)

Renormalization of the electroweak ρ-parameter from supersymmetric particles ....See Entry 105499

The possibility of new fermions with $\Delta I=0$ mass ....See Entry 105527

Possible origin of a natural conservation of flavor in an interaction with neutral Higgs bosons ....See Entry 105558

Coherent π^0 production in neutrino reactions ....See Entry 105614

Search for right-handed currents in muon decay .... See Entry 105631

Gluon bremsstrahlung in charged lepton-nucleon collisions. II. Gluon linear polarization ....See Entry 105652

12.35 COMPOSITE MODELS OF PARTICLES

Fractional angular momentum, fractional charge, and oscillators ....See Entry 105141

W magnetic moment in electroweak mixing and composite models and radiation zeros in $q_i\bar{q}_j \to W\gamma$ ....See Entry 105646

W weak multipole moments in electroweak mixing and composite models ....See Entry 105647

Soft quark annihilation versus bremsstrahlung mechanisms of dilepton production in e^+e^- collisions ....See Entry 105658

The deuteron asymptotic D-state as a probe of the nucleon-nucleon force ....See Entry 105749

Target nucleus excitation dependence of correlation in the multiple production on nuclei at 400 GeV and the additive quark model ....See Entry 105847

12.35C General properties of quantum chromodynamics (dynamics, confinement, etc.)

105555 Anomalous dimensional quark counting of hard processes in QCD. I.S.Avaliani, V.A.Matveev, L.A.Slepchenko (Joint Inst. for Nuclear Res., Dubna, USSR).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.1, p.81-103 (15 Aug. 1983).
An approach to the investigation of hard jet and single-particle production asymptotics in hadron collisions is proposed. In the leading order of QCD perturbation theory, the anomalous dimension quark counting (ADQC) rules are derived, which determine the logarithmic corrections to the point-like power asymptotics in terms of anomalous dimensions of the non-singlet and singlet quark and gluon operators. It is argued that taking the quark distribution and fragmentation functions up to the two-loop order does not destroy universality of the proposed ADQC rules. A parameter-free solution for the effective power exponents in a wide class of hard processes is obtained. (26 refs.)

105556 Gauge-invariant effective Lagrangians for Goldstone-like particles of supersymmetric technicolor models. A.J.Buras, W.Slominski (Max-Planck-Inst. fur Phys. & Astrophys., Werner-Heisenberg-Inst. fur Phys., Munich, Germany).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.1, p.157-82 (15 Aug. 1983).
The authors point out that generally the low-energy spectrum in supersymmetric technicolor models contains quasi-Goldstone fermions and quasi-Goldstone bosons in addition to the usual (pseudo)-Goldstone bosons. Using the language of Kahler geometry, they present a step-by-step procedure for constructing gauge-invariant non-linear Lagrangians involving the fermionic and bosonic Goldstone particles in situations in which the supersymmetry is preserved. Both the cases of fully gauged and partially gauged global symmetries are considered. They discuss the dynamical version of the super-Higgs mechanism and illustrate it with the supersymmetric Susskind-Weinberg technicolor model. (38 refs.)

105557 Factorization for one-loop corrections in the Drell-Yan process. J.C.Collins (Dept. of Phys., Illinois Inst. of Technol., Chicago, IL, USA), D.E.Soper, G.Sterman.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.2, p.381-421 (22 Aug. 1983).
The authors study all the one-loop corrections to the Drell-Yan process in QCD, including gluon exchanges involving spectator partons. The method demonstrates weak factorization at measured dimuon Q^T, and is suitable for generalization to higher orders. (15 refs.)

105558 Possible origin of a natural conservation of flavor in an interaction with neutral Higgs bosons. N.G.Ural'tsev (B.P. Konstantinov Inst. of Nuclear Phys., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.6, p.333-7 (20 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.6, p.281-4 (20 March 1983). [received: Sept. 1983]
In technicolor models the masses of the neutral pseudo-Goldstone bosons which interact with quarks and leptons without flavor conservation automatically acquire an order of magnitude $M \sim (m_q\Lambda_{TC})^{1/2} \sim 0.2\text{-}1$ TeV through the Yukawa interaction. As a result, an effective Lagrangian which conserves only light Higgs bosons satisfies the condition of natural flavor conservation. (4 refs.)

105559 Dependence of low-lying energy eigenvalues on the short- and long-range parts of confining potentials. J.Pasupathy (Centre for Theoretical Studies, Indian Inst. of Sci., Bangalore, India), M.Seetharaman.
J. Phys. G (GB), vol.9, no.9, p.1001-8 (Sept. 1983).
The potential description of a quark-antiquark system seems to work very well in describing a number of hadronic properties. However, the precise form of the potential is unknown. The changes in the low-lying eigenvalues as a result of changes in the long-range part of the potential are investigated in a non-perturbative manner. It is shown by considering a variety of examples that the low-lying eigenvalues are insensitive to the long-range part of the potential. (25 refs.)

105560 Color confinement and asymptotic completeness. T.Suzuki (Dept. of Phys., Kanazawa Univ., Kanazawa, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1827-30 (June 1983).
Studies color-confinement criteria and the quartet mechanism proposed by Kugo and Ojima (1979). Adopting a special gauge, the author finds that the criteria are not always satisfied in 3+1 dimensional QCD. Neither the criteria nor the quartet mechanism works in compact $(QED)_{2+1}$ and abelian

confinement models. Asymptotic completeness and confinement might be incompatible. (9 refs.)

105561 Lattice QCD with light quark masses: does chiral symmetry get broken spontaneously?. I.M.Barbour (Dept. of Natural Philosophy, Univ. of Glasgow, Glasgow, Scotland), J.P.Gilchrist, H.Schneider, G.Schierholz, M.Teper.
Phys. Lett. B (Netherlands), vol.127B, no.6, p.433-9 (11 Aug. 1983).
The authors present a first direct calculation of the properties of QCD for the small quark masses of phenomenological interest without extrapolations. They describe methods specially adapted to invert the fermion matrix at small quark masses. They use these methods to calculate $\langle\bar\psi\psi\rangle$ directly on presently used lattice sizes with different boundary conditions. As is to be expected for a finite system, they do not observe spontaneous chiral symmetry breaking. By comparing the results obtained on lattices of different size, one sees, however, indications that are consistent with eventual spontaneous chiral symmetry breaking in the infinite volume limit. The calculations underline the importance of using antiperiodic boundary conditions for fermions. (17 refs.)

105562 Quark vacuum rearrangement in the strong gluonic field. N.O.Agasyan (Moscow Engng. Phys., Moscow, USSR), D.N.Voskresensky.
Phys. Lett. B (Netherlands), vol.127B, no.6, p.448-52 (11 Aug. 1983).
It is shown that quark-antiquark vacuum rearrangement occurs in a strong gluonic field. The contribution of this to the lagrangian for the case of a strong gluoelectric field A^3 and in the presence of strong gluomagnetic fields $A_n{}^{\pm}$ is determined. Quark condensation changes the colour charge distribution significantly. (17 refs.)

105563 Quantum chromodynamics on a simplicial lattice. R.W.B.Ardill, J.-P.Clarke (Dept. of Math., Royal Holloway Coll., Englefield Green, England), J.-M.Drouffe, K.J.M.Moriarty.
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.203-6 (25 Aug. 1983).
Monte Carlo simulations on a 6^4 simplicial lattice are used to calculate Wilson loops, and hence the string tension, for pure SU(3) gauge theory. The asymptotic freedom scale parameter Λ is measured for both triangles and squares and universality is established. (10 refs.)

105564 Gauge invariant values of gluon masses at high temperature. T.Furusawa, K.Kikkawa (Dept. of Phys., Osaka Univ., Toyonaka, Japan).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.218-20 (25 Aug. 1983).
Both electric and magnetic gluon masses in the high temperature QCD plasma are evaluated up to of order $g^{3/2}$. Gauge covariance is always kept in each step of calculations by taking account of the Ward-Takahashi identity. The magnetic mass is shown to vanish up to $O(g^{3/2}T)$. (10 refs.)

105565 Effective QCD-lagrangian with ξ-function regularisation. W.Dittrich (Inst. for Advanced Study, Princeton, NJ, USA), M.Reuter.
Phys. Lett. B (Netherlands), vol.128B, no.5, p.321-6 (1 Sept. 1983).
The authors show how to construct the effective lagrangian in QCD employing Hawking's ξ-function method (1977). The various loops are attached to all orders to the external covariant constant colormagnetic background field. The construction of the effective potential is far less difficult than the various computations found so far in the literature, e.g. via proper-time or dimensional regularisation methods. (12 refs.)

105566 Cavity quantum chromodynamics. T.H.Hansson, R.L.Jaffe (Dept. of Phys., MIT, Cambridge, MA, USA).
Phys. Rev. D (USA), vol.28, no.4, p.882-907 (15 Aug. 1983).
The authors develop practical and rigorous techniques for calculating and renormalizing loop diagrams in quantum chromodynamics defined in static spherical cavity. Working with Feynman propagators and in the Feynman gauge, they use multiple-reflection expansions for the cavity propagators to isolate and analyze the short-distance singularities in graphs. Nonsingular contributions to graphs are evaluated using a set of 'Feynman rules' in an energy-angular-momentum representation. As an application they describe the calculation of the quark self-energy to lowest order in α_s. They show that the self-energy of a confined massless quark is finite and unambiguous, and that all divergences in the case of a massive quark can be absorbed into a state-independent mass renormalization just as in free space. (18 refs.)

105567 Properties of a classical confining medium in SU_2 gluon dynamics. J.P.Ralston, D.Sivers (High Energy Phys. Div., Argonne Nat. Lab., Argonne, IL, USA).
Phys. Rev. D (USA), vol.28, no.4, p.953-64 (15 Aug. 1983).
The authors examine the properties of a classical nonAbelian system which can be interpreted as the ground state of an extended polarizable medium in Euclidean space. The medium is characterized by the value of two scalar order parameters, $G_{\mu\nu}{}^{a}{}^{*}G_{\mu\nu}{}^{a}=0$ and ${}^{1}/{}_{4}G_{\mu\nu}{}^{a}G_{\mu\nu}{}^{a}=3\sigma^2/g^2$. Starting from the assumption of time independence and spherical symmetry, they are able to find solutions to the classical field equations obeying these constraints and give simple analytic expressions for the vector potential, field-strength tensor, and polarization current in various gauges. They discuss gauge invariants formed from the fields and show that the classical analogs of Wilson loops display an area-law behavior. (22 refs.)

105568 Quantum chromodynamics for static sources in the $A^0=0$ gauge and Schrodinger representation—quantum fluctuations about the classical limit. P.Hoodbhoy (Dept. of Phys., Univ. of Washington, Seattle, WA, USA).
Phys. Rev. D (USA), vol.28, no.4, p.965-72 (15 Aug. 1983).
Quantum chromodynamics for static c-number sources is studied nonperturbatively using the canonical formalism with $A^0=0$. Solutions to the functional differential homogeneous Gauss-law equation are found and the issue of Gauss-law constraints on the state vector is approached by transforming to a set of curvilinear gauge-invariant coordinates. When $\hbar$ is small, but finite, collective oscillations of the gluon field about a mean field are found. An illustrative example of a single color charge source is considered. (18 refs.)

105569 Canonical formalism for the relativistic harmonic oscillator. C.Dullemond, E.van Beveren (Inst. for Theoretical Phys., Univ. of Nijmegen, Nijmegen, Netherlands).
Phys. Rev. D (USA), vol.28, no.4, p.1028-32 (15 Aug. 1983).
A Hamiltonian and its associated Lagrangian are presented for classical relativistic point particles which carry out harmonic oscillations inside a spherical cavity of well-defined radius. It is shown that the particles follow geodesics in an alternative metric. The relevance of the model for the description of hadrons is discussed. Electromagnetism can be introduced in the usual way. (4 refs.)

Topological geometrodynamics .... See Entry 105457

Implications of the non-uniqueness in the solution of the gauge identities for the Schwinger-Dyson equation .... See Entry 105461

U(∞) lattice gauge theory as a free lattice string theory ...... See Entry 105481

Strong-coupling expansion for off-axis glueball masses in lattice gauge theories .... See Entry 105483

An investigation of the infrared behaviour of the gluon propagator in the axial gauge .... See Entry 105492

A supersymmetric variant of Dashen's formula .... See Entry 105511

Vacuum alignment in the breaking of extended hypercolor interactions .... See Entry 105541

Quark-antiquark potential and Q^2 duality .... See Entry 105578

Quark bags and the NN interaction .... See Entry 105588

Baryon spectroscopy .... See Entry 105595

$1/N_{\mathrm{subcolour}}$ and quark-lepton mass hierarchies .... See Entry 105600

Multiplicities of secondary hadrons produced in νp and $\bar\nu$p charged current interactions .... See Entry 105615

Inclusive meson resonance production in K^+p interactions at 70 GeV/c .... See Entry 105680

Infrared properties of two-loop, initial state spectator interactions in the Drell-Yan process .... See Entry 105681

12.35E Applications of quantum chromodynamics to particle properties and reactions

105570 Glueballs in the bag models. M.Jezabek (Inst. of Nuclear Phys., Cracow, Poland), J.Szwed.
Acta Phys. Pol. B (Poland), vol.B14, no.8, p.599-607 (Aug. 1983).
The influence of the bag shape on the lowest lying gluonium states is investigated. The MIT and the surface tension version of the bag model are considered. (10 refs.)

105571 Apparent spin-dependent forces in QCD or the quantum chemistry of hadrons. R.Brout (Faculte des Sci., Univ. Libre de Bruxelles, Bruxelles, Belgium).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.1, p.104-8 (15 Aug. 1983).
Mesons in QCD are viewed as q$\bar{\mathrm{q}}$ pairs at the ends of a string (electric flux line). The $(\mathrm{mass})^2$ spectrum is approximately linear in the number of nodes, ν, in the wave function $\psi(x)$, x being the fraction of total momentum carried by one quark. For the equal mass case ψ is even (odd) under reflection $x \rightleftharpoons (1-x)$ for ν even (odd). Thus this reflection symmetry is to be interpreted as charge conjugation where $C=+1$ (-1) respectively, and hence by Fermi statistics, singlets (triplets) in spin. Since the spectrum of $(\mathrm{mass})^2$ is evenly spaced in ν, one can represent the even and odd states by two Regge trajectories separated by intercept ${}^{1}/{}_{2}$, thereby explaining the famous ${}^{1}/{}_{2}$ intercept difference for the π, ρ system. The argument generalizes to K, K* as well, but must be further analyzed before it is generalized to baryons. (6 refs.)

105572 On the modification of the estimated masses of the crypto-exotics. P.Mukhopadhyay (Phys. Dept., Jadavpur Univ., Calcutta, India).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.17, p.600-4 (27 Aug. 1983).
The author estimates the masses of crypto-exotic mesons by taking into consideration the pairing effect on the binding energies. (9 refs.)

105573 Baryons as chiral solitons. A.D.Jackson, M.Rho (Dept. of Phys., State Univ. of New York, Stony Brook, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.9, p.751-4 (29 Aug. 1983).
Topologically stable solutions to Skyrme's chiral-invariant Lagrangian have been obtained numerically. The single parameter in these solutions has been determined with the Goldberger-Treiman relation. The identification of these objects with baryons leads to sensible statements regarding the sizes and energies of baryons as well as the two- and three-body interactions between baryons at zero separation. (12 refs.)

105574 Gluonic nucleons in a valon bag model. I.Duck, E.Umland (Phys. Dept., Rice Univ., Houston, TX, USA).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.221-4 (25 Aug. 1983).
Two isomers of the nucleon, consisting of three 1S quarks and a transverse electric gluon, are predicted by the bag model to exist at masses around 1600 MeV. Mixing of these states with the nucleons seems unacceptably large. With this motivation the authors reformulate the problem in terms of valons—dressed quark and gluon single-particle eigenstates of (part of) the QCD bag hamiltonian. Now composed of valons, the nucleon and gluonic nucleons are decoupled, thereby retaining previous descriptions of the nucleon. One isomer should be visible in πN elastic scattering and might be the N*(1710). (16 refs.)

105575 Hadron and jet production at collider energies in perturbative QCD. N.G.Antoniou, E.N.Argyres (Nuclear Res. Centre Democritos, Aghia Paraskevi, Attiki, Greece), A.P.Contogouris, S.D.P.Vlassopulos.
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.257-61 (25 Aug. 1983).
Large p_T production of hadrons and jets at collider and ISR energies is studied in conventional perturbative QCD. Recently determined gluon and other parton distributions are used and higher order $[O(\alpha_s{}^3)]$ perturbative corrections (K-factors) are taken into account. Good description of the data is found. The possible role of gluinos and other particles of supersymmetric theories is briefly discussed. (26 refs.)

105576 Exotic mesons from QCD sum rules. J.Govaerts, F.de Viron, D.Gusbin, J.Weyers (Inst. de Phys. Theorique, Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.262-8 (25 Aug. 1983).
A simple method is presented to compute the Wilson expansion coefficients for T-products in QCD with light quarks. Using this method in the framework of QCD sum rules the authors predict the masses of quark-antiquark-gluon states with $J^{PC}=1^{-+}$, 0^{++}, 1^{+-} and 0^{--}. (10 refs.)

105577 Meson exchanges in the harmonic-oscillator quark model. M.Bozoian, H.J.Weber (Dept. of Phys., Univ. of Virginia, Charlottesville, VA, USA).
Phys. Rev. C (USA), vol.28, no.2, p.811-17 (Aug. 1983).
Meson exchanges are introduced into the harmonic oscillator quark model along with a lower quark wave function. The mechanism is based on quark correlations that derive from quark exchange scattering via gluon exchange at short distances. This method allows avoiding spurious van der Waals forces at long range. Meson-baryon coupling constants and vertex form factors are calculated. They are found to be in agreement with those obtained from other quark models, phenomenological potentials, and the broken SU(3) flavor symmetry. The resulting S-wave NN phase shifts are compared with those from quark-molecular models. (27 refs.)

105578 Quark-antiquark potential and Q^2 duality. K.Igi, K.Hikasa (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
Phys. Rev. D (USA), vol.28, no.3, p.565-71 (1 Aug. 1983).
A detailed study is made of Q^2 duality for the bb system and the hypothetical heavy tt system using several potentials which include the perturbative QCD results for short distances. It turns out that the QCD corrections are essential in order that the sum rule holds. The Coulomb-type correction should not be neglected, and the gluonic correction to the leptonic width is also important. (31 refs.)

105579 New procedure for the estimation of the extended-hypercolor boson masses. J.Pulido (CERN, Geneva, Switzerland).
Phys. Rev. D (USA), vol.28, no.3, p.572-9 (1 Aug. 1983).
It is found that the natural suppression of flavor-changing neutral currents and *CP*-violating processes which occur in theories with elementary scalars cannot occur in extended-hypercolor (EHC) theories, thereby confirming the serious flaw encountered with these theories. The procedure is based on the calculation of the EHC gauge-boson masses using Feynman rules in the mass-feed-down mechanism and renders these masses independent of a loop cutoff in the expected mass range. (18 refs.)

105580 The Shifman-Vainshtein-Zakharov method: why it works, why it fails, and ways to improve it. L.Durand (Theory Group, Fermi Nat. Accelerator Lab., Batavia, IL, USA), B.Durand, B.Whitenton.
Phys. Rev. D (USA), vol.28, no.3, p.607-23 (1 Aug. 1983).
Shifman, Vainshtein, and Zakharov (SVZ) have proposed a procedure for calculating hadronic masses and determining nonperturbative parameters in QCD using the operator-product expansion for two-point functions and (exponential) moments of the corresponding spectral functions. In the paper the authors present a detailed theoretical analysis of the SVZ procedure in the context of nonrelativistic potential theory. They find that the phenomenological success of the usual first-order SVZ method in relating hadronic energies (masses) is due to a hidden variational principle and a semiclassical structure which gives correct JWKB-type relations between energies. The first-order method fails theoretically: it does not reproduce the correct potential-model or field-theoretic parameters, e.g. the gluon-condensate parameter of QCD. They show why it breaks down in this application, and that its reliability can be greatly improved in all applications by using higher-order approximations for the moment function. Their results are directly relevant for the SVZ analysis of charmonium and *b*-quarkonium. The general conclusions should also hold for light-quark systems. (37 refs.)

105581 Photino and gluino production from quarkonium decay. Wai-Yee Keung (Phys. Dept., Brookhaven Nat. Lab., Upton, NY, USA).
Phys. Rev. D (USA), vol.28, no.5, p.1129-31 (1 Sept. 1983).
The branching ratios of $\Gamma(V\to g\tilde{g}\tilde{g})/\Gamma(V\to 3g)$ and $\Gamma(V\to g\tilde{g}\tilde{\Gamma})/\gamma(V\to gg\gamma)$ could be larger than 10% for the scalar-quark mass less than 1.3 times the mass of the quark in the quarkonium V. The signature of these events would be the large momentum imbalance, especially for the case of the photino production. (7 refs.)

Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings .... See Entry 105026

Baryon spectroscopy .... See Entry 105595

Unified preon models based on simple gauge groups .... See Entry 105603

Positivity constraints for the nonperturbative QCD parameters in e^+e^- annihilation .... See Entry 105613

Vector-meson decays in the SLAC lattice quantum-chromodynamic theory .... See Entry 105627

D^+-D^0 mass difference .... See Entry 105636

Quantum-chromodynamic corrections to meson-photon transition form factors .... See Entry 105642

On the spoiling of radiation zeros at the one-loop level and infrared finiteness .... See Entry 105648

Radiative corrections to the helicity asymmetries for the Drell-Yan process in QCD .... See Entry 105649

Photoproduction of hermaphrodite baryons .... See Entry 105655

Soft gluon component of diphoton and dilepton transverse momentum .... See Entry 105687

Energetic hadron jets at TeV energies .... See Entry 105689

$\phi\phi$ production in high-energy hadron-hadron collisions and enhancement near threshold .... See Entry 105690

QCD and $p\bar{p}$ collider physics .... See Entry 105700

Production of transverse energy (E_T) in hadron collisions .... See Entry 105702

QCD radiation and the multiplicity distribution at the collider .... See Entry 105703

Hadronic jets .... See Entry 105704

Reduced nuclear amplitudes in quantum chromodynamics .... See Entry 105804

12.35H Phenomenological composite models of particle structure and reactions (partons, bags, etc.)

105582 Elementary particle states based on the Clifford algebra C_7. S.A.Basri (Dept. of Phys., Colorado State Univ., Fort Collins, CO, USA), A.O.Barut.
Int. J. Theor. Phys. (USA), vol.22, no.8, p.691-722 (Aug. 1983).
The lepton isodoublet (e^-,ν_e), the 'bare' nucleon isodoublet (n,p), and their antiparticles are shown to constitute a basis of the irreducible representation of the Clifford algebra C_7. The excited states of these doublets, i.e. (μ^-,ν_μ), (τ^-,ν_τ), ..., and (s^0,c^+), (b^0,t^+) are generated by the products $(e^-,\nu_e)\otimes a$ and $(n,p)\otimes a$, where $a\equiv 2^{-1/2}(e^-e^+ + \nu_e\bar{\nu}_e)$ has the same quantum numbers as the photon state. The bare baryons s, c, b, t carry the strangeness, charm, bottom, and top quantum numbers. These lepton and bare baryon states are in one-to-one correspondence with the integrally charged colored Han-Nambu quarks, and generate all the observed $su(3)$ and $su(4)$ hadron multiplets. (25 refs.)

105583 Topological soliton bag model for baryons. M.Rho, A.S.Goldhaber, G.E.Brown (Inst. for Theoretical Phys., State Univ. of New York, Stony Brook, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.9, p.747-50 (29 Aug. 1983).
Furnishing Skyrme's chiral soliton with a quark-bag core appears to generate a qualitative advance in the phenomenology of nucleon structure. (23 refs.)

105584 Quark and gluon latent heats at the deconfinement phase transition in SU(3) gauge theory. J.Kogut, H.Matsuoka, M.Stone, H.W.Wyld (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA), S.Shenker, J.Shigemitsu, D.K.Sinclair.
Phys. Rev. Lett. (USA), vol.51, no.10, p.869-72 (5 Sept. 1983).
The authors have run computer simulations of the quark and gluon internal energies in SU(3) lattice gauge theory neglecting dynamical fermion loops. At the first-order deconfinement-chiral symmetry restoration transition the internal energies display large discontinuities. With finite-size effects estimated by a procedure suggested by the Bielefeld group, the total latent heat per unit volume is found to be roughly 1.50 ± 0.50 GeV/fm^3, if the transition temperature is 190 ± 20 MeV. Timing estimates for fermion computer simulation methods are presented. (12 refs.)

105585 Meson radiation from a quark-gluon plasma by fission of chromoelectric flux tubes. B.Banerjee, N.K.Glendenning, T.Matsui (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Phys. Lett. B (Netherlands), vol.127B, no.6, p.5453-7 (11 Aug. 1983).
The chromoelectric flux tube model is used to obtain a dynamical description of the evaporation of mesons from a quark-gluon plasma. The radiation pressure is computed to assess whether this process is an important mode for the disassembly of a compressed plasma. A new result for the rate of $q\bar{q}$ pair creation, which is the mechanical for fission of the tube, is employed. (9 refs.)

105586 Confined quarks and the Weinberg sum rules. P.Cea, P.Colangelo, G.Nardulli, G.Paiano, G.Preparata (Dipartimento di Fisica, Univ. di Bari, Bari, Italy).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.225-8 (25 Aug. 1983).
Two point-spectral functions for confined quarks are calculated and canonical results for the Weinberg sum rules are recovered. (19 refs.)

105587 Search for supersymmetry in toponium decays. J.Ellis (Stanford Linear Accelerator Centre, Stanford Univ., Stanford, CA, USA), S.Rudaz.
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.248-52 (25 Aug. 1983).
Although cosmology and unification suggest that the mass of the gluino is larger than about 14 GeV, in many theories of broken supersymmetry the photino $\tilde{\gamma}$, gluino $\tilde{g}$ and one of the spin-zero partners $\tilde{t}$ of the t quark can be lighter than m_t. The authors calculate the decay rates for toponium$\to\tilde{g}\tilde{g}$, $\tilde{\gamma}\tilde{\gamma}$ and tt and show that in many models they can be as large as, or larger than, the rate for toponium$\to e^+e^-$ decay. If it is kinematically accessible, the decay $t\to\tilde{t}+\tilde{\gamma}$ dominates the decays of toponium as well as those of naked top states. (11 refs.)

105588 Quark bags and the NN interaction. P.J.Mulders (Lab. for Nuclear Sci., MIT, Cambridge, MA, USA).
Phys. Rev. D (USA), vol.28, no.3, p.443-9 (1 Aug. 1983).
The NN phase shifts can be nicely parametrized with a P matrix with matching radius $b\approx6.0$ GeV$^{-1}\approx1.2$ fm. For the interaction outside this radius a one-pion-exchange potential is used. For the $(I,J^P)=(0,1^+)$ six-quark system a detailed analysis of the P-matrix pole is made. The pole position and the bag-model prediction are in reasonably good agreement. The residue to the NN channel, however, is a factor of 5 larger than the bag prediction. A possible explanation is that in a six-quark bag there are strong color-singlet correlations. This is demonstrated in a simple model. (21 refs.)

105589 Can $\iota(1440)$, $\theta(1640)$, $\delta(980)$, and S*(980) be accommodated in the quarkonium model?. S.Ono (Inst. fur Theoretische Phys., Rheinisch-Westfallschen Tech. Hochschule Aachen, Aachen, Germany).
Phys. Rev. D (USA), vol.28, no.3, p.558-64 (1 Aug. 1983).
The author shows that a potential model with the Breit-Fermi Hamiltonian gives an excellent description for quarkonium systems as in the Isgur-Karl model for baryons. The author concludes that $\iota(1440)$, $\delta(980)$, and $S^*(980)$ can be quarkonium states but $\theta(1640)$ is not a pure $q\bar{q}$ state. (27 refs.)

105590 Bethe-Salpeter basis for quark-pair-creation model: understanding of *VPP*, *VP*γ, and *P*$\gamma\gamma$ couplings. D.Kulshreshtha, A.N.Mitra (Dept. of Phys., Univ. of Delhi, Delhi, India).
Phys. Rev. D (USA), vol.28, no.3, p.588-96 (1 Aug. 1983).
A Bethe-Salpeter harmonic-oscillator framework developed recently for $q\bar{q}$ mesons in the instantaneous (null-plane) approximation, is employed for the construction of MMM couplings ($M=P$ or V) through quark-loop diagrams. The resulting structure of the matrix elements exhibits the central feature of the quark-pair-creation model, that is, a multiplicative structure for the orbital and spin wave functions of all three $q\bar{q}$ states involved, together with a couple of essential kinematical factors (but only in the numerator) as part of the field-theoretic result. The model is illustrated through two typical meson couplings involving equal-mass quarks, $\rho\to\pi\pi$ and $\omega\to\rho\pi$, as well as through the two electromagnetic processes $\omega\to\gamma\pi^0$ and $\pi^0\to\gamma\gamma$. The $\rho\to\pi\pi$ and $\omega\to\gamma\pi^0$ widths (via direct γ coupling) come out as 142.7 MeV and 888 keV, respectively, with no adjustable parameters. The $\omega\to\gamma\pi^0$ matrix element also agrees to within 1%, with that obtained from the corresponding $\omega\rho\pi$ coupling through vector-meson-dominance (VMD) substitution. The $\pi^0\to\gamma\gamma$ width (7.7 eV) agrees excellently with experiment when it is deduced from $\omega\rho\pi$ coupling via double VMD substitution, but the corresponding amplitude obtained from direct γ coupling is only about half the experimental value. Theoretical reasons are given for this apparent paradox. (33 refs.)

105591 Short-time perturbation theory and nonrelativistic duality. J.B.Whitenton, B.Durand (Phys. Dept., Univ. of Wisconsin, Madison, WI, USA), L.Durand.
Phys. Rev. D (USA), vol.28, no.3, p.597-606 (1 Aug. 1983).
The authors give a simple proof of the nonrelativistic duality relation $\langle W^2\sigma_{\mathrm{bound}}\rangle\approx\langle W^2\sigma_{\mathrm{free}}\rangle$ for appropriate energy averages of the cross sections for $e^+e^-\to$($q\bar{q}$ bound states) and $e^+e^-\to$(free $q\bar{q}$ pair), and calculate the corrections to the relation by relating $W^2\sigma$ to the Fourier transform of the Feynman propagation function and developing a short-time perturbation series for that function. They illustrate their results in detail for simple power-law potentials and potentials which involve combinations of powers. (26 refs.)

105592 How to test the quark-line rule by production of neutral mesons in proton-antiproton annihilation. H.Genz (Inst. fur Theoretische Kernphys., Univ. Karlsruhe, Karlsruhe, Germany).
Phys. Rev. D (USA), vol.28, no.5, p.1094-100 (1 Sept. 1983).
Production of several neutral mesons in reactions involving u, d, $\bar{u}$, and $\bar{d}$ quarks only can be used to test the quark-line rule for a given hadronic system. Recent data on $p\bar{p}\to$(two neutral pseudoscalars) are analyzed yielding restrictions on the pseudoscalar mixing angle θ_{PS} in agreement with theoretical estimates. It is emphasized that production of neutral mesons at LEAR can provide meaningful tests of the quark-line rule and theoretical predictions of θ_{PS}. (15 refs.)

105593 Relativistic corrections in quarkonium. P.Moxhay (School of Phys. & Astron., Univ. of Minnesota, Minneapolis, MN, USA), J.L.Rosner.
Phys. Rev. D (USA), vol.28, no.5, p.1132-7 (1 Sept. 1983).
Relativistic corrections to quarkonium energy levels and electric dipole transition rates are calculated. The author finds a consistent description with both electric confinement and tensor quark-antiquark forces at distances beyond that at which perturbative QCD should be valid. The preliminary masses of the χ_b and χ_b' levels are described satisfactorily. The transitions $\Upsilon''\to\gamma\chi_b$, suppressed in some nonrelativistic models, are predicted to be observed here. (28 refs.)

105594 *B*-meson decays and *t*-quark mass. G.L.Fogli (Istituto di Fisica, Univ. di Bari, Bari, Italy).
Phys. Rev. D (USA), vol.28, no.5, p.1153-65 (1 Sept. 1983).
On the basis of a recent left-right-symmetric model of electroweak interactions, in which natural flavor conservation is ensured and *CP* is spontaneously violated, an approach to generalized Cabibbo mixing in a six-quark picture is worked out. The specific form of the mixing-matrix elements in terms of the quark masses is derived and a consistent comparison with the present phe-

nomenological knowledge of quark mixing is performed. In particular *B*-meson decays are reviewed, by including nonspectator effects coming from annihilation and gluon-emission processes, with a careful treatment of the phase-space factors: the emerging picture on the one hand allows severely constraining the *t*-quark mass, and on the other hand leads to specific predictions about future measurements of the decay parameters. (39 refs.)

105595 Baryon spectroscopy. A.J.G.Hey (California Inst. of Technol., Pasadena, CA, USA), R.L.Kelly.
Phys. Rep. (Netherlands), vol.96, no.2-3, p.71-204 (June 1983).
The subject of baryon spectroscopy is reviewed in some detail, from the viewpoints of theory and of the experimental data. In the theoretical section, the status of both pre- and post-QCD quark models is discussed. A brief account of methods of theoretical analysis is included in the section on baryon resonance experiments. (408 refs.)

105596 New flavours: experiment versus theory. From charm to the 4th family. M.Basile (CERN, Geneva, Switzerland), J.Berbiers, G.Bonvicini, G.Cara Romeo, L.Cifarelli, A.Contin, M.Curatolo, G.D'Ali, C.Del Papa, B.Esposito, P.Giusti, T.Massam, R.Nania, G.Natale, F.Palmonari, G.Sartorelli, M.Spinetti, G.Susinno, L.Votano, A.Zichichi.
Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.435-77
A new method of searching for heavy flavours 'up-like' and 'down-like' in hadronic interactions at the CERN $p\bar{p}$ Collider is proposed. The method is based on the measurement of the $e^{\pm}$ asymmetry in the proton and antiproton hemispheres. The amplitude of the asymmetry depends on the 'leading' production of baryons and antibaryons—the sign on the 'up-like' or 'down-like' nature of the heavy flavour carried by the baryonic states. A detailed study of cross-section estimates, production and decay distributions, and detection acceptances, shows that the effect looks measurable at the CERN $p\bar{p}$ Collider. (16 refs.)

105597 'Reasonable' expectations for hadroproduction at collider energies. G.Preparata (Dipartimento di Fisica, Univ. di Bari, Bari, Italy).
Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.525-37
Based on the development of the massive quark model, quark geometrodynamics, and anisotropic chromodynamics, the author introduces the notion of the fire-string. This is a coherent superposition of excited mesonic resonances ($q\bar{q}$) which resemble as closely as possible a $\bar{q}q$-partonic state. The model allows 'reasonable' expectations for hadroproduction at $p\bar{p}$ collider energies to be assessed. (10 refs.)

Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings .... See Entry 105026

A nonlinear two-dimensional sigma-model in relativistic string theory .... See Entry 105464

$\Delta B=2$ transitions .... See Entry 105498

The charged current couplings and *CP*-violation in the B-meson system .... See Entry 105512

Current algebra, baryons, and quark confinement .... See Entry 105520

Factorization for one-loop corrections in the Drell-Yan process .... See Entry 105557

Local charge compensation in the quark-cascade jet-production model .... See Entry 105604

Relativistic corrections in potential models .... See Entry 105607

Multiplicities of secondary hadrons produced in νp and $\bar{\nu}p$ charged current interactions .... See Entry 105615

Bag-model calculation of leptonic widths .... See Entry 105622

Pion decay constant and effective quark mass from relativistic $q\bar{q}$ wave function .... See Entry 105623

On the nature of the $\theta(1670)$ state .... See Entry 105624

Ω^- and $\Sigma^+\rightarrow p\gamma$ nonleptonic weak decays via current algebra, partial conservation of axial-vector current, and the quark model .... See Entry 105628

Photon decays of baryons with strangeness .... See Entry 105629

Baryon magnetic moments .... See Entry 105640

Magnetic moments of the ground-state baryons .... See Entry 105643

Quark model of baryon magnetic moments .... See Entry 105645

Gluon bremsstrahlung in charged lepton-nucleon collisions. II. Gluon linear polarization .... See Entry 105652

SU(2)×U(1) effects in e^+e^- annihilation: generalized charge asymmetry .... See Entry 105659

Experimental indications for a 2^{++} non-$\bar{q}q$ object .... See Entry 105677

Inclusive meson resonance production in K^+p interactions at 70 GeV/*c* .... See Entry 105680

QCD and $p\bar{p}$ collider physics .... See Entry 105700

QCD radiation and the multiplicity distribution at the collider .... See Entry 105703

Spin alignment of rho mesons produced in $\bar{p}p$ collisions and quark recombination model .... See Entry 105705

Spin-dependent excitations: RPA model and isobar-hole couplings .... See Entry 105754

Sum rule approach to giant resonance states .... See Entry 105814

On the production of the six-quark H dibaryon in the (K^-,K^+) reaction .... See Entry 105938

Hadron colliders versus e^+e^- colliders .... See Entry 106186

12.35K Other composite models
(inc. composite quarks and leptons)

105598 Flavour changing neutral processes in a composite model for quarks, leptons and technifermions. K.Yamawaki (Dept. of Phys., Nagoya Univ., Nagoya, Japan), T.Yokota.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.1, p.144-56 (15 Aug. 1983).
It is argued that flavour-changing neutral processes may be suppressed in a recently proposed composite model for quarks, leptons and technifermions, in which the technicolour dynamics are asymptotically non-free at the composite level and are assumed to have an ultraviolet fixed point. (18 refs.)

105599 Large *N* limit of composite quarks and leptons. S.Otsuki (Dept. of Phys., Kyushu Univ., Fukuoka, Japan), F.Toyoda.
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1815-18 (June 1983).
Left-right symmetric massless quarks and leptons with the Pati-Salam index composed of fermionic and bosonic preons of *N*-plet of $SU(N)_{\text{subcolor}}$ are discussed. For $N_G=N/4$ generations originated successively from preon pairs, 'allowed' transitions with the same generation are $\sim 1/\sqrt{N}$, while those between generations are at most $\sim 1/N$ for $N\rightarrow\infty$. (7 refs.)

105600 $1/N_{\text{subcolour}}$ and quark-lepton mass hierarchies. K.Matumoto (Dept. of Phys., Toyama Univ., Toyama, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1819-22 (June 1983).
Presents a scenario, on the basis of subcolour confining subquark models including technisubquarks in which $1/N_{\text{subcolour}}$ is the principal factor of quark-lepton mass hierarchies. (12 refs.)

105601 A supersymmetric composite model. F.Bordi (Dept. de Phys. Theorique, Univ. de Geneve, Geneve, Switzerland), R.Casalbuoni, D.Dominici, R.Gatto.
Phys. Lett. B (Netherlands), vol.127B, no.6, p.419-22 (11 Aug. 1983).
The authors present a supersymmetric composite model which extends the model by Abbot and Farhi (1981). Its main feature is to be natural, economic, and compatible with the problem of strong *CP* and massless quarks and leptons. (11 refs.)

105602 Hierarchy of fermion masses in supersymmetric composite models. R.Barbieri (Istituto di Fisica, Univ. di Pisa, Pisa, Italy), A.Masiero, G.Veneziano.
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.179-84 (25 Aug. 1983).
The combined effect of chirality and supersymmetry (through Goldstone partnership) can generate a variety of light mass scales for spin 1/2 composites. The general ideas are illustrated in a one-family example with technicolour-type breaking of the standard low energy group. (12 refs.)

105603 Unified preon models based on simple gauge groups. Y.Kayama, H.Nishimura (Graduate School of Sci. & Technol., Kobe Univ., Kobe, Japan), M.Abe.
Phys. Lett. B (Netherlands), vol.128B, no.5, p.290-4 (1 Sept. 1983).
Unified preon models based on simple gauge groups are investigated. Imposing some appropriate conditions, the authors arrive at two possibilities on SU(9) and another on SU(10). They are incompatible with technicolor. They also discuss a simple breaking pattern of these models to estimate the hypercolour confinement scale. (15 refs.)

12.40 MODELS OF STRONG INTERACTIONS

Constraints on K^0-$\bar{K}^0$ mixing from hadronic sum rules .... See Entry 105521

12.40E Statistical models

105604 Local charge compensation in the quark-cascade jet-production model. S.P.Misra (Inst. of Phys., Bhubaneswar, India), B.K.Parida.
Pramana (India), vol.20, no.5, p.375-85 (May 1983).
The charge correlations and the local charge compensation mechanism in rapidity space for quark jets are analysed in the framework of the quark-cascade jet-production model. The calculated results are compared with those observed experimentally in antineutrino-nucleon processes, and for the short range charge correlations observed in e^+e^- annihilation experiments. The results appear consistent with the quark-cascade model. (27 refs.)

'Reasonable' expectations for hadroproduction at collider energies .... See Entry 105597

Inclusive inelastic reaction $np\rightarrow pX$ at 795 MeV .... See Entry 105665

On the scaling behaviour of multiplicity distribution at $\sqrt{s}=540$ GeV and the three-fireball model .... See Entry 105682

12.40F Bootstrap models

105605 Single-particle spectra in bootstrap model based on dual-topological-unitarization diagrams. K.Hirose (Inst. of Phys., Teikoku Women's Univ., Moriguchi, Japan), T.Kanki.
Phys. Rev. D (USA), vol.28, no.5, p.1101-8 (1 Sept. 1983).
The authors study a bootstrap model of inclusive reactions based on dual-topological-unitarization diagrams of the multi-Regge type. By applying the bootstrap equations developed for the multifireball model, they are able to calculate the branching process of the dual multi-Regge chain, keeping longitudinal-momentum conservation exactly. They calculate various single-particle spectra in pion, kaon, and proton fragmentation. These spectra are compared with experimental data. (19 refs.)

12.40H Duality and dual models

Topological geometrodynamics .... See Entry 105457

A nonlinear two-dimensional sigma-model in relativistic string theory .... See Entry 105464

U(∞) lattice gauge theory as a free lattice string theory .... See Entry 105481

Quantum chromodynamics on a simplicial lattice .... See Entry 105563

Quark-antiquark potential and Q^2 duality .... See Entry 105578

Short-time perturbation theory and nonrelativistic duality .... See Entry 105591

Single-particle spectra in bootstrap model based on dual-topological-unitarization diagrams .... See Entry 105605

12.40M Complex angular momentum plane; Regge poles and cuts (Reggeons)
(see also 11.60 for general theory)

105606 Improved high-energy bound on the logarithmic derivative of scattering amplitudes. B.K.Chung, H.J.Shin (Dept. of Phys., Kyunghee Univ., Seoul, Korea).
Phys. Rev. D (USA), vol.28, no.3, p.653-6 (1 Aug. 1983).
It is proved that the logarithmic derivative of the absorptive part of the scattering amplitude with respect to momentum transfer *t* has an improved rigorous upper bound $(7 \ln s)/[2\sqrt{t}(2-\sqrt{t})]$ for a sequence of $s\rightarrow\infty$. It is also observed that the slope of the Regge trajectory is not only rigorously bounded from above by $7/[2\sqrt{t}(2-\sqrt{t})]$, but also by $1/[2\sqrt{t}(2-\sqrt{t})]$, if the total cross section increases in any fashion as $s\rightarrow\infty$. Here *s* is energy squared and $0<t<4$ (in units of pion mass). (10 refs.)

Interaction radius and strong gravity ....See Entry 105202

Apparent spin-dependent forces in QCD or the quantum chemistry of hadrons ....See Entry 105571

Single-particle spectra in bootstrap model based on dual-topological-unitarization diagrams ....See Entry 105605

12.40Q Potential models

105607 Relativistic corrections in potential models. M.G.Olsson (Phys. Dept., Univ. of Wisconsin, Madison, WI, USA), K.J.Miller.
Phys. Rev. D (USA), vol.28, no.3, p.674-6 (1 Aug. 1983).
Following the method of Gromes (1977), the authors calculate effective Hamiltonians for the scalar and an electrostatic potential. By comparing two-particle corrections to the Dirac limit, they eliminate an ambiguity in the corrections to the static propagator. They find that the spin-independent corrections to the scalar potential given by Gromes do not yield the proper Dirac limit, and they present an effective scalar Hamiltonian which does. (10 refs.)

Dependence of low-lying energy eigenvalues on the short- and long-range parts of confining potentials ....See Entry 105559

Quark-antiquark potential and Q^2 duality ....See Entry 105578

The Shifman-Vainshtein-Zakharov method: why it works, why it fails, and ways to improve it ....See Entry 105580

Can ι(1440), θ(1640), δ(980), and S*(980) be accommodated in the quarkonium model? ....See Entry 105589

12.40R Peripheral models (one or more particle exchange)

105608 Quasinuclear levels of the $\Lambda\bar{\Lambda}$-$\Sigma\bar{\Sigma}$ system. R.T.Tyapaev, I.S.Shapiro (Moscow Engng. Phys. Inst., Acad. of Sci., Moscow, USSR).
JETP Lett. (USA), vol.37, no.6, p.345-9 (20 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.6, p.291-4 (20 March 1983). [received: Sept. 1983]
The amplitudes for elastic scattering and for transitions $\Sigma\bar{\Sigma}\rightarrow\Lambda\bar{\Lambda}$ are calculated for orbital angular momenta $L=1,2$. Coupling with a closed channel substantially reduces the widths of the resonances but has only a negligible effect on the positions of the resonances. Recommendations are offered for an experimental search and a possible interpretation of the most recent data. (10 refs.)

Meson exchanges in the harmonic-oscillator quark model ....See Entry 105577

Nucleon-nucleon inelasticities below 1000 MeV ....See Entry 105664

12.40V Vector-meson dominance

Bethe-Salpeter basis for quark-pair-creation model: understanding of *VPP*, *VP*γ, and *P*$\gamma\gamma$ couplings ....See Entry 105590

12.70 HADRON MASS FORMULAS

A mass sum rule in softly broken $N=4$ super Yang-Mills theory ....See Entry 105478

Vacuum alignment in the breaking of extended hypercolor interactions ....See Entry 105541

The Shifman-Vainshtein-Zakharov method: why it works, why it fails, and ways to improve it ....See Entry 105580

13.00 SPECIFIC REACTIONS AND PHENOMENOLOGY

13.10 WEAK AND ELECTROMAGNETIC INTERACTIONS OF LEPTONS

105609 Role of the production of a pseudoscalar meson with an e^+e^--pair in e^+e^- collisions.. T.Miyazaki, K.Kuniyoshi (Dept. of Phys., Sci. Univ. of Tokyo, Tokyo, Japan).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.17, p.577-82 (27 Aug. 1983).
Discussed is what is known in a model-independent way about the $M_{\gamma\gamma}$ vertex through the processes $l\bar{l}\rightarrow M_\gamma$ and $ll\rightarrow llM$. The exact QED calculation for the cross-section is then done and the lepton-pair distribution is presented in the perpendicular plane. (7 refs.)

105610 Scalar electron production in e^+e^- annihilation. M.Kuroda (Inst. of Theoretical Phys., Univ. of Regensburg, Regensburg, Germany), K.Ishikawa, T.Kobayashi, S.Yamada.
Phys. Lett. B (Netherlands), vol.127B, no.6, p.467-71 (11 Aug. 1983).
The single scalar electron production process $e^+e^-\rightarrow e^\pm$+photino+scalar electron (scalar electron$\rightarrow e^\mp$+photino), with the detection of e^+ as well as e^-, provides a clean method to detect scalar electrons when their masses are not lighter than the beam energy. The authors made a complete calculation of the process and evaluated the production cross sections. (12 refs.)

105611 Search for magnetic monopoles in electron-positron collisions at 34 GeV CM energy. P.Musset, M.Price (CERN, Geneva, Switzerland), E.Lohrmann.
Phys. Lett. B (Netherlands), vol.128B, no.5, p.333-5 (1 Sept. 1983).
A search for heavily ionising particles was carried out at the electron-positron storage ring PETRA with the help of Kapton detectors placed inside the vacuum pipe. The total integrated luminosity was 90 pb^{-1} at CM energies above 34 GeV. The search was sensitive to particles with magnetic charge from $1.137/2e$ to $5.137/2e$ and with masses up to 10-16 GeV/c^2. No such particle was found, leading to an upper limit of the production cross section of monopole-antimonopole pairs of 4×10^{-38} cm^2 (95% CL). (8 refs.)

105612 Test of supersymmetry in e^-e^- collisions. W.-Y.Keung, L.Littenberg (Phys. Dept., Brookhaven Nat. Lab., Upton, NY, USA).
Phys. Rev. D (USA), vol.28, no.5, p.1067-70 (1 Sept. 1983).
The production of scalar electrons in e^-e^- collisions can proceed by exchange of a Majorana fermion, which is the photino in supersymmetric theories. Detection of this process will establish the self-conjugate nature of the photino and thus serve as a test of supersymmetry. Reactions of particular polarization configurations $e_L^-e_L^-$ or $e_R^-e_R^-$ are sensitive to the photino mass. The authors study the predicted cross sections and the event distributions. (7 refs.)

105613 Positivity constraints for the nonperturbative QCD parameters in e^+e^- annihilation. I.Caprini (Central Inst. of Phys., Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.4, p.295-308 (1983).
The author investigates the constraints imposed by the positivity properties of the vacuum polarization amplitude upon the QCD nonperturbative parameters, in the framework of the operator product expansion of Shifman, Vainshtein and Zakharov (1979). By using the present experimental data on e^+e^- annihilation into hadrons up to c.m. energies of about 35 GeV, the author obtains quite strong bounds and correlations for the quark and gluon condensate parameters. (16 refs.)

Finite quantum field theory and neutrinodynamics ....See Entry 105458

A test of gauge nature of the W boson in the reaction $e^+e^-\rightarrow Z\gamma$ ....See Entry 105553

Search for scalar particles and excited leptons at PETRA ....See Entry 105657

13.15 NEUTRINO INTERACTIONS

(inc. interactions involving cosmic rays)

105614 Coherent π^0 production in neutrino reactions. D.Rein, L.M.Sehgal (Phys. Inst., RWTH, Aachen, Germany).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.1, p.29-44 (15 Aug. 1983).
The authors have calculated the cross section and angular distribution of the neutral current process $\nu+N\rightarrow\nu+N+\pi^0$ involving the coherent interaction of a neutrino with a complex nucleus. A contrast is made to incoherent production $\nu+n\rightarrow\nu+n+\pi^0$ on a single nucleon. The results are compared with observations from some recent experiments. (18 refs.)

105615 Multiplicities of secondary hadrons produced in νp and $\bar{\nu}p$ charged current interactions. H.Grassler, D.Lanske, R.Schulte (III. Phys. Inst., Tech. Hochschule, Aachen, Germany), G.T.Jones, R.P.Middleton, S.W.O'Neale, K.Bockmann, W.Gebel, C.Geich-Gimbel, B.Nellen, A.Grant, H.Klein, D.R.O.Morrison, P.Schmid, H.Wachsmuth, J.S.Chima, M.M.Mobayyen, M.Talebzadeh, O.Villalobos-Baillie, M.Aderholz, L.Deck, N.Schmitz, R.Settles, K.L.Wernhard, W.Wittek, G.Corrigan, G.Myatt, D.Radojicic, B.Saitta, J.Wells.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.2, p.269-95 (22 Aug. 1983).
In an experiment with the hydrogen bubble chamber BEBC at CERN multiplicities of hadrons produced in νp and $\bar{\nu}p$ interactions have been investigated. Results are presented on the multiplicities of charged hadrons and neutral pions, forward and backward multiplicities of charged hadrons and correlations between forward and backward multiplicities. Comparisons are made with hadronic reactions and e^+e^- annihilation. In the framework of the quark-parton model the data imply similar charged multiplicities for the fragments of a u- and a d-quark, and larger multiplicities for the fragments of a uu- than for a ud-diquark. The correlation data suggest independent fragmentation of the quark and diquark for hadronic masses above ~7 GeV and local charge compensation within an event. (30 refs.)

105616 Production of neutral strange particles in $\bar{\nu}_\mu d_2$ and $\nu_\mu d_2$ charged current interactions. D.Allasia (Istituto di Fisica, Univ. di Torino, Torino, Italy), C.Angelini, S.Barlag, L.Bertanza, A.Bigi, V.Bisi, M.Bloch, F.Bobisut, T.Bolognese, R.Bonarelli, A.Borg, E.Calimani, P.Capiluppi, R.Casali, S.Ciampolillo, P.Van Dam, J.Derkaoui, M.L.Faccini-Turluer, R.Fantechi, V.Flaminio, A.G.Frodesen, D.Gamba, G.Giacomelli, G.Graziani, B.Grung, A.Hornaes, H.Huzita, B.Jongejans, I.Lippi, M.Loreti, C.Louedec, G.Mandrioli, A.Marzari-Chiesa, P.Mazzanti, A.Nappi, R.Pazzi, C.Petri, G.M.Pierazzini, L.Riccati, A.Romero, A.M.Rossi, A.Sconza, P.Serra-Lugaresi, A.Tenner, G.W.Van Apeldoorn, D.Vignaud, C.Visser, R.Wigmans.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.1, p.1-20 (29 Aug. 1983).
The inclusive production of K^0, Λ and $\bar{\Lambda}$ in charged-current (anti)neutrino interactions in deuterium is studied, using the BEBC bubble chamber exposed to the CERN-SPS wide band (anti)neutrino beam. In a selected sample of 8600 charged current $\nu_\mu d_2$ and 6100 $\bar{\nu}_\mu d_2$ interactions, 700 K^0, 448 Λ and 20 $\bar{\Lambda}$ particles were observed. The interactions have been separated in interactions on neutrons and on protons. The production properties are studied in terms of various kinematical variables. The associated production of strange particles, the production of $K^{*\pm}$(890) and of $\Sigma^\pm$(1385) and the inclusive Λ polarization are discussed. The experimental results are compared with the predictions of the Field-Feynman and the Lund fragmentation models. (16 refs.)

105617 Measurement of the ν_μ charged-current cross section. N.J.Baker, P.L.Connolly, S.A.Kahn, M.J.Murtagh, M.Tanaka (Brookhaven Nat. Lab., Upton, NY, USA), C.Baltay, M.Bregman, D.Caroumbalis, L.D.Chen, H.French, M.Hibbs, R.Hylton, P.Igo-Kemenes, J.T.Liu, J.Okamitsu, G.Ormazabal, A.C.Schaffer, K.Shastri, J.Spitzer, E.B.Brucker, P.F.Jacques, M.Kalelkar, E.L.Koller, R.J.Plano, P.E.Stamer, A.Vogel.
Phys. Rev. Lett. (USA), vol.51, no.9, p.735-8 (29 Aug. 1983).
The Fermilab 15-ft bubble chamber, filled with a heavy neon-hydrogen mix, was exposed to a narrow-band ν_μ beam. Based on the observation of 830 charged-current ν_μ interactions, the cross section was found consistent with a linear rise with the neutrino energy in the interval 10 GeV$\leq E_\nu\lesssim$240 GeV. The average slope was determined to be $\sigma_\nu/E_\nu=(0.62\pm0.05)\times10^{-38}$ cm^2 GeV^{-1}. (6 refs.)

105618 $\bar{\nu}_\mu$-nucleon charged-current total cross section for 5-250 GeV. G.N.Taylor, R.J.Cence, F.A.Harris, M.D.Jones, S.I.Parker, M.W.Peters, V.Z.Peterson, V.J.Stenger (Dept. of Phys. & Astron., Univ. of Hawaii, Honolulu, HI, USA), H.C.Ballagh, H.H.Bingham, T.Lawry, J.Lys, M.L.Stevenson, G.P.Yost, D.Gee, F.R.Huson, E.Schmidt, W.Smart, E.Treadwell.
Phys. Rev. Lett. (USA), vol.51, no.9, p.739-42 (29 Aug. 1983).
The $\bar{\nu}_\mu$ charged-current total cross section has been measured with the Fermilab 15-ft bubble chamber plus the external muon identifier and internal 'picket fence.' Beam monitoring information used for the flux calculation was obtained from Blair et al. (1983), whose detector operated in the same dichromatic beam. The present result, averaged over $\bar{\nu}_\mu$ energies from 5 to 250 GeV, is $\sigma/E=(0.340\pm0.019\pm0.022)\times10^{-38}$ cm^2/(GeV nucleon) for an isoscalar target. (17 refs.)

105619 High-energy quasielastic $\nu_\mu n \to \mu^- p$ scattering in deuterium. T.Kitagaki, S.Tanaka, H.Yuta, K.Abe, K.Hasegawa, A.Yamaguchi, K.Tamai, T.Hayashino, Y.Otani, H.Hayano, H.Sagawa (Tohoku Univ., Sendai, Japan), R.A.Burnstein, J.Hanlon, H.A.Rubin, C.Y.Chang, S.Kunori, G.A.Snow, D.Son, P.H.Steinberg, D.Zieminska, R.Engelmann, T.Kafka, S.Sommars, C.C.Chang, W.A.Mann, A.Napier, J.Schneps.
Phys. Rev. D (USA), vol.28, no.3, p.436-42 (1 Aug. 1983).
The authors have studied the quasielastic reaction $\nu_\mu n \to \mu^- p$ in an exposure of the Fermilab deuterium-filled 15-foot bubble chamber to a high-energy wide-band neutrino beam. From an analysis of the Q^2 distribution based on the standard *V-A* theory, the axial-vector mass in a dipole parametrization of the axial-vector form factor is determined to be $M_A = 1.05_{-0.16}^{+0.12}$ GeV, consistent with the values previously reported from low-energy experiments. (18 refs.)

105620 Associated charm production and correlations between multileptons in (anti)neutrino interactions. J.Smith, G.Valenzuela (Inst. for Theoretical Phys., State Univ. of New York, Stony Brook, NY, USA).
Phys. Rev. D (USA), vol.28, no.5, p.1071-9 (1 Sept. 1983).
Associated charm production and decay in (anti)neutrino interactions has often been proposed to explain the (anti)neutrino like-sign dimuon events. The authors show that a particular phenomenological model of $c\bar{c}$ production and decay is also capable of explaining both the $\mu^- e^-$ events seen recently in bubble-chamber experiments and a specific fraction of the neutrino-induced trimuon events. The correlations between these different reaction channels strengthen the conclusion that $c\bar{c}$ pairs are formed in approximately 1% of all deep-inelastic (anti)neutrino interactions. (12 refs.)

Local charge compensation in the quark-cascade jet-production model .... See Entry 105604

Phenomenological structure of weak lepton currents in the reactions of direct and inverse μ decay .... See Entry 105630

13.20 LEPTONIC AND SEMILEPTONIC DECAYS OF MESONS

105621 Measurement of the branching ratio for the rare decay $\pi^0 \to e^+e^-$. J.S.Frank, C.M.Hoffman, R.E.Mischke, D.C.Moir, J.S.Sarracino, P.A.Thompson (Los Alamos Nat. Lab., Los Alamos, NM, USA), M.A.Schardt.
Phys. Rev. D (USA), vol.28, no.3, p.423-35 (1 Aug. 1983).
The paper reports the details of an experiment designed to detect the decay $\pi^0 \to e^+e^-$ and to measure its branching ratio. The experiment used a beam of 300-MeV/c π^- mesons incident on a liquid-hydrogen target to produce neutral pions in the reaction $\pi^- p \to \pi^0 n$. Electron-positron pairs were detected in a magnetic spectrometer by multiwire proportional chambers. A gas Cherenkov counter provided electron identification. The effective-mass distribution of e^+e^- pairs was decomposed with the aid of a Monte Carlo simulation of the $\pi^0 \to e^+e^-$ signal and background processes. The result is 59 ± 21 events, which corresponds to $\Gamma(\pi^0 \to e^+e^-)/\Gamma(\pi^0 \to \gamma\gamma) = (17 \pm 6 \pm 3) \times 10^{-8}$, where the first error is due to statistics and the second is an estimate of systematic effects. The central value is almost four times the unitarity lower limit while existing calculations generally predict values no longer than twice the unitary limit. (33 refs.)

105622 Bag-model calculation of leptonic widths. B.Margolis, R.R.Mendel (Phys. Dept., McGill Univ., Montreal, Quebec, Canada).
Phys. Rev. D (USA), vol.28, no.3, p.468-71 (1 Aug. 1983).
The authors calculate leptonic widths of the light vector mesons in a modified MIT bag model, under the assumption that the total quark-antiquark momentum is identically zero in the center-of-mass system of the meson. All free parameters are determined from spectroscopy. One finds agreement with experiment to within 25%. (11 refs.)

105623 Pion decay constant and effective quark mass from relativistic $q\bar{q}$ wave function. T.N.Pham (Centre de Phys. Theorique, Ecole Polytech., Palaiseau, France).
Phys. Rev. D (USA), vol.28, no.3, p.472-5 (1 Aug. 1983).
Expressions for the pion decay constant and $\pi^0 \to 2\gamma$ decay amplitude are given in terms of the effective quark mass m_q assuming a $q\bar{q}$ bound-state structure for massless pion. The pion decay constant is found to be given by $f_\pi = (3/2\pi) m_q$, which gives, for $m_q = 330$ MeV, $f_\pi = 160$ MeV, in good agreement with the measured value of 135 MeV. (10 refs.)

Restrictions on left-right symmetric gauge theories from the neutral kaon system and B decays .... See Entry 105473

The charged current couplings and *CP*-violation in the B-meson system .... See Entry 105512

Higher-order effects and the vector boson physical parameters .... See Entry 105526

Photino and gluino production from quarkonium decay .... See Entry 105581

Search for supersymmetry in toponium decays .... See Entry 105587

Associated charm production and correlations between multileptons in (anti)neutrino interactions .... See Entry 105620

13.25 HADRONIC DECAYS OF MESONS

105624 On the nature of the $\theta(1670)$ state. J.Turnau (Inst. of Nuclear Phys., Cracow, Poland).
Acta Phys. Pol. B (Poland), vol.B14, no.8, p.629-32 (Aug. 1983).
It is shown that the quarkonium-gluonium mixture model of $\theta(1670)$ state fails in many points. On the other hand, the mixing of the $s\bar{s}$ state with the $u\bar{u}s\bar{s}$ member of 36-plet is shown to yield the decay properties of f′(1515) and $\theta(1670)$ consistent with the experimental observations. (13 refs.)

105625 Study of the decay $J/\psi \to \gamma\eta\pi\pi$. C.Edwards, R.Partridge, C.Peck, F.C.Porter (Phys. Dept., California Inst. of Technol., Pasadena, CA, USA), D.Antreasyan, Y.F.Gu, W.Kollman, M.Richardson, K.Strauch, A.Weinstein, D.Aschman, M.Cavalli-Sforza, D.Coyne, C.Newman-Holmes, H.F.W.Sadrozinski, D.Gelphman, R.Hofstadter, R.Horisberger, I.Kirkbride, H.Kolanoski, K.Konigsmann, R.Lee, A.Liberman, J.O'Reilly, A.Osterheld, B.Pollock, J.Tompkins, E.D.Bloom, F.Bulos, R.Chestnut, J.Gaiser, G.Godfrey, C.Kiesling, W.Lockman, S.Lowe, M.Oreglia, D.L.Scharre, K.Wacker.
Phys. Rev. Lett. (USA), vol.51, no.10, p.859-62 (5 Sept. 1983).
The radiative decay $J/\psi \to \gamma\eta\pi\pi$ has been studied with data taken with the crystal-ball detector at the SPEAR e^+e^- storage ring. In addition to the well-known η', the $\eta\pi\pi$ mass spectrum shows a broad enhancement centered at ~1700 MeV. The authors have searched for the $\iota(1440)$ in the $\eta\pi\pi$ mass spectrum and find $R(J/\psi \to \gamma\iota)(\iota \to \eta\pi\pi)/R(J/\psi \to \gamma\iota)(\iota \to K\bar{K}\pi) < 0.5$ (90% confidence level). (8 refs.)

105626 Measurement of $\psi(3097)$ and $\psi'(3686)$ decays into selected hadronic modes. M.E.B.Franklin (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA), G.J.Feldman, G.S.Abrams, M.S.Alam, C.A.Blocker, A.Blondel, A.M.Boyarski, M.Breidenbach, D.L.Burke, W.C.Carithers, W.Chinowsky, M.W.Coles, S.Cooper, W.E.Dieterle, J.B.Dillon, J.Dorenbosch, J.M.Dorfan, M.W.Eaton, G.Gidal, G.Goldhaber, G.Hanson, K.G.Hayes, T.Himel, D.G.Hitlin, R.J.Hollebeek, W.R.Innes, J.A.Jaros, P.Jenni, A.D.Johnson, J.A.Kadyk, A.J.Lankford, R.R.Larsen, M.Levi, R.E.Millikan, V.Luth, M.E.Nelson, C.Y.Pang, J.F.Patrick, M.L.Perl, B.Richter, A.Roussarie, D.L.Scharre, R.H.Schindler, R.F.Schwitters, J.L.Siegrist, J.Strait, H.Taureg, M.Tonutti, G.H.Trilling, E.Vella, R.A.Vidal, I.Videau, J.M.Weiss, H.Zaccone.
Phys. Rev. Lett. (USA), vol.51, no.11, p.963-6 (12 Sept. 1983).
Measurements of $\psi(3097)$ and $\psi'(3686)$ branching fractions for selected hadronic decays are presented. The ratio of ψ' to ψ branching fractions for these decays is consistent with the ratio of branching fractions to lepton pairs, with the exception of the decays to $p\pi$ and K^*K for which this ratio is substantially smaller. (6 refs.)

105627 Vector-meson decays in the SLAC lattice quantum-chromodynamic theory. W.F.L.Ward (Dept. 34-10, Lockheed Missiles & Space Co., Sunnyvale, CA, USA).
Phys. Rev. D (USA), vol.28, no.5, p.1138-52 (1 Sept. 1983).
The large-distance-dominated hadronic decays of the K^*, ϕ, and ω mesons of the lowest-lying vector-meson nonet of ordinary flavor SU(3) symmetry are discussed from the point of view of the SLAC lattice Hamiltonian QCD theory. The agreement between the theoretical results and observation is reasonable. This agreement is taken as further evidence for the applicability of the two key ingredients in the calculational procedure to large-distance hadron dynamics. Here, the author has reference to (a) the vacuum-insertion technique of Lee, Primack, and Treiman (1973) for the evaluation of light-hadron matrix elements of effective low-energy interacting densities and (b) the identification of the SLAC lattice currents with the physical hadron currents to leading order in the SLAC order-$1/g^2$ effective Hamiltonian for the fluxless light-hadron sector—in the spirit of Gell-Mann's work (1964) in current algebra. Indeed, when the results of the present paper are combined with the result for the decay $\rho \to \pi\pi$ in the same theoretical framework, the author can say that the SLAC lattice QCD theory, taken together with these two techniques, represents a viable scheme for understanding the large-distance aspects of the hadronic decays of the entire vector-meson nonet of the ordinary SU(3) flavor symmetry. (27 refs.)

Restrictions on left-right symmetric gauge theories from the neutral kaon system and B decays .... See Entry 105473

Strangeness-changing processes and the limit on the right-handed gauge-boson mass .... See Entry 105537

Photino and gluino production from quarkonium decay .... See Entry 105581

Bethe-Salpeter basis for quark-pair-creation model: understanding of *VPP*, *VP*γ, and *P*$\gamma\gamma$ couplings .... See Entry 105590

Relativistic corrections in quarkonium .... See Entry 105593

***B*-meson decays and *t*-quark mass** .... See Entry 105594

Energy dependence of the fundamental parameters of the K^0-$\bar{K}^0$ system. I. Experimental analysis .... See Entry 105634

Evidence for *F* meson at 1970 MeV .... See Entry 105654

13.30 DECAYS OF BARYONS

105628 Ω^- and $\Sigma^+ \to p\gamma$ nonleptonic weak decays via current algebra, partial conservation of axial-vector current, and the quark model. M.D.Scadron, M.Visinescu (Phys. Dept., Univ. of Arizona, Tucson, AZ, USA).
Phys. Rev. D (USA), vol.28, no.5, p.1117-24 (1 Sept. 1983).
By employing the current-algebra—PCAC (partial conservation of axial-vector current) program at the hadron level, the three decays $\Omega^- \to \Xi^0\pi^-$, $\Xi^-\pi^0$, ΛK^- are reasonably described in terms of only one fitted $(\Delta I = {}^1/_2)/(\Delta I = {}^3/_2)$ parameter of expected small 6% magnitude. Other parameters needed in the analysis, the baryon octet, and decuplet weak transitions $\langle B' | \mathcal{H}_W{}^{PC} | B \rangle$, $\langle D | \mathcal{H}_W{}^{PV} | B \rangle$, and $\langle D | \mathcal{H}_W{}^{PC} | B \rangle$, are completely constrained from $B \to B'\pi$ weak decays and independently from the quark model. The $\Sigma^+ p\gamma$ radiative decay amplitude and asymmetry parameters are then determined in terms of no free parameters. (34 refs.)

105629 Photon decays of baryons with strangeness. J.W.Darewych, M.Horbatsch, R.Koniuk (Dept. of Phys., York Univ., Downsview, Ontario, Canada).
Phys. Rev. D (USA), vol.28, no.5, p.1125-8 (1 Sept. 1983).
The photon-decay amplitudes and widths of the low-lying strange baryons are calculated within the framework of the nonrelativistic quark model of Isgur and Karl (1978). A comparison with experiment is made. (13 refs.)

Catalysis of flavor nonconservation by monopoles .... See Entry 105504

Precise measurement of the Σ^+ magnetic moment .... See Entry 105639

13.35 DECAYS OF LEPTONS

105630 Phenomenological structure of weak lepton currents in the reactions of direct and inverse μ decay. B.K.Kerimov, V.A.Kazakov, M.Ya.Safin, V.V.Trefilov (Dept. of theoretical Phys., Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.5, p.88-94 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.5, p.77-82 (1982).
The muon decay $\mu \to e\nu\bar{\nu}$ and the inverse process $\nu_\mu e^- \to \nu_e \mu^-$ are investigated in the case of the interaction of charged and nondiagonal neutral lepton currents of general form. It is shown how the structure of the interaction may be established using experimental data on these processes. On the basis of the known values of the μ-decay parameters, bounds on the coupling constants of the currents are obtained. (10 refs.)

105631 Search for right-handed currents in muon decay. J.Carr, G.Gidal, B.Gobbi, A.Jodidio, C.J.Oram, K.A.Shinsky, H.M.Steiner, D.P.Stoker, M.Strovink, R.D.Tripp (Dept. of Phys., Univ. of California, Berkeley, CA, USA).
Phys. Rev. Lett. (USA), vol.51, no.8, p.627-30 (22 Aug. 1983).
New limits are reported on right-handed currents, based on precise measurement of the e^+ spectrum end point in μ^+ decay. Highly polarized muons from the TRIUMF 'surface' beam were stopped in metal foils within a 1.1-T spin-holding longitudinal field or a 70-G spin-precessing transverse field. For the spin-held data, the *V-A* decay rate vanishes in the beam direction at the end point. Measurement of this rate sets the 90%-confidence limits $\xi P_\mu \delta / \rho > 0.9959$ and $M(W_R) > 380$ GeV, where W_R is the possible right-handed gauge boson. (13 refs.)

105632 Precise measurement of the tau lifetime. J.A.Jaros (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA), D.Amidei, G.H.Trilling, G.S.Abrams, C.A.Blocker, A.M.Boyarski, M.Breidenbach, D.L.Burke, J.M.Dorfan, G.J.Feldman, G.Gidal, L.Gladney, M.S.Gold, G.Goldhaber, L.Golding, G.Hanson, C.Hoard, R.J.Hollebeek, W.R.Innes, J.A.Kadyk, A.J.Lankford, R.R.Larsen, B.LeClaire, M.Levi, N.Lockyer, V.Luth, C.Matteuzzi, M.E.Nelson, R.A.Ong, M.L.Perl, B.Richter, P.C.Rowson, T.Schaad, H.Schellman, D.Schlatter, P.D.Sheldon, J.Strait, C.de la Vaissiere, J.M.Yelton, C.Zaiser.
Phys. Rev. Lett. (USA), vol.51, no.11, p.955-8 (12 Sept. 1983).
The τ lifetime was measured with the Mark II vertex detector at the storage ring PEP. $\tau_\tau=(3.20\pm0.41\pm0.35)\times10^{-12}$ sec was found, which agrees well with e-μ-τ universality. (9 refs.)

105633 A search for decays of heavy neutrinos. F.Bergsma, J.Dorenbosch, M.Jonker, C.Nieuwenhuis (NIKHEF, Amsterdam, Netherlands), J.V.Allaby, U.Amaldi, G.Barbiellini, L.Barone, C.Berger, A.Capone, W.Flegel, L.Lanceri, M.Metcalf, J.Panman, K.Winter, I.Abt, J.Aspiazu, F.W.Busser, H.Daumann, P.D.Gall, F.Niebergall, K.H.Ranitzsch, P.Schutt, P.Stahelin, P.Gorbunov, E.Grigoriev, V.Kaftanov, V.Khovansky, A.Rosanov, A.Baroncelli, B.Borgia, C.Bosio, M.Diemoz, U.Dore, F.Ferroni, E.Longo, L.Luminari, P.Monacelli, F.de Notaristefani, P.Pistilli, C.Santoni, L.Tortora, V.Valente.
Phys. Lett. B (Netherlands), vol.128B, no.5, p.361-6 (1 Sept. 1983).
A search for heavy neutrinos was conducted in the neutrino beam produced by the 400 GeV proton beam-dump and in the 400 GeV wide-band neutrino beam at CERN. A heavy neutrino associated with the τ lepton was searched for in the beam-dump experiment. No assumption on the nature of heavy neutrinos was made in the wide-band beam experiment. A search was made for neutrinos decaying into two electrons and a light neutrino. Since no events were observed, an upper limit on the neutrino mixing angles as a function of the neutrino mass is derived. The beam-dump experiment is sensitive to a neutrino mass range of 10-250 MeV and an upper limit at 90% confidence level on the square of the neutrino mixing angle of $\approx10^{-10}$ was obtained for neutrino masses greater than 180 MeV. The wide-band neutrino experiment is sensitive to neutrinos with a mass in a larger range (10-490 MeV), and for masses greater than 250 MeV yields an upper limit on the square of the neutrino mixing angle of $\approx10^{-6}$. (25 refs.)

13.40 ELECTROMAGNETIC PROCESSES AND PROPERTIES

13.40D Electromagnetic mass differences

105634 Energy dependence of the fundamental parameters of the K^0-$\bar{K}^0$ system. I. Experimental analysis. S.H.Aronson (Phys. Dept., Brookhaven Nat. Lab., Upton, NY, USA), G.J.Bock, Hai-Yang Cheng, E.Fischbach.
Phys. Rev. D (USA), vol.28, no.3, p.476-94 (1 Aug. 1983).
An analysis of K^0 regeneration data from Fermilab in the energy range 30-110 GeV has been carried out to determine the K_L-K_S mass difference Δm, the K_S lifetime τ_S, and the CP-violation parameter η_{+-}. The authors find that the average values of Δm, τ_S, $\tan\phi_{+-}$, and $|\eta_{+-}|$ at Fermilab energies differ from the accepted low-energy ($\sim$5 GeV) values by approximately 4, 2, 3, and 9 standard deviations, respectively. As a consequence of the discrepancy between low-energy and high-energy values, an investigation of a possible energy dependence of the parameters was carried out. Using two different methods, the parameters were fitted to a form $x=x_0(1+b_x{}^{(N)}\gamma^N)$ where x is any of the parameters Δm, τ_S, $|\eta_{+-}|$, and $\tan\phi_{+-}$, $\gamma=E_K/m_K$ is the usual relativistic factor, and $N=1$ or 2. The resulting slope parameters $b_x{}^{(N)}$ differ from zero by 0-4 standard deviations depending on the parameter and on whether the low-energy value is included. The details of the fits are presented, and a discussion is also given of new experiments which could check and extend the present results. (37 refs.)

105635 Energy dependence of the fundamental parameters of the K^0-$\bar{K}^0$ system. II. Theoretical formalism. S.H.Aronson (Phys. Dept., Brookhaven Nat. Lab., Upton, NY, USA), G.J.Bock, Hai-Yang Cheng, E.Fischbach.
Phys. Rev. D (USA), vol.28, no.3, p.495-523 (1 Aug. 1983).
For pt.I see ibid., vol.28, no.3, p.476-94 (1983). The authors present a detailed analysis of the previously reported anomalous energy dependence of the fundamental K^0-$\bar{K}^0$ parameters $\Delta m=m_L$-m_S, τ_S, $|\eta_{+-}|$, and $\tan\phi_{+-}$. Such variations with energy can arise from the interaction of the kaons with an external field or medium. A phenomenological formalism is introduced to describe such energy-dependent influences on the K^0-$\bar{K}^0$ system. Using this formalism they demonstrate that effects of the type suggested by the data cannot be ascribed to an interaction of the kaons with an electromagnetic, hypercharge, or gravitational field, or to the scattering of the kaons from stray charges or cosmological neutrinos. The data are, however, compatible with an interaction which is even under charge conjugation, and models of such an interaction are discussed. They also consider the possibility that such effects may arise from a fundamental violation of Lorentz invariance. All of the mechanisms which appear capable of describing the data also suggest that similar effects could arise in neutrino oscillations, and some of the consequences of such a possibility are outlined. (69 refs.)

105636 D^+-D^0 mass difference. V.S.Mathur, M.T.Yamawaki (Dept. of Phys. & Astron., Univ. of Rochester, Rochester, NY, USA).
Phys. Rev. D (USA), vol.28, no.3, p.669-70 (1 Aug. 1983).
The hadronic component of SU(2) mass splitting of heavy pseudoscalar mesons is calculated from QCD sum rules. The electromagnetic component is obtained from a generalisation of the Dashen sum rule. The authors' result for the D^+-D^0 mass difference is in very good agreement with the experimental value. (12 refs.)

105637 Low-mass right-handed gauge bosons, manifest left-right symmetry, and the K_L-K_S mass difference. A.Datta (Dept. of Phys., Jadavpur Univ., Calcutta, India), A.Raychaudhuri.
Phys. Rev. D (USA), vol.28, no.5, p.1170-7 (1 Sept. 1983).
The authors calculate the K_L-K_S mass difference in left-right-symmetric models with four quarks. It is found that a low right-handed mass scale requires strong deviations from manifest left-right symmetry. (19 refs.)

Constraints on K^0-$\bar{K}^0$ mixing from hadronic sum rules ....See Entry 105521

Strangeness-changing processes and the limit on the right-handed gauge-boson mass ....See Entry 105537

Dynamical generation of fermion mass differences within grand unified theories with a reduced mass-scale range of static symmetry ....See Entry 105538

13.40F Electromagnetic form factors; electric and magnetic moments

105638 Pion and nucleon twist-4 structure functions in the limit $x\rightarrow1$. M.Soldate (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.1, p.61-80 (15 Aug. 1983).
The $x\rightarrow1$ behavior of the pion and nucleon structure functions is studied here within the framework of the operator product expansion. The work on the twist-4 structure functions is performed in the longitudinal operator basis, which has the advantage that all the exact information known about the operator matrix elements has been used during the transformation into this basis. The simplicity of the twist-4 operator matrix elements is such that it is possible to arrive at power counting arguments for the $x\rightarrow1$ behavior in analogy with the standard counting rules for the twist-2 structure functions. (18 refs.)

105639 Precise measurement of the Σ^+ magnetic moment. C.Ankenbrandt, J.P.Berge, A.E.Brenner, J.Butler, K.Doroba, J.E.Elias, J.Lach, P.Laurikainen, J.MacLachlan, J.Marriner (Fermi Nat. Accelerator Lab., Batavia, IL, USA), E.McCliment, E.W.Anderson, A.Breakstone, T.Cardello, P.S.Cooper, L.J.Teig, J.L.Thron, Y.W.Wah.
Phys. Rev. Lett. (USA), vol.51, no.10, p.863-6 (5 Sept. 1983).
The Σ^+ magnetic moment is measured to be $(2.38\pm0.02)\mu_N$ with use of 44457 polarized $\Sigma^+\rightarrow p\pi^0$ decays in a charged hyperon beam. The inclusively produced Σ^+ in this 210-GeV/c beam have a polarization of about 0.20 for production angles between 2.5 and 7.0 mrad. (9 refs.)

105640 Baryon magnetic moments. G.E.Brown (Phys. Dept., State Univ. of New York, Stony Brook, NY, USA), F.Myhrer.
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.229-34 (25 Aug. 1983).
The authors discuss the baryon magnetic moments using the chiral bag model. The pion cloud contributes significantly to the moments and they point out that pion-pion interactions which enhances this contribution together with an isoscalar part is sufficient to explain the deviation of the baryon magnetic moments from their broken SU(6) values. (31 refs.)

105641 Structure functions of nucleons inside nuclei. J.Szwed (Inst. of Computer Sci., Jagellonian Univ., Cracow, Poland).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.245-7 (25 Aug. 1983).
The structure functions of nucleons inside large nuclei is discussed. The presence of Δ isobars in nuclei, which simulate nuclear interactions, is able to explain the recently measured difference between the structure of bound and free nucleons. (13 refs.)

105642 Quantum-chromodynamic corrections to meson-photon transition form factors. E.Braaten (Dept. of Phys., Univ. of Florida, Gainesville, FL, USA).
Phys. Rev. D (USA), vol.28, no.3, p.524-33 (1 Aug. 1983).
The author calculates corrections to the hard-scattering amplitude for meson-photon transition form factors using dimensional regularization. Special attention is paid to the pseudoscalar case in which there is an ambiguity associated with γ_5. He resolves this ambiguity by appealing to axial-vector Ward identities and check the answer by using a four-dimensional regularization. (12 refs.)

105643 Magnetic moments of the ground-state baryons. M.Gupta, N.Kaur (Dept. of Phys., Panjab Univ., Chandigarh, India).
Phys. Rev. D (USA), vol.28, no.3, p.534-9 (1 Aug. 1983).
Baryon magnetic moments are calculated in the harmonic-oscillator quark model incorporating (i) unlike previous attempts, a natural mass scale for quarks, taken as one-third of the nucleon mass for u and d quarks and the strange-quark mass suggested by Lipkin's sum rule m_s-$m_u=m_\Lambda$-m_p, (ii) a minimal nontrivial mixing, $|8\,{}^1/_2{}^+\rangle=\cos\phi|(56,0^+)_{N=0}\rangle+\sin\phi|(70,0^+)_{N=2}\rangle$, and (iii) replacement of Pauli spinors by Dirac spinors for including relativistic corrections. In the parameter-free nonrelativistic limit, the authors find a fairly good fit, which gets further improved in the relativistic case. (23 refs.)

105644 Neutrino magnetic moment in supersymmetry. S.N.Biswas, A.Goyal, J.N.Passi (Dept. of Phys. & Astrophys., Univ. of Delhi, Delhi, India).
Phys. Rev. D (USA), vol.28, no.3, p.671-3 (1 Aug. 1983).
Contributions to the magnetic moment of a massive neutrino due to the exchanges of supersymmetric partners of the conventional leptons and gauge bosons have been evaluated at the one-loop level. The authors also calculate the neutrino decay rate. Using the constraints on the masses of supersymmetric partners, they find the contribution to be comparable to that obtained in the standard theory. (15 refs.)

105645 Quark model of baryon magnetic moments. L.Brekke, R.G.Sachs (Phys. Dept., Univ. of Chicago, Chicago, IL, USA).
Phys. Rev. D (USA), vol.28, no.5, p.1178-84 (1 Sept. 1983).
The magnetic moments of the baryon octet and the $\Sigma^0\rightarrow\Lambda^0$ transition moment are calculated for the most general form of wave function describing an essentially nonrelativistic constituent quark model. For definiteness the quarks are taken to have Dirac moments. Flavor symmetry is assumed, that is, the Lande g factor is taken to be the same for all the baryons, an assumption that is justified by the small probabilities $({}^2P)^2$, $({}^4P)^2$, and $({}^4D)^2$ suggested by the final results. All of the measured moments can be fitted by this model. Results of making the fit are the following: (1) the ratios of intrinsic quark moments are $\mu_u/\mu_d=-1.93\pm0.09$, $\mu_s/\mu_d=0.79\pm0.12$, (2) the total admixture of decimet and singlet states with the octet amounts to $10\pm14\%$, (3) if $|\mu_d|$ is assumed to be 1 nuclear magneton (μ_N), the probabilities of admixed angular momentum states satisfy the condition ${}^2/_3({}^2P)^2-{}^1/_2({}^4P)^2+({}^4D)^2=0.05\pm0.09$, and (4) within the context of the model there is an upper bound on the absolute value of the $\Sigma^0\rightarrow\Lambda^0$ transition moment equal to $(1.97\pm0.14)\mu_N$ and depending only on the measured values of the seven magnetic moments. A more precise measurement of the transition moment is needed to confirm that it does not exceed this bound. Numerical values are also specified for two matrix elements that may be useful for determining more detailed properties of the wave function in specific models but they will be very model dependent. At present, all of the qualitative features of these results would appear to be consistent with a dynamical model based on simple potentials between constituent quarks augmented by spin-orbit couplings and SU(3)-breaking interactions of the order of magnitude of the 'hyperfine' interaction of De Rujula, Georgi, and Glashow (1975). (11 refs.)

105646 *W* magnetic moment in electroweak mixing and composite models and radiation zeros in $q_i\bar{q}_j\rightarrow W\gamma$. R.W.Robinett (Phys. Dept., Univ. of Wisconsin-Madison, Madison, WI, USA).
Phys. Rev. D (USA), vol.28, no.5, p.1185-91 (1 Sept. 1983).
The same experimental and theoretical constraints that are used to set limits on the masses of the weak bosons in the composite-model versions of elec-

troweak mixing models are used to bound the magnetic-moment parameter of the *W*. The author finds in general electroweak mixing schemes, ones with additional heavy isospin-1 bosons (W'), that off-diagonal weak-boson electromagnetic interactions ($WW'\gamma$ vertices) are allowed. The cross section for the process $q_i\bar{q}_j \to W\gamma$, which has been suggested as the best way to measure the *W* moments, is generalized to include the effects of these off-diagonal couplings as well as arbitrary and independent *W* magnetic dipole and electric quadrupole moments. (29 refs.)

105647 ***W*** **weak multipole moments in electroweak mixing and composite models.** R.W.Robinett (Phys. Dept., Univ. of Wisconsin-Madison, Madison, WI, USA).
Phys. Rev. D (USA), vol.28, no.5, p.1192-7 (1 Sept. 1983).
The form of the *WWZ* vertex, i.e. the *W* weak multipole moments, is examined in composite-model versions of electroweak mixing models. The weak charge e_z and weak-magnetic-moment parameter κ_Z can vary by as much as 40% from their standard-model values. The differential cross section for $f\bar{f} \to W^+W^-$ is generalized to include the effects of arbitrary and independent *W* electromagnetic and weak moments. (23 refs.)

A test of gauge nature of the W boson in the reaction $e^+e^- \to Z\gamma$ .... See Entry 105553

Meson exchanges in the harmonic-oscillator quark model .... See Entry 105577

High-energy quasielastic $\nu_\mu n \to \mu^- p$ scattering in deuterium ... See Entry 105619

Two-body form factors at high Q^2 .... See Entry 105651

13.40H Electromagnetic decays

105648 On the spoiling of radiation zeros at the one-loop level and infrared finiteness. M.L.Laursen, M.A.Samuel, A.Sen (Dept. of Phys., Oklahoma State Univ., Stillwater, OK, USA).
Phys. Rev. D (USA), vol.28, no.3, p.650-2 (1 Aug. 1983).
The authors consider the amplitude for the radiative decay $W^- \to \phi_1\phi_2\gamma$ (scalar quarks) including one-loop gluon corrections. They study this process to see if the amplitude (radiation) zeros found in lowest order survive at the one-loop level. The subset of diagrams containing self-mass insertions preserves the zero. Seagull types are shown to have a violation which is similar to $\kappa \neq 1$. Triangle and box diagrams spoil the zeros as they do in the case of a scalar *W*. However, the amplitude is completely free of any mass singularities in the classical null zone. They conjecture that this will remain true for spin-$^1/_2$ quarks. (11 refs.)

Photino and gluino production from quarkonium decay .... See Entry 105581

Search for supersymmetry in toponium decays .... See Entry 105587

Bethe-Salpeter basis for quark-pair-creation model: understanding of *VPP*, *VP*γ, and *P*$\gamma\gamma$ couplings .... See Entry 105590

Relativistic corrections in quarkonium .... See Entry 105593

Pion decay constant and effective quark mass from relativistic $q\bar{q}$ wave function .... See Entry 105623

Study of the decay $J/\psi \to \gamma\eta\pi\pi$ .... See Entry 105625

Ω^- and $\Sigma^+ \to p\gamma$ nonleptonic weak decays via current algebra, partial conservation of axial-vector current, and the quark model .... See Entry 105628

Photon decays of baryons with strangeness .... See Entry 105629

W **magnetic moment in electroweak mixing and composite models and radiation zeros in $q_i\bar{q}_j \to W\gamma$** .... See Entry 105646

13.40K Electromagnetic corrections to strong and weak interaction processes

105649 Radiative corrections to the helicity asymmetries for the Drell-Yan process in QCD. P.Ratcliffe (Internat. School for Advanced Studies, Trieste, Italy).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.1, p.45-60 (15 Aug. 1983).
The next-to-leading-logarithmic corrections to the helicity cross sections for the Drell-Yan process are calculated. While it is wellknown that these corrections are large, it is shown here that when considering the helicity asymmetry (initial-initial) these large radiative effects cancel. Thus the leading-order calculation for the asymmetry is a good approximation. (13 refs.)

105650 Precision predictions for the intermediate vector boson parameters. M.Consoli (Istituto di Fisica, Univ. di Catania, Catania, Italy), L.Maiani.
Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.478-88
Accurate measurements of the physical parameters of intermediate vector bosons (IVB) should soon be possible in $\bar{p}p$ and e^+e^- colliders. The authors present the main results of an analysis of radiative corrections to IVB parameters predicted in lowest order. The analysis is restricted to the masses M_w and M_z and to the leptonic decay rates. (11 refs.)

13.60 PHOTON AND CHARGED-LEPTON INTERACTIONS WITH HADRONS

(for neutrino interactions, see 13.15)

Study of the lepton-violating (μ^-,e^+) reaction in modern gauge theories .... See Entry 105455

Quantum-chromodynamic corrections to meson-photon transition form factors .... See Entry 105642

13.60F Elastic and Compton scattering

105651 Two-body form factors at high Q^2. F.Gross (Dept. of Phys., Coll. of William & Mary, Williamsburg, VA, USA), B.D.Keister.
Phys. Rev. C (USA), vol.28, no.2, p.823-35 (Aug. 1983).
The charge form factor of a scalar deuteron at high momentum transfer is examined in a model employing scalar nucleons and mesons. With an eye towards establishing consistency criteria for more realistic calculations, several aspects of the model are examined in detail: the role of nucleon and meson singularities in the one-loop impulse diagram, the role of positive- and negative-energy nucleons, and the relationship to time-ordered perturbation theory. It is found that at large Q^2 (1) the form factor is dominated by a term in which the spectator nucleon is on the mass shell, and (2) the meson singularity structure of the d-n-p vertex function is unimportant in determining the overall high-Q^2 behavior of the form factor. (12 refs.)

13.60H Total and inclusive cross sections

(inc. deep-inelastic processes)

105652 Gluon bremsstrahlung in charged lepton-nucleon collisions. II. Gluon linear polarization. O.E.Olsen, H.A.Olsen.
Ark. Fys. Semin. Trondheim (Norway), no.7, p.1-24 (1983).
The linear polarization of gluons emitted in charged lepton-nucleon scattering, including the effects of weak neutral currents, is calculated. The polarization is given in the target nucleon rest system, as well as in the center of mass system. (8 refs.)

105653 $O(4)$ symmetry in inclusive lepton-hadron scatterings. S.Koretune (Dept. of Phys., Fukui Medical School, Fukui, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1746-52 (June 1983).
The method of $O(4)$ symmetry by Freedman and Wang (1967) is applied to inclusive lepton-hadron scatterings. It is shown that Nachtman's moments correctly take into account the kinematical target mass correction even in the region where Wilson's operator product expansion cannot be applied. (8 refs.)

Single-particle spectra in bootstrap model based on dual-topological-unitarization diagrams .... See Entry 105605

13.60M Meson-resonance production

105654 Evidence for *F* meson at 1970 MeV. A.Chen, M.Goldberg, N.Horwitz, A.Jawahery, P.Lipari, G.C.Moneti, C.G.Trahern, H.Van Hecke (Syracuse Univ., Syracuse, NY, USA), M.S.Alam, S.E.Csorna, L.Garren, M.D.Mestayer, R.S.Panvini, Xia Yi, R.Giles, J.Hassard, M.Hempstead, K.Kinoshita, W.W.MacKay, F.M.Pipkin, R.Wilson, H.Kagan, P.Avery, C.Bebek, K.Berkelman, D.G.Cassel, J.W.DeWire, R.Ehrlich, T.Ferguson, R.Galik, M.G.D.Gilchriese, B.Gittelman, H.Halling, D.L.Hartill, D.Herrup, S.Holzner, M.Ito, J.Kandaswamy, V.Kistiakowsky, D.L.Kreinick, Y.Kubota, N.B.Mistry, F.Morrow, E.Nordberg, M.Ogg, R.Perchonok, R.Plunkett, A.Silverman, P.C.Stein, S.Stone, D.Weber, R.Wilcke, A.J.Sadoff, S.Behrends, K.Chadwick, J.Chauveau, P.Ganci, T.Gentile, J.M.Guida, J.A.Guida, R.Kass, A.C.Melissinos, S.L.Olsen, G.Parkhurst, D.Peterson, R.Poling, C.Rosenfeld, G.Rucinski, P.Tipton, E.H.Thorndike, J.Green, R.G.Hicks, F.Sannes, P.Skubic, A.Snyder, R.Stone.
Phys. Rev. Lett. (USA), vol.51, no.8, p.634-7 (22 Aug. 1983).
Evidence is presented for a narrow meson resonance of mass $1970 \pm 5 \pm 5$ MeV produced in continuum e^+e^- annihilations at $\sqrt{s}$ of 10.5 GeV, and decaying into a ϕ and a charged π. (11 refs.)

13.60P Baryon and baryon resonance production

105655 Photoproduction of hermaphrodite baryons. T.Barnes, F.E.Close (Rutherford Appleton Lab., Chilton, Didcot, England).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.277-80 (25 Aug. 1983).
Shows that photoexcitation of the lightest hermaphrodite baryons is strongly suppressed from photon targets but allowed from neutrons, a result that is reminiscent of a quark model selection rule due to Moorhouse (1966). This is consistent with suggestions that the P_{11} (1710) is the lightest q^3G baryon and eliminates the possibility that the Roper resonance is dominantly an hermaphrodite state. Magnetic moments do not constrain the possibility of considerable mixing of q^3G into the nucleon and delta's Fock space wavefunctions. (17 refs.)

105656 Koba-Nielsen-Olesen scaling and production mechanism in high-energy collisions. Chou Kuang-chao (Inst. of Theoretical Phys., Acad. Sinica, Beijing, China), Liu Lian-sou, Meng Ta-chung.
Phys. Rev. D (USA), vol.28, no.5, p.1080-5 (1 Sept. 1983).
An analysis of the existing data on photoproduction and electroproduction of protons is made. Koba-Nielsen-Olesen (KNO) scaling is observed in both cases. The scaling function of the nondiffractive γp processes turns out to be the same as that for nondiffractive hadron-hadron collisions, but the scaling function for deep-inelastic e^-p collisions is very much different from that for e^-e^+ annihilation processes. Taken together with the observed difference in KNO scaling functions in e^-e^+ annihilation and nondiffractive hadron-hadron processes these empirical facts provide further evidence for the conjecture: The KNO scaling function of a given collision process reflects its reaction mechanism. Arguments for this conjecture are given in terms of a semiclassical picture. It is shown that, in the framework of the proposed picture, explicit expressions for the above-mentioned KNO scaling functions can be derived from rather general assumptions. (27 refs.)

Reduced nuclear amplitudes in quantum chromodynamics ...... See Entry 105804

13.65 HADRON PRODUCTION BY ELECTRON-POSITRON COLLISIONS

105657 Search for scalar particles and excited leptons at PETRA. Y.Ducros (Dept. de Phys. des Particules Elementaires, Saclay, Gif-sur-Yvette, France).
Acta Phys. Pol. B (Poland), vol.B14, no.8, p.589-97 (Aug. 1983).
A search for scalar leptons, charged Higgs and excited leptons has been done with the five experiments installed at PETRA (CELLO-JADE-MARK J-PLUTO-TASSO). No scalar lepton or Higgs particles with conventional decay are created in e^+e^- annihilation. The highest value of the mass for such particles is close to the beam energy (17 GeV/c). Direct production of excited leptons also gives a negative result up to a mass value equal to 30 GeV/c^2. Comparison with QED for reaction $e^+e^- \to \gamma\gamma$ gives a limit of 59 GeV/c^2 for the e* mass. (10 refs.)

105658 Soft quark annihilation versus bremsstrahlung mechanisms of dilepton production in e^+e^- collisions. J.Ftacnik (Dept. of Theoretical Phys., Comenius Univ., Bratislava, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.9, p.972-89 (1983).
The spectra of low mass dileptons produced by soft quark-antiquark annihilation mechanism in e^+e^- collisions at $\sqrt{s}=3$ GeV are predicted. The role of background due to the production of low mass dileptons produced via the bremsstrahlung of initial particles is investigated. The experimental observation of soft-annihilation dileptons consistent with the present analysis would give further support to the idea of common partonic origin of low mass dileptons produced in hadron-hadron, lepton-hadron and e^+e^- collisions. (55 refs.)

105659 SU(2)×U(1) effects in e^+e^- annihilation: generalized charge asymmetry. B.F.L.Ward (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.1, p.43-60 (29 Aug. 1983).
The observability of the SU(2)×U(1) electroweak charge asymmetry effects in e^+e^- annihilation at $\sqrt{s}=29$ GeV is addressed in the context of a Feynman-Field type fragmentation model. The author assumes three colors of five flavored quarks and one heavy lepton τ, and neglects at this time, the hard gluon bremsstrahlung events. The author takes $b \rightarrow c+X$ as the b-decay mode and assumes all τs and heavy hadrons decay within the resolution of the detector so that only light hadrons and leptons are detected. Allowing all these decays to occur, the author then computes the expected front-back asymmetry of negatively charged particles weighted with z^n for $z \geq 0.0175$, where $n=0.5, 1, \ldots, 7, 10$, and z is the light-cone momentum fraction. It is found, for example, that such an asymmetry is $\sim 5\%$ for $n=2$ for $\sin^2 \theta_W=0.236$ and $\Lambda_{QCD}=0.34$ GeV. In other words, due to the large number of charge particles produced per event, this SU(2)×U(1) charge asymmetry may be accessible experimentally in $e^+e^- \rightarrow X$ already at PEP and PETRA energies. (19 refs.)

105660 Signals for supersymmetric particles in three-jet events for e^+e^- annihilations. M.J.Herrero, C.Lopez, F.J.Yundurain (Dept. de Fisica Teorica, Univ. Autonoma de Madrid, Madrid, Spain).
Phys. Lett. B (Netherlands), vol.127B, no.6, p.463-6 (11 Aug. 1983).
The authors discuss the e^+e^- production of three jets with supersymmetric particles, $\phi\bar{q}\lambda$ and $\phi^*\phi g$. Formulas for the cross sections are given. They find that, if the ϕ, λ are reasonably light, the signal to background ratio makes it possible that supersymmetry jets be observed at LEP-like energies. (9 refs.)

Hadron and jet production at collider energies in perturbative QCD ....See Entry 105575

Local charge compensation in the quark-cascade jet-production model ....See Entry 105604

Single-particle spectra in bootstrap model based on dual-topological-unitarization diagrams ....See Entry 105605

Role of the production of a pseudoscalar meson with an e^+e^--pair in e^+e^- collisions. ....See Entry 105609

Precise measurement of the tau lifetime ....See Entry 105632

13.75 HADRON-INDUCED LOW- AND INTERMEDIATE-ENERGY REACTIONS AND SCATTERING, ENERGY ≤ 10 GEV

(for higher energies, see 13.85)

13.75C Nucleon-nucleon interactions, including antinucleon, deuteron, etc. (energy ≤ 10 GeV)

(for N-N interactions in nuclei, see 21.30)

105661 Energy variation of the analyzing power in the reaction $p_{pol}+p \rightarrow d+\pi^+$. A.Saha, K.K.Seth, D.Kielczewska, S.Iversen, M.Kaletka, D.Barlow, D.Smith (Northwestern Univ., Evanston, IL, USA).
Phys. Rev. Lett. (USA), vol.51, no.9, p.759-62 (29 Aug. 1983).
Precision measurements of the analyzing powers for the reaction $p_{pol}+p \rightarrow d+\pi^+$ have been made at $\simeq 550$, 600, 650, 700, and 800 MeV. The data have been analyzed in terms of Legendre polynomials. It is found that excitation functions for both even and odd Legendre coefficients exhibit very similar resonant behaviors. It is concluded that the triplet amplitudes are as strongly dominated by the $\Delta(1232)$ as the well-known singlet amplitude, ${}^1D_2$, and that the data to not exhibit any anomalous behavior suggestive of dibaryon resonances. (14 refs.)

105662 Structures revealed in the neutron-proton mass spectrum in the deuteron break-up reaction. T.Siemiarczuk, J.Stepaniak, P.Zielinski (High Energy Phys. Lab., Inst. for Nuclear Res., Warsaw, Poland).
Phys. Lett. B (Netherlands), vol.128B, no.5, p.367-70 (1 Sept. 1983).
A sample of 'non-spectator' events in the $dp \rightarrow (pn)\,p$ break-up reaction at 3.3 GeV/c deuteron momentum is studied using films from 1 m hydrogen bubble chamber. The effective mass distribution of two nucleons from the deuteron break-up exhibits enhancements near the sum of neutron and proton masses and at $M_{pn}=2020$ and 2130 MeV. (25 refs.)

105663 The measurement of K_{NN} and K_{LL} in $\vec{p}p \rightarrow \vec{n}X$ at 800 MeV. G.Glass, T.S.Bhatia, J.C.Hiebert, L.C.Northcliffe, W.B.Tippens, B.J.VerWest (Texas A&M Univ., College Station, TX, USA), C.L.Hollas, C.R.Newsom, R.D.Ransome, P.J.Riley, G.P.Pepin, B.E.Bonner, J.E.Simmons.
Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.27-30 (15 Sept. 1983).
The spin-transfer parameters K_{NN} and K_{LL} have been measured for $\vec{p}p \rightarrow \vec{n}X$ at 0° and 800 MeV for neutron momenta between 700 and 1200 MeV/c. Peak values of K_{NN} and K_{LL} are -0.30 ± 0.05 and -0.5 ± 0.1 respectively. These results are in substantial disagreement with VerWest's field theoretic model. (10 refs.)

105664 Nucleon-nucleon inelasticities below 1000 MeV. J.H.Gruben, B.J.VerWest (Phys. Dept., Texas A&M Univ., College Station, TX, USA).
Phys. Rev. C (USA), vol.28, no.2, p.836-47 (Aug. 1983).
NN inelasticities are determined from a helicity partial-wave decomposition of a peripheral model for $NN \rightarrow NN\pi$. The helicity partial-wave formalism is presented for the reaction $NN \rightarrow NN\pi$ and the relation between partial-wave helicity amplitudes and NN partial-wave reaction cross sections is derived. Partial-wave cross sections are projected out of the pion- and rho-exchange diagrams with NN and NΔ intermediate states. Below 1000 MeV one obtains significant contributions to the total cross section from many isospin one partial wave while isospin zero inelasticities are non-negligible only for $J=1$. Large ${}^1D_2$ and ${}^3F_3$ inelasticities originate in these first-order Born-approximation terms for $NN \rightarrow NN\pi$ which have no resonance behavior in the NN system. The effects of omitting rho exchange and form factors from the model are studied and determined to be small for $L \gtrsim 3$. Comparisons are made with other calculations of NN inelasticities and show qualitative agreement. (14 refs.)

105665 Inclusive inelastic reaction $np \rightarrow pX$ at 795 MeV. G.Glass, M.Jain, L.C.Northcliffe (Texas A&M Univ., College Station, TX, USA), C.L.Hollas, C.R.Newsom, P.J.Riley, B.E.Bonner, J.E.Simmons.
Phys. Rev. D (USA), vol.28, no.5, p.1045-9 (1 Sept. 1983).
The inclusive reaction $np \rightarrow pX$, where X includes a pion, has been studied at 795 MeV with measurements of the cross section $d^2\sigma/dp\,d\Omega$. Proton momentum spectra were measured for laboratory angles between 0° and 31°. These angles cover the full forward hemisphere in the center-of-mass system and give, with the use of symmetry assumptions, a value for the total reaction cross section, $\rho^R=11.0 \pm 0.8$ mb, exclusive of the $np \rightarrow d\pi^0$ reaction. The data are also presented as measurements of the cross section $d^2\sigma/dt\,dM$, where t is the four-momentum transfer squared and M is the invariant missing mass. The results are compared with a model calculation of one-pion exchange that includes ρ and ω exchange. The t dependence is also discussed in terms of a statistical model. (16 refs.)

105666 Amplitude analysis of elastic p-p scattering at 6 GeV/c at all t's. N.Ghahramany (Dept. of Phys. & Inst. of Theoretical Sci., Univ. of Oregon, Eugene, OR, USA), G.R.Goldstein, M.J.Moravcsik.
Phys. Rev. D (USA), vol.28, no.5, p.1086-93 (1 Sept. 1983).
The extensive set of polarization data obtained at the Argonne Zero Gradient Synchrotron for elastic proton-proton scattering at 6 GeV/c at a full set of values of t is used to determine the five complex reaction amplitudes, using the optimal formalism. The determination is easiest in the transversity formalism, and from that the 'planar' amplitudes (including the helicity amplitudes) are obtained. A complete determination is made at 20 different values of t, from -0.1 to -1.9 (GeV/c)^2, using data interpolated in t. In addition, a less complete set of data permits the determination of the five magnitudes (but not of the four phases) in the range from $t=-1.0$ to $t=-2.0$ (GeV/c)^2. The magnitudes of the five amplitudes can be obtained without any ambiguity, but for the four relative phases several distinct solutions exist, one of which is selected on the basis of continuity in t and minimum χ^2. There continues to be evidence that in the planar system in which the orientation axes are 90° from the helicity axes, all amplitudes tend to be either pure real or pure imaginary. (5 refs.)

$\Delta B=2$ transitions ....See Entry 105498

Quark bags and the NN interaction ....See Entry 105588

13.75G Pion-baryon interactions (energy ≤ 10 GeV)

105667 Energy-dependent partial-wave analysis of the $\pi^+d \rightarrow pp$ reaction in the region $\sqrt{s}=2.09$-2.42 GeV. A.V.Kravtsov, M.G.Ryskin, I.I.Strakovsky (Leningrad Nuclear Phys., Inst., Leningrad, USSR).
J. Phys. G (GB), vol.9, no.9, p.L187-90 (Sept. 1983).
A satisfactory description of available experimental data (1000 points) for the $\pi^+d \rightarrow pp$ process was obtained using a model including ${}^3P_1$, ${}^1D_2$ and ${}^3F_3$ diproton resonances in the $I=1$ channel. (11 refs.)

105668 Measurement of $\pi^-p \rightarrow ne^+e^-$ at 300 MeV/c and a search for scalar and vector bosons heavier than the π^0. C.M.Hoffman, J.S.Frank, R.E.Mischke, D.C.Moir, J.S.Sarracino, P.A.Thompson (Los Alamos Nat. Lab., Los Alamos, NM, USA), M.A.Schardt.
Phys. Rev. D (USA), vol.28, no.3, p.660-2 (1 Aug. 1983).
The authors report the results of an experimental study of the reaction $\pi^-p \rightarrow ne^+e^-$ at 300 MeV/c over the range of e^+e^- effective mass from 140 to 160 MeV/c^2. The observed number of events is only one quarter of that expected from a calculation of inverse pion electroproduction. They see no evidence for the production of light Higgs bosons or any other particle that decays into e^+e^- in this mass region. (11 refs.)

105669 Amplitudes of the $\pi d \rightarrow NN$ process. A.A.Zayats.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1138-41 (Aug. 1983). In Russian.
A general analysis is performed for the $\pi d \rightarrow NN$ process. The treatment involves various amplitudes (invariant, helical, multipole and CMS amplitudes). Relations between the amplitudes and their properties are studied. (14 refs.)

13.75J Kaon-baryon interactions (energy ≤ 10 GeV)

105670 Existence of Ξ resonances above 2 GeV. C.M.Jenkins, J.R.Albright, R.N.Diamond, H.Fenker, J.H.Goldman, S.Hagopian, V.Hagopian, W.Morris (Florida State Univ., Tallahassee, FL, USA), L.Kirsch, R.Poster, P.Schmidt, S.U.Chung, R.C.Fernow, H.Kirk, S.D.Protopopescu, D.P.Weygand, B.T.Meadows, Z.Bar-Yam, J.Dowd, W.Kern, M.Winik.
Phys. Rev. Lett. (USA), vol.51, no.11, p.951-4 (12 Sept. 1983).
Ξ^{*-} production was studied in the reaction $K^-+p \rightarrow K^+_{slow}+X^-$ at 5 GeV/c. The slow K^+ was electronically detected, while the X^- was observed as a missing mass, thus allowing for observation of all Ξ^* independent of decay mode. The observed Ξ states were $\Xi(1320)$, $\Xi(1530)$, $\Xi(1820)$, $\Xi(2030)$, $\Xi(2250)$, $\Xi(2370)$, and $\Xi(2500)$. These data establish and confirm the existence of $\Xi(2250)$ and indicate a peculiar production-cross-section behavior for the $\Xi^*(2370)$. (12 refs.)

13.85 HADRON-INDUCED HIGH- AND SUPER-HIGH-ENERGY INTERACTIONS, ENERGY > 10 GEV

(for low energies, see 13.75)

Anomalous dimensional quark counting of hard processes in QCD ....See Entry 105555

13.85D Elastic scattering (energy > 10 GeV)

105671 Proton-antiproton elastic scattering at four-momentum transfer up to 0.5 GeV^2 at the CERN SPS collider. R.Battiston (Istituto di Fisica, Univ. di Pisa, Pisa, Italy), M.Bozzo, P.L.Braccini, F.Carbonara, R.Carrara, R.Castaldi, F.Cervelli, G.Chiefari, E.Drago, M.Haguenauer, B.Koene, G.Matthaie, L.Merola, M.Napolitano, V.Palladino, G.Sanguinetti, G.Sciacca, G.Sette, R.van Swol, J.Timmermans, C.Vannini, J.Velasco, F.Visco.
Phys. Lett. B (Netherlands), vol.127B, no.6, p.472-5 (11 Aug. 1983).
Proton-antiproton elastic scattering was measured at a centre of mass energy $\sqrt{s}=540$ GeV. In the four-momentum transfer range $0.21<-t<0.50$ GeV^2 the t-distribution of about 7000 events is well represented by the exponential shape $\exp(bt)$ with slope parameter $b=13.7 \pm 0.3$ GeV^{-2}. A new measurement of the slope for $-t<0.19$ GeV^2 confirms the earlier result, giving evidence for a change of slope of about 4 GeV^{-2} around $-t \approx 0.15$ GeV^2. (7 refs.)

105672 Elastic and total cross section measurement at the CERN proton-antiproton collider. G.Arnison, A.Astbury (Rutherford Appleton Lab., Chilton, England), B.Aubert, C.Bacci, G.Bauer, A.Bezaguet, R.Bock, R.Bossart, J.Bosser, T.J.V.Bowcock, M.Calvetti, T.Carroll, P.Catz, P.Cennini, S.Centro, F.Ceradini, S.Cittolin, D.Cline, C.Cochet, J.Colas, M.Corden, D.Dallman, M.DeBeer, M.Della Negra, M.Demoulin, D.Denegri, R.Desalvo, A.Diciaccio, D.DiBitonto, L.Dobrzynski, J.Dowell, M.Edwards, K.Eggert, E.Eisenhandler, N.Ellis, P.Erhard, L.Evans, H.Faissner, G.Fontaine, R.Frey, R.Fruhwirth, J.Garvey, S.Geer, C.Ghesquiere, P.Ghez, K.Giboni, W.R.Gibson, Y.Giraud-Heraud, A.Givernaud, A.Gonidec, G.Grayer, P.Gutierrez, T.Hansl-Kozanecka, W.J.Haynes, L.O.Hertzberger, C.Hodges, D.Hoffmann, H.Hoffmann, G.von Holtey, D.J.Holthuizen, R.J.Homer, A.Honma, W.Jank, G.Jorat, P.I.P.Kalmus, V.Karimaki, R.Keeler, I.Kenyon, A.Kernan, R.Kinnunen, H.Kowalski, W.Kozanecki, D.Kryn, F.Lacava, J.-P.Laugier, J.-P.Lees , H.Lehmann, R.Leuchs, A.Leveque, D.Linglin, E.Locci, M.Loret, J.-J.Malosse, T.Markiewicz, G.Maurin, T.McMahon, J.-P.Mendiburu, M.-N.Minard, K.Morgan, M.Moricca, H.Muirhead, F.Muller, A.K.Nandi, L.Naumann, A.Norton, A.Orkin-Lecourtois, L.Paoluzzi, G.Piano Mortari, M.Pimia, A.Placci, M.Rabany, E.Radermacher, J.Ransdell, H.Reithler, J.Rich, J.-P.Revol, M.Rijssenbeek, C.Roberts, J.Rohlf, P.Rossi, C.Rubbia, B.Sadoulet, G.Sajot, G.Salvi, G.Salvini, J.Sass, J.Saudraix, A.Savoy-Navarro, D.Schinzel, W.Scott, T.P.Shah, P.Sievers, D.Smith, M.Spiro, J.Strauss, K.Sumorok, F.Szoncso, C.Tao, G.Thompson, J.Timmer, E.Tscheslog, J.Tuominiemi, J.-P.Vialle, G.Vismara, J.Vrana, V.Vuillemin, H.D.Wahl, P.Watkins, J.Wilson, G.Y.Xie, M.Yvert, E.Zurfluh.
Phys. Lett. B (Netherlands), vol.128B, no.5, p.336-42 (1 Sept. 1983).
Proton-antiproton elastic scattering at CM energy 540 GeV has been studied in the t-range $0.04 < -t < 0.45$ GeV^2. The data are well fitted by the form $\exp(bt)$ with $b=17.1 \pm 1.0$ GeV^{-2} for $|t|=0.04$-0.18 GeV^2 and $b=13.7 \pm 0.2 \pm 0.2$ GeV^{-2} for $|t|=0.21$-0.45 GeV^2. A luminosity measurement combined with the optical theorem gives $\sigma_{tot}=67.6 \pm 5.9 \pm 2.7$ mb and $\sigma_{el}/\sigma_{tot}=0.209 \pm 0.018 \pm 0.008$. (18 refs.)

105673 Comparison of small-angle $p\bar{p}$ and pp elastic scattering at the CERN intersecting storage rings. N.Amos, M.M.Block (Northwestern Univ., Evanston, IL, USA), G.J.Bobbink, M.Botje, D.Favart, C.Leroy, F.Linde, P.Lipnik, J.-P.Matheys, D.Miller, K.Potter, S.Shukla, C.Vander Velde-Wilquet, S.Zucchelli.
Phys. Lett. B (Netherlands), vol.128B, no.5, p.343-8 (1 Sept. 1983).
Antiproton-proton and proton-proton small-angle elastic scattering have been measured for centre-of-mass energies $\sqrt{s}=30.7$ and 62.5 GeV at the CERN Intersecting Storage Rings (ISR). Antiproton-proton total cross sections are obtained using the optical theorem. The measurement of the Coulomb scattering and its interference with the nuclear scattering allows a determination of the ratio of the real-to-imaginary part of the forward nuclear scattering amplitude. Also presented are measurements for the nuclear slope parameter at $\sqrt{s}=62.5$ GeV. The new results reinforce the conclusions drawn recently from measurements at $\sqrt{s}=52.8$ GeV. In particular, the $p\bar{p}$ total cross section is rising at ISR energies and should continue to rise well beyond these energies. (25 refs.)

105674 Elastic scattering and total cross section at the CERN collider. R.Battiston, M.Bozzo, P.L.Braccini, F.Carbonara, R.Carrara, R.Castaldi, F.Cervelli, G.Chiefari, E.Drago, M.Haguenauer, B.Koene, G.Matthiae, L.Merola, M.Napolitano, V.Palladino, G.Sanguinetti, G.Sciacca, G.Sette, R.van Swol, J.Timmermans, C.Vannini, J.Velasco, F.Visco.
Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.237-50
In the 1981 Collider run, proton-antiproton elastic scattering was measured in the range $0.05 < -t < 0.19$ GeV^2. The t-distribution could be fitted by the exponential exp (bt) with slope parameter $b=17.2 \pm 1.0$ GeV^{-2}. Combining this data with the measurement of the inelastic interaction rate the total cross-section was found to be $\sigma_t=66 \pm 7$ mb. The ratio σ_{el}/σ_t is 0.20 ± 0.02. In the 1982 run elastic scattering was measured in the range $0.21 < -t < 0.5$ GeV^2. The t-distribution is well described by the slope parameter $b=13.6 \pm 0.5$ GeV^{-2}. A marked variation of the slope parameter with t takes place around $-t=0.15$ GeV^2, an effect similar to that previously observed at the ISR. Measurement of inelastic scattering are also discussed. (13 refs.)

105675 Measurement of small-angle $p\bar{p}$ and pp elastic scattering at the CERN intersecting storage rings. D.Favart (Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium).
Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.270-81
The small-angle elastic scattering of protons with protons and antiprotons has been measured at 52.8 and 30.4 GeV center-of-mass energy. Using the known total cross-section for pp scattering, a simultaneous fit to the $p\bar{p}$ and pp differential cross sections allows one to determine the difference between the $p\bar{p}$ and pp total cross-sections and the ratio of the real-to-imaginary part of the pp and $p\bar{p}$ forward nuclear scattering amplitudes at both energies. In addition, the nuclear slope parameter at low momentum transfer is obtained for pp and $p\bar{p}$ at 52.8 GeV. (17 refs.)

105676 Small angle elastic scattering at the CERN proton-antiproton collider. G.Arnison, A.Astbury (Rutherford Appleton Lab., Didcot, England), B.Aubert, C.Bacci, G.Bauer, A.Bezaguet, R.Bock, R.Bossart, J.Bosser, T.J.V.Bowcock, M.Calvetti, T.Carroll, P.Catz, P.Cennini, S.Centro, F.Ceradini, S.Cittolin, D.Cline, C.Cochet, J.Colas, M.Corden, D.Dallman, M.DeBeer, M.Della Negra, M.Demoulin, D.Denegri, R.Desalvo, A.Di Ciaccio, D.DiBitonto, L.Dobrzynski, J.Dowell, M.Edwards, K.Eggert, E.Eisenhandler, N.Ellis, P.Erhard, H.Faissner, G.Fontaine, R.Frey, R.Fruhwirth, J.Garvey, S.Geer, C.Ghesquiere, P.Ghez, K.L.Giboni, W.R.Gibson, Y.Giraud-Heraud, A.Givernaud, A.Gonidec, G.Grayer, P.Gutierrez, T.Hansl-Kozanecka, W.J.Haynes, L.O.Hertzberger, C.Hodges, D.Hoffmann, H.Hoffmann, D.J.Holthuizen, R.J.Homer, A.Honma, W.Jank, G.Jorat, P.I.P.Kalmus, V.Karimaki, R.Keeler, I.Kenyon, A.Kernan, R.Kinnunen, H.Kowalski, W.Kozanecki, D.Kryn, F.Lacava, J.-P.Laugier, J.-P.Lees, H.Lehmann, R.Leuchs, A.Leveque, D.Linglin, E.Locci, M.Loret, J.-J.Malosse, T.Markiewicz, G.Maurin, T.McMahon, J.-P.Mendiburu, M.-N.Minard, K.Morgan, M.Moricca, H.Muirhead, F.Muller, A.K.Nandi, L.Naumann, A.Norton, A.Orkin-Lecourtois, L.Paoluzi, G.Piano Mortari, M.Pimia, A.Placci, E.Radermacher, J.Ransdell, H.Reithler, J.-P.Revol, J.Rich, M.Rijssenbeek, C.Roberts, J.Rohlf, P.Rossi, C.Rubbia, B.Sadoulet, G.Sajot, G.Salvi, G.Salvini, J.Sass, J.Saudraix, A.Savoy-Navarro, D.Schinzel, W.Scott, T.P.Shah, M.Spiro, J.Strauss, K.Sumorok, F.Szoncso, D.Smith, C.Tao, G.Thompson, J.Timmer, E.Tscheslog, J.Tuominiemi, J.-P.Vialle, J.Vrana, V.Vuillemin, H.D.Wahl, P.Watkins, J.Wilson, G.Y.Xie, M.Yvert, E.Zurfluh.
Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.293-312
Proton-antiproton elastic scattering at a centre of mass energy $\sqrt{s}=540$ GeV has been studied at low momentum transfer. The measured value of the logarithmic slope of the differential elastic cross-section, $b=17.1 \pm 0.9$ GeV^{-2} for $0.04 \leq |t| \leq 0.18$ GeV^2, $b=12.9 \pm 0.3$ GeV^{-2} for $0.19 \leq |t| \leq 0.42$ GeV^2 confirms the previous evidence from the UA1 and UA4 collaborations for an increase at small t. A preliminary estimate of the proton-antiproton total cross-section shows an increase of about 50% from ISR to collider energy. (12 refs.)

Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings ... .See Entry 105026

13.85H Inelastic scattering, many-particle final states (energy>10GeV)

105677 Experimental indications for a 2^{++} non-$\bar{q}q$ object. V.Chabaud, J.De Groot, B.Hyams, T.Papadopoulou (CERN, Geneva, Switzerland), L.Gorlich, B.Niczyporuk, M.Rozanska, K.Rybicki, J.Turnau, M.Cerrada, H.Dietl, J.Gallivan, B.Gottschalk, E.Lorenz, G.Lutjens, G.Lutz, W.Manner, R.Richter, U.Stierlin, B.Stringfellow.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.1, p.1-14 (15 Aug. 1983).
Using high-statistics data from the $\pi p \rightarrow \pi\pi n$ reaction, the authors have remade a model-independent partial-wave analysis in finer mass bins at low four-momentum transfer. The Breit-Wigner fits to the leading waves yield $m_p=(777.4 \pm 2.0)$ MeV and $\Gamma_p=(160_{-4.0}^{+4.1})$ MeV, as well as $m_f=(1273.3 \pm 2.3)$ MeV, $\Gamma_f=(179.2_{-6.6}^{+69})$ MeV and $x_f=(84.9 \pm 2.5)\%$. The last two parameters yield $\Gamma(f \rightarrow \pi\pi)=(152.1 \pm 7.3)$ MeV, a value which is higher than the one resulting from fits to the decays of the $J^{PC}=2^{++}$ mesons. On the basis of a smaller discrepancy. Rosner (1981) has speculated about a non-$\bar{q}q$ admixture (possibly gg) in the f(1270), i.e. $|f(1270)> = |q\bar{q}> \cos\theta + |gg> \sin\theta$. Repeating his fits with more recent data they obtain a considerably more significant effect with $\sin^2\theta=0.18 \pm 0.04$. This sets a mass of an orthogonal state $|f_T> = -|q\bar{q}> \sin\theta + |gg> \cos\theta$ between 1420 and 1620 MeV. The f_T could be identified with a 1440 MeV state seen in some $\bar{K}K$ experiments, A_1 exchange being a possible production mechanism. A fit to the polarized target K^+K^- data at ~18 GeV/c yields $m(f_T)=(1445_{-19}^{+20})$ MeV and $\Gamma(f_T)=(81_{-25}^{+52})$ MeV. (31 refs.)

105678 Multiplicity distributions in $\alpha\alpha$ and αp collisions at the CERN ISR. W.Bell (CERN, Geneva, Switzerland), K.Braune, G.Claesson, D.Drijard, M.A.Faessler, H.G.Fischer, H.Frehse, R.W.Frey, S.Garpman, W.Geist, C.Gruhn, P.C.Gugelot, P.Hanke, M.Heiden, W.Herr, P.G.Innocenti, T.J.Ketel, E.E.Kluge, I.Lund, G.Mornacchi, T.Nakada, I.Otterlund, M.Panter, B.Povh, A.Putzer, K.Rauschnabel, M.Rensch, E.Stenlund, T.J.M.Symons, R.Szwed, O.Ullaland, T.Walcher, M.Wunsch.
Phys. Lett. B (Netherlands), vol.128B, no.5, p.349-53 (1 Sept. 1983).
The multiplicities of charged secondaries from inelastic αp and $\alpha\alpha$ collisions have been measured using the Split-Field Magnet detector at the CERN Intersecting Storage Rings. Corrected multiplicity distributions for $\alpha\alpha$ and αp interactions are compared with those for pp interactions and with theoretical predictions. (18 refs.)

105679 Search for Λp states in the baryon-exchange reaction $pp \rightarrow \Lambda p K^+$ at 11.75 GeV/c. M.W.Arenton, D.S.Ayres, R.Diebold, E.N.May, L.Nodulman, J.R.Sauer, A.B.Wicklund (Argonne Nat. Lab., Argonne, IL, USA), E.C.Swallow.
Phys. Rev. D (USA), vol.28, no.3, p.657-9 (1 Aug. 1983).
The authors have obtained 1400 events of the baryon-exchange reaction $pp \rightarrow \Lambda p K^+$ using the ANL Zero Gradient Synchrotron 11.75-GeV/c polarised proton beam and the effective-mass spectrometer. A search for enhancements in the Λp mass spectrum has been made. No enhancements are observed; in particular, the narrow Λp enhancement at 2.13 GeV seen in $K^- d \rightarrow \Lambda p \pi^-$ is not observed. They establish limits on the production of narrow states of ~10 nb. Also, 100000 events of the forward reaction $pp \rightarrow \Lambda K^+ p$ were examined and no narrow Λp enhancements are seen. (9 refs.)

13.85K Inclusive reactions, including total cross sections, (energy > 10 GeV)

105680 Inclusive meson resonance production in K^+p interactions at 70 GeV/c. M.Barth, C.De Clercq, E.A.De Wolf, J.J.Dumont, D.P.Johnson, J.Lemonne, P.Theocharpoulos (Inter-Univ. Inst. for High Energies, Brussels, Belgium), H.Drevermann, Y.Goldschmidt-Clermont, G.Harigel, C.Milstene, J.P.Porte, R.T.Ross, S.Squarcia, G.Vassiliadis, C.Caso, R.Contri, F.Fontanelli, R.Monge, U.Trevisan, J.F.Baland, J.Beaufays, J.Hanton, F.Grard, L.Gatignon, P.A.van der Poel, D.J.Schotanus, A.Stergiou, R.T.van de Walle, A.A.Borovikov, P.V.Chliapnikov, A.B.Fenyuk, I.A.Gritsaenki, O.V.Kasian, G.N.Khromova, V.M.Kubic, S.B.Lugovsky, V.I.Nikolaenko, Y.L.Petrovikh, V.M.Ronjin, V.A.Uvarov, A.P.Vorobjev.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.2, p.296-330 (22 Aug. 1983).
A detailed analysis of inclusive $K^{*+,0}(890)$, $\bar{K}^{*-,0}(890)$, $K^{*+,0}(1420)$, ϕ, ρ^0, and f(1270) resonance production in K^+p interactions at 70 GeV/c is presented. The data are compared with the results available at lower energies and with quark-parton model predictions. The main finding is that fast $K^{*+,0}(890)$, ϕ and ρ^0 production can be interpreted in terms of either single $\bar{s}$ or single u kaon valence quark recombination and thus may provide information about the kaon structure function. It appears that the kaon valence quarks carry about 50% of the K^+ momentum, with the strange $\bar{s}$-quark carrying approximately twice the momentum of the u-quark. (35 refs.)

105681 Infrared properties of two-loop, initial state spectator interactions in the Drell-Yan process. C.A.Nelson (Dept. of Phys., State Univ. of New York, Binghamton, NY, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.2, p.366-80 (22 Aug. 1983).
The author uses the light-cone axial gauge of proper-time ordered perturbation theory and studies the soft-IR properties of the two-loop virtuals' diagrams considered by Bodwin, Brodsky and Lepage (1981) from $\pi\pi \rightarrow \mu^+\mu^- + X$. It is shown that although the systematic summation over all possible spectator interactions removes the outside soft-IR divergences in the non-overlapping ladder Glauber diagrams, unphysical inside soft-IR divergences persist. So, in the light-cone axial gauge the on-shell Glauber region is not a gauge invariant concept which can be physically isolated from radiative corrections which non-trivially involve other diagrammatic regions. Due to gauge invariance it can be potentially misleading in eikonal phenomenologies based on perturbative QCD to assume an ad hoc inside soft-IR cutoff in analyzing possible non-abelian effects in multiple scatterings involving spectators. (16 refs.)

105682 On the scaling behaviour of multiplicity distribution at $\sqrt{s}=540$ GeV and the three-fireball model. Cai Xu, Liu Lian-Sou (Inst. fur Theoretische Phys., Freie Univ. Berlin, Berlin, Germany).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.14, p.495-500 (6 Aug. 1983).
The discrepancy between the $p\bar{p}$ Collider data and the nondiffractive scaling distribution for lower energies is analysed. It is shown that this discrepancy

can readily be explained in the framework of the three-fireball model. (9 refs.)

105683 Prompt muon-neutrino production in a 400-GeV proton beam-dump experiment. R.C.Ball, C.T.Coffin, H.R.Gustafson, L.W.Jones, M.J.Longo, T.J.Roberts, B.P.Roe, E.Wang (Univ. of Michigan, Ann Arbor, MI, USA), C.Castoldi, G.Conforto, M.B.Crisler, J.S.Hoftun, T.Y.Ling, T.A.Romanowski, J.T.Volk, S.Childress, M.E.Duffy, G.K.Fanourakis, R.J.Loveless, D.D.Reeder, D.L.Schumann, E.S.Smith.

Phys. Rev. Lett. (USA), vol.51, no.9, p.743-6 (29 Aug. 1983).

The prompt ν_μ and $\bar{\nu}_\mu$ flux produced by 400-GeV protons has been measured with a detector located 56 m from a tungsten target. The cross section for the hadronic production of charm is determined to be $27\pm4\pm5$ μb/nucleon subject to the following assumptions: $D\bar{D}$ production only; A^1 variation of cross section; and a parameterization of the D-production cross section which is $(1-x)^4 \exp(-2m_\perp)$. The ratio of prompt $\bar{\nu}_\mu$ flux to prompt ν_μ is measured to be $1.12\pm0.24\pm0.17$, consistent with predominantly $D\bar{D}$ production. (17 refs.)

105684 Nuclear enhancement of π^0 and η mesons produced as large transverse momenta. J.Povlis (Fermilab, Batavia, IL, USA), J.Biel, C.Bromberg, B.Brown, C.Chandlee, S.Cihangir, S.R.W.Cooper, T.Ferbel, D.Garelick, G.Glass, M.Glaubman, S.-R.Han, K.Heller, S.Hossain, J.Huston, A.Jonckheere, J.LeBritton, R.A.Lewis, F.Lobkowicz, M.McLaughlin, M.Marshak, C.A.Nelson,Jr., E.Peterson, E.Pothier, K.Ruddick, M.Shupe, P.Slattery, G.A.Smith.

Phys. Rev. Lett. (USA), vol.51, no.11, p.967-70 (12 Sept. 1983).

The authors have measured the large-p_T inclusive cross sections for π^0 and η production near 90° in the center-of-mass system in 200-GeV/c π^+ and proton collisions with beryllium, carbon, and aluminum targets. The cross section for both π^0 and η mesons rises with increasing nucleon number (A) of the target nucleus as A^α, with $\alpha>1$. The ratio of the π^0 yield in pA collisions to that in π^+A collisions decreases with increasing p_T. (9 refs.)

105685 Inclusive production of direct photons in 200-GeV/c collisions. M.McLaughlin (Fermilab, Batavia, IL, USA), J.Biel, C.Bromberg, B.Brown, C.Chandlee, S.Cihangir, S.R.W.Cooper, T.Ferbel, D.Garelick, G.Glass, M.Glaubman, S.-R.Han, K.Heller, S.Hossain, J.Huston, A.Jonckheere, J.LeBritton, R.A.Lewis, F.Lobkowicz, M.Marshak, C.A.Nelson,Jr., E.Peterson, E.Pothier, J.Povlis, K.Ruddick, M.Shupe, P.Slattery, G.A.Smith.

Phys. Rev. Lett. (USA), vol.51, no.11, p.971-4 (12 Sept. 1983).

The authors have measured the inclusive production of direct photons in the transverse momentum (p_T) range 2.1-5.0 GeV/c in 200-GeV/c collisions of protons and π^+ mesons on a carbon target. A significant yield of direct photons was observed for $p_T>2.5$ GeV/c. The invariant cross section for direct-photon production, when compared with measurements from the CERN intersecting storage rings, can be expressed in terms of p_T and $x_T=2p_T\sqrt{s}$ as $(42\pm14)(1-x_T)^{8.1\pm1.0}p_T{}^{-6.6\pm0.3}$ μb/GeV^2 for the c.m. energy range from $\sqrt{s}=19.4$ to 63 GeV, and for the x_T range from 0.2 to 0.5. (11 refs.)

105686 Supersymmetric decay modes of the W and single electron production in p-p̄ collisions. R.Barbeiri (Dipartimento di Fisica, Univ. di Pisa, Pisa, Italy), N.Cabibbo, L.Maiani, S.Petrarca.

Phys. Lett. B (Netherlands), vol.127B, no.6, p.458-62 (11 Aug. 1983).

Scalar electrons and scalar neutrinos may appear among the decay products of the W produced in p-p̄ collisions. Under the assumption that: (se)$\rightarrow$e+photino and (sν_e)$\rightarrow$undetected neutrals, the authors compute the contribution of the decay: W$\rightarrow$(Se)+(sν_3) to the process $p+\bar{p}\rightarrow e^\pm+$missing energy+hadrons. A numerical analysis, performed in the case m(se)=20 GeV and m(sν_3)=0, shows that a visible signal is expected in the region of the electron transverse momentum and angle which is unfavoured by conventional W decays. Related effects in Z production and decay are also discussed. (9 refs.)

105687 Soft gluon component of diphoton and dilepton transverse momentum. G.Pancheri, Y.N.Srivastava (INFN, Lab. Nazionali di Frascati, Frascati, Italy).

Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.235-9 (25 Aug. 1983).

The rise with energy in the mean transverse momentum of diphotons and dileptons produced in hadronic scattering is discussed through an expression obtained by summing soft gluons. Some numerical tests and predictions are presented. (13 refs.)

105688 The dominance of jets at large transverse energy in a full-azimuth hadron calorimeter at ISR energies. T.Akesson (CERN, Geneva, Switzerland), M.G.Albrow, S.Almehed, R.Batley, O.Benary, O.Botner, H.Boggild, H.Breuker, H.Brody, V.Burkert, R.Carosi, A.A.Carter, J.R.Carter, P.Cecil, W.E.Cleland, S.U.Chung, D.Cockerill, S.Dagan, E.Dahl-Jensen, I.Dahl-Jensen, P.Dam, G.Damgaard, S.Eidelman, W.M.Evans, C.W.Fabjan, P.Frandsen, S.Frankel, W.Frati, M.Gibson, U.Goerlach, H.Gordon, A.Hallgren, K.H.Hansen, B.Heck, V.Hedberg, J.Hiddleston, H.J.Hilke, J.Hooper, G.Jarlskog, P.Jeffreys, T.Jensen, A.Kalinovsky, G.Kesseler, T.Killian, R.Kroeger, K.Kulka, J.v.d. Lans, J.Lindsay, D.Lissauer, B.Lorstad, T.Ludlam, A.Markou, N.A.McCubbin, U.Mjornmark, W.Molzon, R.Moller, B.S.Nielsen, A.Nilsson, L.H.Olsen, Y.Oren, L.Rosselet, E.Rosso, A.Rudge, R.Schindler, I.Stumer, M.Sullivan, G.Thorstenson, E.Vella, J.Williamson, W.J.Willis, M.Winik, W.Witzeling, C.Woody, W.A.Zajc.

Phys. Lett. B (Netherlands), vol.128B, no.5, p.354-60 (1 Sept. 1983).

Events with a large transverse energy in a calorimeter with full azimuthal coverage and $|y|<0.9$ have been investigated in pp collisions at $\sqrt{s}=30$, 45, and 63 GeV. A striking change in the event structure, corresponding to a clear emergence of high-p_T jets, is observed at $\sqrt{s}=63$ and 45 GeV in the region between 25 and 35 GeV in transverse energy. At $\sqrt{s}=30$ GeV, the data extend to $E_T\sim20$ GeV, but no such change in the event structure is observed. (12 refs.)

105689 Energetic hadron jets at TeV energies. P.Carruthers, C.C.Shih (Theoretical Div., Los Alamos Nat. Lab., Los Alamos, NM, USA), Minh Duong-Van.

Phys. Rev. D (USA), vol.28, no.3, p.663-6 (1 Aug. 1983).

The authors use recently measured proton gluon distributions to revise previous QCD perturbation theory calculations of very-large-$p\perp$ π^0 and jet inclusive productions. The CERN ISR large-$p_\perp$ π^0 inclusive cross sections and new hard-jet inclusive cross sections from the CERN $\bar{p}p$ collider are well described with a common cutoff Λ and no other adjustable parameters, using the one-loop coupling parameter $\alpha(Q^2)$. Predictions are made for large-$p\perp$ π^0 production at the Fermilab collider, Tevatron I, and a hypothetical future collider of CM energy 10 or 20 TeV. As the energy increases, the gluon-gluon collisions are predicted to become more and more significant, exceeding 60% at 20-TeV energies for $p\perp$ up to 500 GeV/c. (14 refs.)

105690 $\phi\phi$ production in high-energy hadron-hadron collisions and enhancement near threshold. S.P.Misra (Inst. of Phys., Bhubaneswar, India).

Phys. Rev. D (USA), vol.28, no.5, p.1109-12 (1 Sept. 1983).

Excessive $\phi\phi$ production has been seen in $\pi p\rightarrow\phi\phi X$ and $pp\rightarrow\phi\phi X$ with an enhancement near $\phi\phi$ threshold. A lowest-order phenomenological model to interpret this as an evidence of gluon-gluon collisions appears to be consistent with data, and suggests that similar other reactions parallel to photon-photon collisions may also be looked for. (17 refs.)

105691 Physics at the CERN collider using a 'minimum bias' trigger. G.Arnison, A.Astbury (Rutherford Appleton Lab., Didcot, England), B.Aubert, C.Bacci, G.Bauer, A.Bezaguet, R.Bock, T.J.V.Bowcock, M.Calvetti, T.Carroll, P.Catz, P.Cennini, S.Centro, F.Ceradini, S.Cittolin, D.Cline, C.Cochet, J.Colas, M.Corden, D.Dallman, M.DeBeer, M.Della Negra, M.Demoulin, D.Denegri, A.Di Ciaccio, D.DiBitonto, L.Dobrzynski, J.D.Dowell, M.Edwards, K.Eggert, E.Eisenhandler, N.Ellis, P.Erhard, H.Faissner, G.Fontaine, R.Frey, R.Fruhwirth, J.Garvey, S.Geer, C.Ghesquiere, P.Ghez, K.L.Giboni, W.R.Gibson, Y.Giraud-Heraud, A.Givernaud, A.Gonidec, G.Grayer, P.Gutierrez, T.Hansl-Kozanecka, W.J.Haynes, L.O.Hertzberger, C.Hodges, D.Hoffmann, H.Hoffmann, D.J.Holthuizen, R.J.Homer, A.Honma, W.Jank, G.Jorat, P.I.P.Kalmus, V.Karimaki, R.Keeler, I.Kenyon, A.Kernan, R.Kinnunen, H.Kowalski, W.Kozanecki, D.Kryn, F.Lacava, J.-P.Laugier, J.-P.Lees, H.Lehmann, K.Leuchs, A.Leveque, D.Linglin, E.Locci, M.Loret, J.-J.Malosse, T.Markiewicz, G.Maurin, T.McMahon, J.-P.Mendiburu, M.-N.Minard, M.Moricca, H.Muirhead, F.Muller, A.K.Nandi, L.Naumann, A.Norton, A.Orkin-Lecourtois, L.Paoluzi, G.Petrucci, G.Piano Mortari, M.Pimia, A.Placci, E.Radermacher, J.Ransdell, H.Reithler, J.-P.Revol, J.Rich, M.Rijssenbeek, C.Roberts, J.Rohlf, P.Rossi, C.Rubbia, B.Sadoulet, G.Sajot, G.Salvi, G.Salvini, J.Sass, J.Saudraix, A.Savoy-Navarro, D.Schinzel, W.Scott, T.P.Shah, M.Spiro, J.Strauss, K.Sumorok, F.Szoncso, D.Smith, C.Tao, G.Thompson, J.Timmer, E.Tscheslog, J.Tuominiemi, S.Van der Meer, J.-P.Vialle, J.Vrana, V.Vuillemin, H.D.Wahl, P.Watkins, J.Wilson, G.Y.Xie, M.Yvert, E.Zurfluh.

Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.10-49

The authors present results from the CERN p̄p collider of events collected using a minimum bias trigger. The detector is briefly described and the pseudorapidity distributions, multiplicity, and KNO scaling results presented. The transverse energy distributions, correlations, and jets are discussed. (29 refs.)

105692 Inclusive charged and neutral particle production and search for relativistic particles with fractional electric charge at the CERN pp̄ collider. M.Banner, P.Bloch, F.Bonaudi, K.Borer, M.Borghini, J.-C.Chollet, A.G.Clark, C.Conta, P.Darriulat, L.Di Lella, J.Dines-Hansen, P.-A.Dorsaz, L.Fayard, M.Fraternali, D.Foideveaux, J.-M.Gaillard, D.Gildemeister, V.G.Goggi, H.Grote, B.Hahn, H.Hanni, J.R.Hansen, P.Hansen, T.Himel, V.Hungerbuhler, P.Jenni, O.Kofoed-Hansen, M.Livan, S.Loucatos, B.Madsen, P.Mani, B.Mansoulie, G.C.Mantovani, L.Mapelli, B.Merkel, M.Mermikides, R.Mollerud, B.Nilsson, C.Onions, G.Parrour, F.Pastore, H.Plothow-Besch, N.Prevot, J.-P.Repellin, A.Rothernberg, A.Roussarie, G.Sauvage, J.Schacher, J.L.Siegrist, F.Stocker, J.Teiger, V.Vercesi, H.H.Williams, H.Zaccone, W.Zeller, A.Zylberstejn.

Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.50-74

The authors present results on the production of charged and neutral particles at large angle at an energy $\sqrt{s}=540$ GeV. No evidence has been found for the existence of light relativistic quarks. (13 refs.)

105693 Review of results from the UA5 experiment. D.R.Ward (Cavendish Lab., Univ. of Cambridge, Cambridge, England).

Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.75-111

The author presents a general review of the results obtained from the UA5 streamer chamber experiment in the first year of operation of the CERN SPS-collider at $\sqrt{s}=540$ GeV. Particular emphasis is placed on recent results on particle multiplicities and on preliminary results from the latest runs of UA5 in September 1982. (21 refs.)

105694 Multiplicity correlations in p̄p-collisions at 540 GeV. G.Ekspong (Stockholm Univ., Stockholm, Sweden).

Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.112-22

Multiplicity correlations of long range in pseudorapidity are found to be stronger than at ISR energies. The analysis gives no evidence for intrinsic long range correlations. The data are consistent with a physical picture involving random emission of small clusters along the rapidity plateau. The average cluster size is about 2 charged particles, the same as at ISR energies. (4 refs.)

105695 Experimental observation of isolated large transverse energy electrons with associated missing energy at $\sqrt{s}=540$ GeV. G.Arnison, A.Astbury (Rutherford Appleton Lab., Didcot, England), B.Aubert, C.Bacci, G.Bauer, A.Bezaguet, R.Bock, T.J.V.Bowcock, M.Calvetti, T.Carroll, P.Catz, P.Cennini, S.Centro, F.Ceradini, S.Cittolin, D.Cline, C.Cochet, J.Colas, M.Corden, D.Dallman, M.DeBeer, M.Della Negra, M.Demoulin, D.Denegri, A.Di Ciaccio, D.DiBitonto, L.Dobrzynski, J.D.Dowell, M.Edwards, K.Eggert, E.Eisenhandler, N.Ellis, P.Erhard, H.Faissner, G.Fontaine, R.Frey, R.Fruhwirth, J.Garvey, S.Geer, C.Ghesquiere, P.Ghez, K.L.Giboni, W.R.Gibson, Y.Giraud-Heraud, A.Givernaud, A.Gonidec, G.Grayer, P.Gutierrez, T.Hansl-Kozanecka, W.J.Haynes, L.O.Hertzberger, C.Hodges, D.Hoffmann, H.Hoffmann, D.J.Holthuizen, R.J.Homer, A.Honma, W.Jank, G.Jorat, P.I.P.Kalmus, V.Karimaki, R.Keeler, I.Kenyon, A.Kernan, R.Kinnunen, H.Kowalski, W.Kozanecki, D.Kryn, F.Lacava, J.-P.Laugier, J.-P.Lees, H.Lehmann, K.Leuchs, A.Leveque, D.Linglin, E.Locci, M.Loret, J.-J.Malosse, T.Markiewicz, G.Maurin, T.McMahon, J.-P.Mendiburu, M.-N.Minard, M.Moricca, H.Muirhead, F.Muller, A.K.Nandi, L.Naumann, A.Norton, A.Orkin-Lacourtois, L.Paoluzi, G.Petrucci, G.Piano Mortari, M.Pimia, A.Placci, E.Radermacher, J.Ransdell, H.Reithler, J.-P.Revol, J.Rich, M.Rijssenbeek, C.Roberts, J.Rohlf, P.Rossi, C.Rubbia, B.Sadoulet, G.Sajot, G.Salvi, G.Salvini, J.Sass, J.Saudraix, A.Savoy-Navarro, D.Schinzel, W.Scott, T.P.Shah, M.Spiro, J.Strauss, K.Sumorok, F.Szoncso, D.Smith, C.Tao, G.Thompson, J.Timmer, E.Tscheslog, J.Touminiemi, S.Van der Meer, J.-P.Vialle, J.Vrana, V.Vuillemin, H.D.Wahl, P.Watkins, J.Wilson, G.Y.Xie, M.Yvert, E.Zurfluh.

Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.123-90

Reports the results of two searches made on data recorded at the CERN SPS p̄p Collider: one for isolated large-E_T electrons, the other for large-E_T neutrinos using the technique of missing transverse energy. Both searches converge to the same events, which have the signature of a two-body decay of a particle mass in excess of 70 GeV/c^2. The topology as well as the number of events fits well the hypothesis that they are produced by the process $\bar{p}p\rightarrow W^\pm X$, with $W^\pm\rightarrow e^\pm\nu$. (10 refs.)

105696 Preliminary searches for hadron jets and for large transverse momentum electrons at the SPS $\bar{p}p$ collider. M.Banner (CENS, Gif-sur-Yvette, France), R.Battiston, P.Bloch, F.Bonaudi, K.Borer, M.Borghini, J.-C.Chollet, A.G.Clark, C.Conta, P.Darriulat, L.Di Lella, J.Dines-Hansen, P.-A.Dorsaz, L.Fayard, M.Fraternali, D.Froidevaux, J.-M.Gaillard, O.Gildemeister, V.G.Goggi, H.Grote, B.Hahn, H.Hanni, J.R.Hansen, P.Hansen, T.Himel, V.Hungerbuhler, P.Jenni, O.Kofoed-Hansen, E.Lancon, M.Livan, S.Loucatos, B.Madsen, P.Mani, B.Mansoulie, G.C.Mantovani, L.Mapelli, B.Merkel, M.Mermikides, R.Mollerud, B.Nilsson, C.Onions, G.Parrour, F.Pastore, H.Plothow-Besch, M.Polverel, J.-P.Repellin, A.Rothenberg, A.Roussarie, G.Sauvage, J.Schacher, J.-L.Siegrist, H.M.Steiner, G.Stimpfl, F.Stocker, J.Teiger, V.Vercesi, A.Weidberg, H.Zaccone, W.Zeller.
Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.190-236
The authors present a preliminary analysis of the UA2 data collected during the last Collider run (20 nb^{-1} integrated luminosity) with particular emphasis on large transverse momentum hadron jets and on electrons having the configuration expected from the decay of electroweak bosons. The data provide very strong evidence of two-jet dominance in events with large transverse energy in the central region. Four electron candidates have been observed with a transverse momentum in excess of 20 GeV/c, which are associated with no other large transverse energy production within the UA2 acceptance. While this result is in all respects consistent with a $W \rightarrow e\nu$ hypothesis, more work is needed to ensure that the background is well understood and to further ascertain electron identification. No electron pair was detected with an invariant mass in excess of 40 GeV/c^2. (8 refs.)

105697 Measurements of σ_{tot}, $d\sigma_{el}/dt$, and event distributions in $\bar{p}p$ and pp collisions at $\sqrt{s}=31$, 53, and 63 GeV. M.Ambrosio, G.Anzivino, G.Barbarino, G.Carboni, V.Cavasinni, T.Del Prete, P.D.Grannis, D.Lloyd Owen, M.Morganti, G.Paternoster, S.Patricelli, F.Schiavo, M.Valdata-Nappi.
Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.251-69
Experiment R210 has been designed with the primary aim of measuring precisely $\sigma_{tot}(\bar{p}p)$ and $\sigma_{tot}(pp)$ over the ISR energy range. The experiment is also equipped with small-angle detectors which allow one to measure $d\sigma_{el}/dt$, and with a system of drift chambers and scintillation hodoscopes to measure charged multiplicities and angular distributions of emitted secondaries. Data have been collected at $\sqrt{s}=31$, 53, and 63 GeV. (no refs.)

105698 Recent large transverse momentum results from the ISR. L.Camilleri (CERN, Geneva, Switzerland).
Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.282-9
Results are presented on the comparison of high p_T phenomena in $p\bar{p}$ and pp collisions and on studies of jets in total energy triggers. The R110 and R807 experiments on the CERN intersecting storage rings are discussed. (7 refs.)

105699 Elastic scattering and total cross-sections. A.Martin (CERN, Geneva, Switzerland).
Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.351-71
The author confronts recent data on pp and $p\bar{p}$ at the ISR and at the collider with rigorous results and with various models. It is shown that precise measurements at presently available energies and at higher energies will allow one to clarify the situation. (28 refs.)

105700 QCD and $p\bar{p}$ collider physics. G.Altarelli (Istituto di Fisica, Univ. di Roma I, Roma, Italy).
Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.372-92
The author considers $\bar{p}p$ production of jets at large transverse momentum; most of these are predicted to be gluon jets. Cross section and multiplicity data is presented as validation of QCD. (19 refs.)

105701 Observation and study of jets at high p_T with UA1 central calorimetry. J.Sass (CENS, Gif-sur-Yvette, France).
Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.393-404
The status of the jets studies in UA1 is presented. The author considers the apparatus and calibration, and data samples for various trigger conditions. The jet finding method is discussed and the results and statistical analysis shown. (no refs.)

105702 Production of transverse energy (E_T) in hadron collisions. M.Greco (Lab. Nazionali di Frascati, INFN, Frascati, Italy).
Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.496-502
The author considers the properties of high E_T hadronic events produced in purely hadronic processes and Drell-Yan processes. The similarities between these two classes of processes and possible links based on the present understanding of perturbative QCD beyond the leading logarithmic approximation are discussed. (5 refs.)

105703 QCD radiation and the multiplicity distribution at the collider. G.Pancheri (Lab. Nazionali di Frascati, INFN, Frascati, Italy).
Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.503-13
The multiplicity distribution in hadron-hadron collisions is discussed as arising from the soft gluon bremsstrahlung accompanying parton-parton scattering, KNO scaling is mean scaling in the energy variable and is seen to arise when the microscopic system of quarks and gluons is averaged over the hadronic matter coordinates. The shape of the multiplicity distribution for the UA1 data at the collider energy is well fitted by a soft QCD radiation formula, using a QCD parameter $\Lambda \simeq 100$ MeV. The reduced cumulants γ_i are expected to decrease with energy. (16 refs.)

105704 Hadronic jets. M.Jacob (CERN, Geneva, Switzerland).
Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.538-52
The impressive results on jets obtained at the $p\bar{p}$ collider are considered. The author assesses the progress made, and focuses on the correct estimates of large effects using perturbative QCD. (34 refs.)

Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings .... See Entry 105026

Possible scalar-quark production of the proton-antiproton collider .... See Entry 105506

Anomalous dimensional quark counting of hard processes in QCD .... See Entry 105555

Hadron and jet production at collider energies in perturbative QCD .... See Entry 105575

How to test the quark-line rule by production of neutral mesons in proton-antiproton annihilation .... See Entry 105592

New flavours: experiment versus theory. From charm to the 4th family .... See Entry 105596

'Reasonable' expectations for hadroproduction at collider energies .... See Entry 105597

Single-particle spectra in bootstrap model based on dual-topological-unitarization diagrams .... See Entry 105605

Spin alignment of rho mesons produced in $\bar{p}p$ collisions and quark recombination model .... See Entry 105705

Fermilab $\bar{p}p$ collider .... See Entry 106185

Hadron colliders versus e^+e^- colliders .... See Entry 106186

13.85M Cosmic ray interactions

(see also 94.40 Cosmic rays)

Inelasticity of nucleus-nucleus collisions and composition of high-energy cosmic rays .... See Entry 110834

13.88 POLARISATION IN INTERACTIONS AND SCATTERING

105705 Spin alignment of rho mesons produced in $\bar{p}p$ collisions and quark recombination model. J.Ftacnik, P.Lichard, J.Pisut (Dept. of Theoretical Phys. Comenius Univ., Bratislava, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.8, p.889-902 (1983).
The ρ^0 spin alignment recently observed by the Ludmila collaboration in $\bar{p}p$ collisions at 22.4 GeV/c is examined in the framework of a quark-parton recombination model. It is pointed out that this phenomenon can naturally be explained only in a version of the model with negligible parton transverse motion. The inclusion of primordial transverse momenta of partons leads to almost complete disappearance of the effect. Contrary to other characteristics (e.g. particle multiplicities, single particle inclusive spectra), which are more or less well described by the quark recombination model, the polarization of hadrons produced in high energy collisions is difficult to explain and will probably serve as a decisive test of the authors understanding of underlying dynamics. (37 refs.)

Polarization effects in the process of bremsstrahlung creation of massive mesons in a magnetic field .... See Entry 105529

Gluon bremsstrahlung in charged lepton-nucleon collisions. II. Gluon linear polarization .... See Entry 105652

Energy variation of the analyzing power in the reaction $p_{pol}+p \rightarrow d+\pi^+$ .... See Entry 105661

The measurement of K_{NN} and K_{LL} in $\vec{p}p \rightarrow \vec{n}X$ at 800 MeV .... See Entry 105663

Amplitude analysis of elastic *p-p* scattering at 6 GeV/*c* at all *t*'s .... See Entry 105666

Search for Λp states in the baryon-exchange reaction $pp \rightarrow \Lambda pK^+$ at 11.75 GeV/*c* .... See Entry 105679

13.90 OTHER TOPICS IN SPECIFIC REACTIONS AND PHENOMENOLOGY OF ELEMENTARY PARTICLES

105706 Limits to the number of neutrinos: a comment on the Z^0 discovery. F.Halzen, K.Mursula (Res. Inst. for Theoretical Phys., Univ. of Helsinki, Helsinki, Finland).
Phys. Rev. Lett. (USA), vol.51, no.10, p.857-8 (5 Sept. 1983).
The observation of four *Z*s in a sample of events containing 32 charged *W*s improves terrestrial bounds on the number of neutrinos by roughly one order of magnitude. Also a bound on the production cross section of *Z*s relative to *W*s is obtained. These bounds do not depend on the determination of the *Z* width. (8 refs.)

Possible scalar-quark production of the proton-antiproton collider .... See Entry 105506

New procedure for the estimation of the extended-hypercolor boson masses .... See Entry 105579

Experimental observation of isolated large transverse energy electrons with associated missing energy at $\sqrt{s}=540$ GeV .... See Entry 105695

Preliminary searches for hadron jets and for large transverse momentum electrons at the SPS $\bar{p}p$ collider .... See Entry 105696

14.00 PROPERTIES OF SPECIFIC PARTICLES AND RESONANCES

14.20 BARYONS AND BARYON RESONANCES

(inc. antiparticles)

$\Delta B=2$ transitions .... See Entry 105498

Proton instability and the $SU_5 \otimes U_1$ subgroup of SO_{10} .... See Entry 105507

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Gluonic nucleons in a valon bag model .... See Entry 105574

Topological soliton bag model for baryons .... See Entry 105583

Baryon spectroscopy .... See Entry 105595

Quasinuclear levels of the $\Lambda\bar{\Lambda}$-$\Sigma\bar{\Sigma}$ system .... See Entry 105608

Production of neutral strange particles in $\bar{\nu}_\mu d_2$ and $\nu_\mu d_2$ charged current interactions .... See Entry 105616

Ω^- and $\Sigma^+ \rightarrow p\gamma$ nonleptonic weak decays via current algebra, partial conservation of axial-vector current, and the quark model .... See Entry 105628

Photon decays of baryons with strangeness .... See Entry 105629

Pion and nucleon twist-4 structure functions in the limit $x \rightarrow 1$ .... See Entry 105638

Baryon magnetic moments .... See Entry 105640

Structure functions of nucleons inside nuclei .... See Entry 105641

Magnetic moments of the ground-state baryons .... See Entry 105643

Quark model of baryon magnetic moments .... See Entry 105645

Photoproduction of hermaphrodite baryons .... See Entry 105655

Energy variation of the analyzing power in the reaction $p_{pol}+p \to d+\pi^+$ .... See Entry 105661

Existence of Ξ resonances above 2 GeV .... See Entry 105670

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14.40 MESONS AND MESON RESONANCES

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The charged current couplings and *CP*-violation in the B-meson system .... See Entry 105512

Constraints on K^0-$\bar{K}^0$ mixing from hadronic sum rules .... See Entry 105521

Polarization effects in the process of bremsstrahlung creation of massive mesons in a magnetic field .... See Entry 105529

Strangeness-changing processes and the limit on the right-handed gauge-boson mass .... See Entry 105537

Glueballs in the bag models .... See Entry 105570

Apparent spin-dependent forces in QCD or the quantum chemistry of hadrons .... See Entry 105571

On the modification of the estimated masses of the crypto-exotics .... See Entry 105572

Exotic mesons from QCD sum rules .... See Entry 105576

Meson radiation from a quark-gluon plasma by fission of chromoelectric flux tubes .... See Entry 105585

Search for supersymmetry in toponium decays .... See Entry 105587

Can $\iota(1440)$, $\theta(1640)$, $\delta(980)$, and S*(980) be accommodated in the quarkonium model? .... See Entry 105589

Bethe-Salpeter basis for quark-pair-creation model: understanding of VPP, $VP\gamma$, and $P\gamma\gamma$ couplings .... See Entry 105590

Relativistic corrections in quarkonium .... See Entry 105593

***B*-meson decays and *t*-quark mass** .... See Entry 105594

Coherent π^0 production in neutrino reactions .... See Entry 105614

Production of neutral strange particles in $\bar{\nu}_\mu d_2$ and $\nu_\mu d_2$ charged current interactions .... See Entry 105616

Associated charm production and correlations between multileptons in (anti)neutrino interactions .... See Entry 105620

Measurement of the branching ratio for the rare decay $\pi^0 \to e^+e^-$ .... See Entry 105621

Bag-model calculation of leptonic widths .... See Entry 105622

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Study of the decay $J/\psi \to \gamma\eta\pi\pi$ .... See Entry 105625

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14.60 LEPTONS

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Lepton-number violation with quasi-Dirac neutrinos .... See Entry 105536

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Large *N* limit of composite quarks and leptons .... See Entry 105599

$1/N_{subcolour}$ and quark-lepton mass hierarchies .... See Entry 105600

Hierarchy of fermion masses in supersymmetric composite models .... See Entry 105602

Scalar electron production in e^+e^- annihilation .... See Entry 105610

Test of supersymmetry in e^-e^- collisions .... See Entry 105612

Associated charm production and correlations between multileptons in (anti)neutrino interactions .... See Entry 105620

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A search for decays of heavy neutrinos .... See Entry 105633

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Search for scalar particles and excited leptons at PETRA .... See Entry 105657

Soft quark annihilation versus bremsstrahlung mechanisms of dilepton production in e^+e^- collisions .... See Entry 105658

Soft gluon component of diphoton and dilepton transverse momentum .... See Entry 105687

Limits to the number of neutrinos: a comment on the Z^0 discovery .... See Entry 105706

Neutrinoless double electron capture as a tool to measure the electron neutrino mass .... See Entry 105789

An underground search for anomalous penetrating particles such as massive magnetic monopoles .... See Entry 110829

Constraints on light particles from stellar evolution .... See Entry 110891

14.80 OTHER AND HYPOTHETICAL PARTICLES

105707 Electrometer designs for use in an unbound-quark search. E.R.Williams (Electrical Measurements & Standard Div., NBS, Washington, DC, USA), G.T.Gillies.
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.15, p.520-4 (13 Aug. 1983).
An instrument capable of modulating a small capacitance is described. It is to be used as an electrometer in a search for stable fractionally charged particles in test masses of several grams each, the largest yet studied. The new approach uses Gauss's law to sense charge directly and does not require the measurement of small forces, as has been the case in most previous quark searches. Preliminary results from an unoptimized experiment are encouraging, showing sensitivities of a few $100e/\sqrt{H_z}$ at atmospheric pressures and without any special precautions. (11 refs.)

105708 Search for fractional charges in water. D.C.Joyce, P.C.Abrams, R.W.Bland, R.T.Johnson, M.A.Lindgren, M.H.Savage, M.H.Scholz, B.A.Young (Phys. & Astron. Dept., San Francisco State Univ., San Francisco, CA, USA), C.L.Hodges.
Phys. Rev. Lett. (USA), vol.51, no.9, p.731-4 (29 Aug. 1983).
Results are presented from a search for fractional charges in water from a variety of natural sources. About 30000 water drops have been measured, comprising 51 μg of water and dissolved materials. No evidence for fractional charge was seen. (11 refs.)

Phase diagram of the $SU(2)$ lattice gauge theory with a mixed action .... See Entry 105469

Fractional charges at finite temperature .... See Entry 105470

Time delay and the dyon charge .... See Entry 105472

Photon mass in a background of thermal particles .... See Entry 105482

The dynamical symmetries of the monopole in geometric quantization .... See Entry 105502

Catalysis of flavor nonconservation by monopoles .... See Entry 105504

Possible scalar-quark production of the proton-antiproton collider .... See Entry 105506

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Low energy *CP* violation in broken supersymmetry .... See Entry 105515

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Strangeness-changing processes and the limit on the right-handed gauge-boson mass .... See Entry 105537

Quantum-electrodynamics without renormalization. III. Vacuum polarization and the mass of the photon .... See Entry 105547

A test of gauge nature of the W boson in the reaction $e^+e^- \to Z\gamma$ .... See Entry 105553

Weak interactions in the region of the Fermi scale .... See Entry 105554

Gauge-invariant effective Lagrangians for Goldstone-like particles of supersymmetric technicolor models .... See Entry 105556

Possible origin of a natural conservation of flavor in an interaction with neutral Higgs bosons .... See Entry 105558

Gauge invariant values of gluon masses at high temperature .... See Entry 105564

New procedure for the estimation of the extended-hypercolor boson masses .... See Entry 105579

Photino and gluino production from quarkonium decay .... See Entry 105581

***B*-meson decays and *t*-quark mass** .... See Entry 105594

Flavour changing neutral processes in a composite model for quarks, leptons and technifermions .... See Entry 105598

Large *N* limit of composite quarks and leptons .... See Entry 105599

$1/N_{subcolour}$ and quark-lepton mass hierarchies .... See Entry 105600

Hierarchy of fermion masses in supersymmetric composite models .... See Entry 105602

Scalar electron production in e^+e^- annihilation .... See Entry 105610

Search for magnetic monopoles in electron-positron collisions at 34 GeV CM energy .... See Entry 105611

Test of supersymmetry in e^-e^- collisions .... See Entry 105612

Search for right-handed currents in muon decay .... See Entry 105631

Low-mass right-handed gauge bosons, manifest left-right symmetry, and the K_L-K_s mass difference .... See Entry 105637

***W* magnetic moment in electroweak mixing and composite models and radiation zeros in $q_i\bar{q}_j \to W\gamma$** .... See Entry 105646

***W* weak multipole moments in electroweak mixing and composite models** .... See Entry 105647

On the spoiling of radiation zeros at the one-loop level and infrared finiteness .... See Entry 105648

Precision predictions for the intermediate vector boson parameters .... See Entry 105650

Search for scalar particles and excited leptons at PETRA .... See Entry 105657

Measurement of $\pi^- p \to n e^+ e^-$ at 300 MeV/c and a search for scalar and vector bosons heavier than the π^0 .... See Entry 105668

Inclusive production of direct photons in 200-GeV/*c* collisions .... See Entry 105685

Supersymmetric decay modes of the W and single electron production in p-$\bar{p}$ collisions .... See Entry 105686

Soft gluon component of diphoton and dilepton transverse momentum .... See Entry 105687

Inclusive charged and neutral particle production and search for relativistic particles with fractional electric charge at the CERN $p\bar{p}$ collider .... See Entry 105692

Experimental observation of isolated large transverse energy electrons with associated missing energy at $\sqrt{s}=540$ GeV .... See Entry 105695

Preliminary searches for hadron jets and for large transverse momentum electrons at the SPS $\bar{p}p$ collider .... See Entry 105696

Limits to the number of neutrinos: a comment on the Z^0 discovery .... See Entry 105706

Inductive monopole detector employing planar high order superconducting gradiometer coils .... See Entry 106216

Comment on searches for slowly moving magnetic monopoles .... See Entry 106256

An underground search for anomalous penetrating particles such as massive magnetic monopoles .... See Entry 110829

Constraints on light particles from stellar evolution .... See Entry 110891

Search for superheavy monopoles in 65 kg of iron magnetic sand with a SQUID fluxmeter .... See Entry 110896

Saving the invisible axion .... See Entry 110900

20.00 NUCLEAR PHYSICS

21.00 NUCLEAR STRUCTURE

21.10 GENERAL AND AVERAGE PROPERTIES OF NUCLEI; PROPERTIES OF NUCLEAR ENERGY LEVELS

(for properties of specific nuclei listed by mass ranges, see 27.)

105709 Retarded dissipation of the $Z=64$ shell gap in ${}_{66}{}^{160}Dy_{94}$. N.Ibrahim, N.M.Stewart (Bedford Coll., Univ. of London, London, England).
J. Phys. G (GB), vol.9, no.9, p.L195-8 (Sept. 1983).
The possible effect of the recently discovered subshell closure at $Z=64$ is investigated for ^{160}Dy. Energy levels and B(E2) ratios are compared with IBM-1 calculations assuming either a single $Z=50$-82 shell or subshell closure at $Z=64$. The latter calculation improves agreement with experiment. (10 refs.)

105710 On the relative quality of the spin expansion and frequency expansion for the description of rotational level energies. L.K.Peker, S.Pearlstein (Nat. Nuclear Data Center, Brookhaven Nat. Lab., Upton, NY, USA), J.H.Hamilton.
J. Phys. G (GB), vol.9, no.9, p.1025-32 (Sept. 1983).
The expansions $E_{rot}(I)=\Sigma_{i=1}{}^{n1}A_i[I(I+1)]^i$ and $E_{rot}(I)=\Sigma_{i=1}{}^{n2}\alpha_i\omega_1{}^{2i}$ that describe the energies of the levels in the ground-state rotational bands with $K^\pi=0^+$ are generally not equivalent unless $n_1=n_2=1$ or ∞. A method is proposed to characterise this non-equivalency quantitatively. It was found that in some nuclei, like ^{248}Cm and ^{176}Er, the $I(I+1)$ expansion is better than the ω^2 expansion, whereas in the majority of nuclei the ω^2 expansion is better. The data demonstrate that the rates of convergence of the $I(I+1)$ and ω^2 expansions for E_{rot} depend on the individual properties of the nuclei. (7 refs.)

105711 A semimicroscopic model of nuclear vibrations with separable forces and the giant dipole resonance of ^{12}C. V.N.Orlin (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
Nucl. Phys. A (Netherlands), vol.A405, no.2, p.263-86 (29 Aug. 1983).
In the generalized ph basis generated for the realistic nuclear ground state, the nuclear hamiltonian is approximated by an expression containing the separable effective forces and terms which can be estimated from the spectroscopic data. The model hamiltonian obtained is used to describe normal nuclear vibrations. The application of this approach in the shell-model theory of nuclear reactions is discussed. The S-matrix for nucleon-nucleus scattering is calculated explicitly. The ^{12}C photodisintegration calculation is made as a test example. (33 refs.)

105712 Neutron and proton alignment at high spin in ^{168}W. G.D.Dracoulis, H.Hubel, A.P.Byrne, R.F.Davie (Dept. of Nuclear Phys., Res. School of Phys. Sci., Australian Nat. Univ., Canberra, Australia).
Nucl. Phys. A (Netherlands), vol.A405, no.2, p.363-80 (29 Aug. 1983).
Excited states in the neutron-deficient nucleus ^{168}W, populated in the $^{148}Sm(^{24}Mg,4n)^{168}W$ reaction have been studied using γ-ray spectroscopy. The yrast band, which is identified up to about 28, shows a very strong backbend at low frequency $\hbar\omega_c=0.235$ MeV attributed to the $(i_{13/2})^2$ neutron alignment. Evidence for a second backbend is also observed. A strongly populated odd-spin (probably negative-parity) sideband is also indentified to the spin, and shows several band-crossing anomalies. The characterisation of the anomalies is made by comparison with CSM calculations. Proton and neutron alignments are probably present in the sideband, and the second backbend in the yrast sequence may be due to alignment of $i_{13/2}$ protons. (27 refs.)

105713 $(f_{7/2})_{7,0}{}^{-2}$ configuration high-spin states in ^{60}Co strongly excited in the $^{62}Ni(\vec{d},\alpha)$ reaction. H.Nann, W.W.Jacobs, A.D.Bacher, W.P.Jones, Li Qing-Li, E.J.Stephenson (Dept. of Phys., Indiana Univ., Bloomington, IN, USA).
Nucl. Phys. A (Netherlands), vol.A406, no.1, p.81-93 (12 Sept. 1983).
The $^{62}Ni(\vec{d},\alpha)^{60}Co$ reaction has been studied with 78 MeV vector polarized deuterons. Angular distribution of the differential cross section and vector analyzing power have been measured for strongly populated states in ^{60}Co up to an excitation energy of 5 MeV. The transferred orbital and total angular momenta L and J were determined from the characteristic shapes of the differential cross sections and vector analyzing powers yielding a number of new spin assignments. The $J^\pi=7^+$ stretched $[(^{62}Ni_{g.s})_{0+}\otimes(1f_{7/2})_{7,0}{}^{-2}]$ configuration was found to be distributed at least over nine states located at 1.51, 3.09, 3.46, 3.67, 3.78, 4.04, 4.55, 4.70 and 4.80 MeV. (13 refs.)

105714 Microscopic calculation of dynamical effects: the energy dependence of nucleon self-energies in ^{208}Pb. H.M.Sommermann (Max-Planck-Inst. fur Kernphys., Heidelberg, Germany), K.F.Ratcliff, T.T.S.Kuo.
Nucl. Phys. A (Netherlands), vol.A406, no.1, p.109-33 (12 Sept. 1983).
Dynamical effects on the single-particle self-energy $\Sigma(\omega)$, i.e. its ω-dependence, are studied microscopically using realistic finite-range NN interactions (Reid soft-core reaction matrix). The self-energy $\Sigma(\omega)$ and corresponding effective mass $m^*(\omega)$ are evaluated for proton and neutron particles in ^{209}Bi and ^{209}Pb (first and second shell) and for proton and neutron holes in ^{207}Tl and ^{207}Pb. The authors calculate, furthermore, the self-consistent energies and related spectroscopic factors (Z). In heavy nuclei the coupling of particles to highly collective low-lying surface vibrations is found to cause dynamical effects much stronger than in nuclear matter. Consequently, the single-particle and single-hole energies which enter into the calculation of highly excited states are different from their experimental values. The correct inclusion of dynamical effects in the calculation of the giant dipole resonance is discussed. (31 refs.)

105715 Molecular alpha-particle clustering in ^{218}Ra; dipole collectivity in the vicinity of nuclear shell closures. M.Gai, J.F.Ennis, M.Ruscev, E.C.Schloemer, B.Shivakumar, S.M.Sterbenz, N.Tsoupas, D.A.Bromley (A.W. Wright Nuclear Structure Lab., Yale Univ., New Haven, CT, USA).
Phys. Rev. Lett. (USA), vol.51, no.8, p.646-9 (22 Aug. 1983).
Evidence for the presence of alpha-particle clustering in ^{218}Ra comes from a number of observables: binding energy, S_{2n}, Q_α, $E_x(J^\pi)$, $\theta_\alpha{}^2$, and F_α. That this clustering is a signature for the new dipole collectivity suggested by Iachello and Jackson (1982, 1983) follows from observation of simultaneous enhancement of selected $E1$, $E2$, and $E3$ deexcitation transition matrix elements; of these the $E1$ enhancement is most pronounced as would be expected for dipole collectivity. (15 refs.)

105716 Rotational structure and Nilsson orbitals for highly deformed odd-A nuclei in the $A\sim100$ region. F.K.Wohn, J.C.Hill (USDOE, Iowa State Univ., Ames, IA, USA), R.F.Petry, H.Dejbakhsh, Z.Berant, R.L.Gill.
Phys. Rev. Lett. (USA), vol.51, no.10, p.873-6 (5 Sept. 1983).
Six rotational bands have been found in ${}_{39}{}^{99}Y_{60}$, ${}_{39}{}^{101}Y_{62}$, ${}_{38}{}^{99}Sr_{61}$, and ${}_{40}{}^{101}Zr_{61}$. All bands have small and very similar values of $\hbar^2/2\mathcal{I}$ that indicate deformations of $\sim$0.3-0.4 and imply that these nuclei are among the most deformed known, with $\mathcal{I}\sim0.8\mathcal{I}_{rigid}$. Relative strengths of intraband γ transitions suggest Nilsson orbital assignments of $\pi^5/_2[422]$ for the Y ground bands. (16 refs.)

105717 Transition charge and current densities of collective isoscalar quadrupole states in ^{208}Pb. H.Sagawa (Nat. Inst. for Nuclear Phys. & High-Energy Phys., Amsterdam, Netherlands), N.Van Giai.
Phys. Lett. B (Netherlands), vol.127B, no.6, p.393-8 (11 Aug. 1983).
Transition charge densities and current distributions of isoscalar quadrupole states in ^{2108}Pb are calculated in the self-consistent RPA model. The authors find clear differences between the low lying state and the giant resonance for transition charge densities as well as current distributions. The implications on the transverse form factors of electron scattering are discussed. (17 refs.)

105718 The moment of inertia of ^{130}Ce above spin $30\hbar$. P.J.Nolan, R.Aryaeinejad, A.H.Nelson, D.J.G.Love, D.M.Todd, P.J.Twin (Oliver Lodge Lab., Univ. of Liverpool, Liverpool, England).
Phys. Lett. B (Netherlands), vol.128B, no.5, p.285-9 (1 Sept. 1983).
The structure of ^{130}Ce has been investigated at high spin following the $^{100}Mo(^{34}S, 4n)^{130}Ce$ reaction. Evidence is seen near $\hbar\omega=0.6$ MeV for the alignment of $i_{13/2}$ neutrons which is predicted by the cranked shell model. Rotational structure extends up to $\hbar\omega=0.8$ MeV with a constant moment of inertia ($\mathcal{J}_{band}{}^{(2)}$), equal to the rigid body value above $\hbar\omega=0.6$ MeV. (11 refs.)

105719 The RPA calculation of bandhead energies in many-boson systems. J.Dukelsky, G.G.Dussel, R.P.J.Perazzo, H.M.Sofia (Dept. de Fisica, Comision Nacional de Energia Atomica, Buenos Aires, Argentina).
Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.1-4 (15 Sept. 1983).
The RPA is used to correct the Hartree self-consistent single-boson energies. The spurious states that appear as a consequence of broken symmetries are set at zero energy and can therefore be eliminated. The method is exemplified with an SU_3 Hamiltonian with only s and d bosons. (15 refs.)

105720 Anharmonicities of gamma vibration in ^{168}Er. I.Hamamoto (Niels Bohr Inst., Copenhagen, Denmark).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.157-69 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
Properties of the γ-vibration in ^{168}Er are examined both in a macroscopic and in a microscopic approach with special emphasis on the anharmonicities of two-phonon states. It is found that in order to account for recent experimental evidence it is necessary to assume large anharmonic components both in the collective potential energy surface and in the mass parameters. Points which are not clear in the present understanding of the gamma-motion are described. (17 refs.)

105721 Excitation modes of the γ-band in ^{24}Mg through the $^{24}Mg(\vec{p},p')$ reaction. M.Sugitani, T.Hasegawa, S.Kubono, Y.Ishizaki (Inst. for Nuclear Study, Univ. of Tokyo, Tokyo, Japan), K.Iwatani, T.Fujisawa, K.Yoshinada.
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.250-4
The analyzing powers and differential cross sections have been measured for the ground rotational band and γ-band of ^{24}Mg through the $^{24}Mg(\vec{p},p')$ reaction at the incident energies of 29.3 and 40.4 MeV. The experimental cross sections and analyzing powers for the 3^+ state in the γ-band have been reproduced by a second-order DWBA calculation with an effective nucleon-nucleon interaction and with a shell model description to the nuclear structure of ^{24}Mg. The (p-d-p′) process gives a significant improvement both to the analyzing powers and to the cross sections to reproduce the experimental data. (7 refs.)

105722 Proton inelastic scattering by the even-Ge isotopes at $E_p=22$ MeV. P.Avignon, L.H.Rosier, R.Tamisier, B.Ramstein (Inst. de Phys., Nantes, France), J.P.Delaroche.
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.255-9
Even-Ge(p,p′) inelastic scattering has been studied at 22 MeV with an overall energy resolution of 10 keV using a tandem Van de Graaff and a split pole magnetic spectrometer. Angular distributions have been obtained for about 40 levels in each isotope. DWBA, vibrational and asymmetric rotor model CC calculations have been made. Spin and parity assignments have been deduced. Possible unnatural parity levels have been populated. (8 refs.)

105723 Sum-rule strengths of low-lying 4^+ levels in $^{74-82}$Se nuclei. K.Ogino, Y.Kadota, K.Haga (Dept. of Nuclear Engng., Kyoto Univ., Kyoto, Japan), S.Matsuki, T.Higo, T.Shiba, N.Sakamoto, T.Yanabu.
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.260-4
The low-lying spectra of the even $^{74-82}$Se nuclei up to $E_x=5.0$ MeV were investigated with inelastic proton scattering at $E_p=64.8$ MeV. Several 4^+ states in ^{74,78,80,82}Se were found at $2.0<E_x<5.0$ MeV, while in ^{76}Se more than ten states were observed in the same energy region. The energy weighted sum rule fraction of the 4^+ states increases with decreasing neutron number from ^{82}Se (1.0%) up to ^{76}Se (3.7%), and then decreases. A self-consistent

RPA calculation reproduces the excitation energies and transition strengths of the 4^+ states observed in the present experiment. (12 refs.)

105724 Excitation of low-lying collective bands in inelastic hadron scattering. M.N.Harakeh (Nuclear Phys. Lab., Univ. of Washington, Seattle, WA, USA).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.446-67
Considers the excitation of β- and octupole bands in permanently deformed nuclei in the framework of the coupled channel method. Transition densities for the β- and octupole bands derived from the ground state density and satisfying, respectively, the conditions of particle conservation and translational invariance, are presented. Transition potentials derived from optical model potentials along similar lines are used in the coupled channel analysis of inelastic hadron scattering from β- and octupole bands in deformed nuclei. The coupling of giant resonance modes into these low-lying bands manifesting themselves in additional terms to the transition densities is discussed. (32 refs.)

105725 Probing the nuclear structure with heavy-ion reactions. R.A.Broglia (Niels Bohr Inst., Univ. of Copenhagen, Copenhagen, Denmark).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.107-58
Nuclei display distortions in both ordinary space and in gauge space. It is suggested that it is possible to learn about the spatial distribution of the Nilsson orbitals and about the change of the pairing gap with the rotational frequency through the analysis of one- and two-nucleon transfer reactions induced in heavy-ion collisions. (27 refs.)

105726 Description of high spin states. A.Faessler (Inst. fur Theoretische Phys., Univ. Tubingen, Tubingen, Germany).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.267-86
Three points are discussed: (i) The nature of the second backbending (bb) in the rare earth nuclei will be theoretically investigated. It will be confirmed that 2. bb is due to the alignment of a $h_{11/2}$-proton pair. The oscillating behaviour of the 2. bb can explain the variation of the second anomaly in the $N=90$ isotones. Strong variations of the 2. bb with the neutron number can be explained by the change of the deformation β. (ii) The smooth increase of the moment of inertia in the actinide nuclei is explained mainly by the alignment of a $i_{13/2}$ proton pair. This is confirmed by measurements of the g-factors and the blocking effect in odd proton nuclei where the odd proton is in a $i_{13/2}$ level. In ^{248}Cm, where one has a smaller deformation, one finds a roughly equal role for $i_{13/2}$ and $j_{15/2}$ neutrons for the increase of the moment of inertia. (iii) In this third part high spin spectra are studied in the even mass Hg-isotopes by coupling two quasi-particles to an interacting boson core. This calculation can reproduce the anomalous behaviour of the yrast states around angular momentum 8, 10 and 12. (41 refs.)

105727 New directions in studies of nuclei far from stability with heavy ions. J.H.Hamilton (Phys. Dept., Vanderbilt Univ., Nashville, TN, USA).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.300-10
Many techniques are being employed to study nuclei far from stability. Here the author concentrates on some highlights in the use of heavy ions to probe nuclei far from stability. In addition to probing nuclei far from stability along lines of count Z or N, nuclei at very high angular momenta are another important area of research far from the stable ground states. The author looks at some new directions being opened up by heavy ions, some of the new facilities and then some interesting new results. (29 refs.)

105728 Multiple discontinuities of the moment of inertia at high spin. J.H.Hamilton (Phys. Dept., Vanderbilt Univ., Nashville, TN, USA).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.311-16
What happens to a nucleus at high spins is one of the major fields of nuclear structure today as evidenced by the several recent international conferences in this field. The author concentrates on two new approaches to study high spin states-partial fusion reactions and neutron multiplicity experiments. The latter has been used to study states to a record high spin for a light nucleus, tentatively 20^+ in ^{74}Kr. The former has been employed to observe third and higher discontinuities of $\mathcal{J}$ in ^{158}Er. (14 refs.)

105729 Recent results on nuclei far from stability in the mass region $A \simeq 70$. A.V.Ramayya (Phys. Dept., Vanderbilt Univ., Nashville, TN, USA), J.Eberth.
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.317-26
Recent advances in experimental techniques, of in-beam γ spectroscopy for the detection of γ rays from evaporation residues induced by heavier ions, have made possible to investigate the level structures of nuclei far from stability. The nuclei in the mass region $A \simeq 70$ are very interesting because they exhibit wide variety of band structure and are also transitional nuclei. The authors discuss some of the advances made in in-beam gamma-ray spectroscopy techniques and the results obtained in this mass region. Also, they discuss briefly the present understanding of these results. (16 refs.)

Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions .... See Entry 105008

Heavy-Ion Collisions. Proceedings of the International Summer School .... See Entry 105028

Different treatments of pairing correlations for nuclear shapes at high spin .... See Entry 105732

Deformation changes along the yrast line in ^{160}Yb .... See Entry 105733

Strong effect of the sign of the hexadecapole moment on the polarized-proton inelastic scattering to the $4_1{}^+$ states in the even $^{74-82}$Se .... See Entry 105742

Nuclear level density at high excitation energies .... See Entry 105748

The screening of the particle-hole interaction to all orders .... See Entry 105750

Nuclear effective interactions and spin excitations .... See Entry 105752

Pairing correlations at high spin and finite temperature: a modified BCS approach .... See Entry 105757

The nuclear field theory .... See Entry 105759

The hydrodynamic limit of the microscopic collective model: the U(3)-boson model .... See Entry 105771

Vibrational and rotational flow in nuclei .... See Entry 105772

Time dependent Hartree-Fock and beyond .... See Entry 105774

The nuclear response function .... See Entry 105776

Self-consistent description of nuclear excitations .... See Entry 105779

Molecular orbital model study of the ${}_{\Lambda}^{9}$Be, ${}_{\Lambda\Lambda}^{10}$Be, ${}_{3\Lambda}^{11}$Be and ${}_{4\Lambda}^{12}$Be hypernuclei .... See Entry 105783

Structure of the ${}_{\Lambda\Lambda}^{10}$Be hypernucleus .... See Entry 105784

The decay of ^{153}Tb oriented in a gadolinium host .... See Entry 105788

Proton spin-orbit splittings in the continuum .... See Entry 105812

Sum rule approach to giant resonance states .... See Entry 105814

Proton hole states in ^{95}Y and ^{95,97,99}Nb .... See Entry 105879

Study of ^{46,48}Ca(α,p) reactions .... See Entry 105884

21.10D Binding energy and masses

105730 Are heavy-ion entropy production and nuclear level density discrepancies related?. C.S.Warke, M.Uhlig, W.Greiner (Inst. fur Theoretische Phys., Johann Wolfgang Goethe-Univ., Frankfurt/Main, Germany).
J. Phys. G (GB), vol.9, no.9, p.1083-102 (Sept. 1983).
The thermodynamic properties of a system of Dirac particles interacting through classical fields are studied within the interaction models proposed recently. The theoretical formalism is based on the variational ansatz of the Gibbs free energy. The binding energy per nucleon, pressure and specific entropy are calculated from the low-temperature expansion in the range of densities and temperatures of interest to heavy-ion reactions. The calculated value of specific entropy produced in heavy-ion collisions is found to be much less than that obtained from the measured value of the deuteron to proton ratio. The model of Boguta and Bodmer (1977) predicts larger values of the specific entropy as compared with those of the Walecka model. It is pointed out that the difficulty of understanding the nuclear level density data may be related to that of the entropy production in heavy-ion reactions. A relativistic generalisation of Bethe's level density parameter and the average thermal energy, useful in hydrodynamic calculations, are derived. (27 refs.)

105731 Ground state properties of actinide nuclei. D.Galeriu (Inst. of Phys. & Nuclear Engng., Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.6, p.477-87 (1983).
The ground state properties of actinide nuclei—mass excess, deformation, level scheme, level density—are computed by the macroscopic-microscopic method. The nuclear potential includes nonspheroidal deformation and the macroscopic energy is given by the Yakawa plus exponential model. The mass excess is reproduced with an r.m.s. of 0.67 MeV while the level density at the neutron binding energy is within a factor of two in accordance with experimental data, without free parameters. The level density is computed with a microscopic intrinsic level density and collective enhancement. Improvements for lighter actinide are suggested. (32 refs.)

Properties of the three-nucleon bound states with virtual Δ-isobar excitation .... See Entry 105735

The four-nucleon problem with local realistic NN interactions .... See Entry 105745

Effective mass in nuclei and the level density parameter .... See Entry 105746

Different regimes of dissipative collisions .... See Entry 105928

21.10F Shape, charge, radius and form factors

105732 Different treatments of pairing correlations for nuclear shapes at high spin. M.Faber, A.Faessler, H.Markum (Inst. fur Theoretische Phys., Univ. Tubingen, Tubingen, Germany).
J. Phys. G (GB), vol.9, no.9, p.1069-82 (Sept. 1983).
Strutinsky calculations are used to investigate the shape and fission stability of rotating nuclei. A cranked Woods-Saxon single-particle Hamiltonian is provided to describe triaxial and dumb-bell shapes. Since the cranking term violates time-reversal symmetry the convenient BCS method cannot be applied. On the other hand, the consideration of pairing by the solution of HFB equations is possible for a few selected nuclei only. As demonstrated recently, pairing influences the shape of fission barriers up to very high angular momenta and should not be neglected. Thus, modifications of the BCS equations are desirable. Such methods are discussed and their results are compared with the HFB results. (23 refs.)

105733 Deformation changes along the yrast line in ^{160}Yb. R.Bengtsson (NORDITA, Copenhagen, Denmark), Yong-Shou Chen, Jing-Ye Zhang, S.Aberg.
Nucl. Phys. A (Netherlands), vol.A405, no.2, p.221-36 (29 Aug. 1983).
The yrast states of ^{160}Yb are calculated using the cranked HFB model with particle-number projection and assuming diabatic bands. The energy of each state is minimized with respect to the proton and neutron pairing gap parameters and the deformation parameters ϵ and γ. The deformation of the ground band is found to increase with increasing spin, i.e. ϵ gets larger. Simultaneously γ gets slightly negative. In the s-band the dominating deformation change is an increase of γ with increasing spin. The calculated deformation changes are in qualitative agreement with recently measured transition quadrupole moments. Moments of inertia and energies are compared to measured quantities. (23 refs.)

105734 Equilibrium deformations for the Ra-Th region of nuclei. P.Rozmej, B.Nerlo-Pomorska, K.Pomorski (Maria Curie-Sklodowska Univ., Lublin, Poland).
Nucl. Phys. A (Netherlands), vol.A405, no.2, p.252-62 (29 Aug. 1983).
New parameters of the single particle Nilsson potential for the Ra-Th region have been found. They are $\kappa_p=0.0561$, $\mu_p=0.702$, $\kappa_n=0.0588$, $\mu_n=0.442$. The fit is made to the experimental single-particle energy levels in the new quadrupole and hexadecapole equilibrium deformation points, obtained by the shell-correction method with a simple consistency condition. The equilibrium deformations calculated by this method are in good agreement with the experimental data. Experimental values of the quadrupole moments of ^{222}Rn, ^{222}Ra and ^{224}Ra are reproduced for the first time within the Nilsson-plus-Strutinsky method. (28 refs.)

105735 Properties of the three-nucleon bound states with virtual Δ-isobar excitation. C.Hajduk, P.U.Sauer, W.Strueve (Inst. fur Theoretical Phys., Univ. of Hannover, Hannover, Germany).
Nucl. Phys. A (Netherlands), vol.A405, no.3, p.581-604 (5 Sept. 1983).
Wave function components containing a single Δ-isobar are included in the calculation of the three-nucleon bound states. Multiple Δ-effects are ignored. The two-nucleon interaction acts in all partial waves up to total angular momentum $I=2$. The presence of a Δ-isobar increases the three-nucleon binding energy by about 0.3 MeV, 0.6 MeV repulsion being dispersive two-body effect, and 0.9 MeV attraction arising from the three-nucleon force with an intermediate Δ-isobar. The effect of the Δ on the three-nucleon charge and magnetic form factors and on the weak decay is investigated. (36 refs.)

105736 Study of isotope shifts, isotone shifts and nuclear compressibility from the analysis of muonic X-ray transitions. K.V.Subba Rao, A.A.Kamal (Phys. Dept., Osmania Univ., Hyderabad, India).
Pramana (India), vol.20, no.5, p.363-73 (May 1983).
Muonic X-ray transitions in various spherical nuclei in the region $13 \leq Z \leq 83$ have been analysed and the isotope and isotope shifts in charge radius R are investigated. Assuming $R=r_0A^{1/3}$, the isotopic and isotonic behaviour of the parameter r_0 is also studied. The variation of r_0 with mass number A reveals the variation of average nucleon density, which in turn sheds light on the compressibility of nuclear matter. The isotope and isotone shifts in R exhibit the shell effects in the vicinity of magic neutron and proton numbers: 20, 28, 50, 82 and 126. The results indicate that neutron-proton interaction is maximum at the beginning of a major neutron shell and decreases gradually as the shell gets filled up. The behaviour of parameter r_0 clearly suggests that low-Z nuclei are highly compressible while high-Z nuclei are more or less imcompressible. The parameter r_0 too is observed to exhibit profound shell effects. (5 refs.)

105737 Nuclear charge and matter distributions. P.E.Hodgson (Nuclear Phys. Lab., Univ. of Oxford, Oxford, England).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.70-96
Discusses the analysis of electron and proton scattering to give nuclear charge distributions, and then enlarges the analysis to include nuclear matter distributions. Other topics described include self-consistent calculations and nucleon orbit radii. (43 refs.)

105738 What do we learn from self-consistent models about nuclear density distributions?. F.Tondeur (Univ. Libre de Bruxelles, Brussels, Belgium).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.97-106
The detailed knowledge of nuclear density distributions is of great interest in several models of heavy ion collisions. Experiment has reached a very good precision in determining the shape of the charge densities in nuclei, even for far-unstable nuclei. However, only few accurate data have been obtained till now about neutron and matter distributions. Nuclear density distributions can be described by several characteristic quantities, like their RMS radii. Higher moments can also be used to give a detailed description of the density ρ ($\bar{r}$), but it is often more convenient to use the quantities ρ_c, $R_{1/2}$ and t, which are the central density, the half-density radius and the 90%-10% surface thickness, although they can often only be defined approximately. The author also examines the surface asymmetry, defined as the difference between the inner part of the surface thickness (inside $R_{1/2}$) and the outer part (outside $R_{1/2}$). (22 refs.)

105739 Shape coexistence and a new region of strong deformation in nuclei far from stability. J.H.Hamilton (Phys. Dept., Vanderbilt Univ., Nashville, TN, USA).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.287-99
Describes the discovery of super deformation in the region of Z and N both at or near 38. Simultaneously, Moller and Nix (1982) carried out calculations that predicted that nuclei in this region of $N \approx Z \approx 38$ should have the strongest ground state deformation of any nuclei with $\beta \approx 0.4$. New studies in the Sr nuclei support this conclusion. Indeed, it has been found experimentally and now predicted theoretically a new region of super deformation. The understanding of the origin of this deformation gives insights into nuclear shape coexistence in a wide range of different masses. (42 refs.)

Heavy-Ion Collisions. Proceedings of the International Summer School .... See Entry 105028

Rotational structure and Nilsson orbitals for highly deformed odd-*A* nuclei in the $A\sim100$ region .... See Entry 105716

Transition charge and current densities of collective isoscalar quadrupole states in ^{208}Pb .... See Entry 105717

Excitation of low-lying collective bands in inelastic hadron scattering .... See Entry 105724

Probing the nuclear structure with heavy-ion reactions .... See Entry 105725

Description of high spin states .... See Entry 105726

Ground state properties of actinide nuclei .... See Entry 105731

Exchange-current contributions to the ^{3}He magnetic properties .... See Entry 105741

The deuteron asymptotic D-state as a probe of the nucleon-nucleon force .... See Entry 105749

The nuclear field theory .... See Entry 105759

Dynamic deformation model of nuclear collective motions .... See Entry 105765

Effect of nuclear curvature energy on the transition between nuclei and bubbles in dense matter .... See Entry 105782

Decay of mass-separated ^{187}Au (8.4 min) to ^{187}Pt .... See Entry 105792

Low energy octupole resonance in deformed nuclei .... See Entry 105818

Excitation of the quasi-bound state in ^{4}He by electron scattering at medium momentum transfer .... See Entry 105842

Inelastic electron scattering from ^{9}Be .... See Entry 105843

Differential muon-capture rate and the deuterium form factors in the timelike region .... See Entry 105845

Effects of the proton-neutron hole interaction to the form factor in (*d,t*) reactions on $N=50$ target nuclei .... See Entry 105877

Study of ^{46,48}Ca(α,p) reactions .... See Entry 105884

The absolute normalization of three-nucleon transfer reactions .... See Entry 105905

Dynamical thresholds for compound-nucleus formation in symmetric heavy-ion reactions .... See Entry 105908

Charge equilibration in deep-inelastic peripheral collisions .... See Entry 105929

K^+ and K^- elastic scattering within the framework of multiple scattering theory .... See Entry 105936

Pionic 3d→2p X-ray measurements in ^{50,52,54}Cr, ^{45}Sc, ^{51}V, ^{55}Mn and Fe .... See Entry 106637

21.10H Spin, parity, and isobaric spin

$(f_{7/2})_{7,0}{}^{-2}$ configuration high-spin states in ^{60}Co strongly excited in the ^{62}Ni(d,α) reaction .... See Entry 105713

Rotational structure and Nilsson orbitals for highly deformed odd-*A* nuclei in the $A\sim100$ region .... See Entry 105716

Proton inelastic scattering by the even-Ge isotopes at $E_p=22$ MeV .... See Entry 105722

Energy levels in ^{93}Mo populated by the ^{93}Nb(p,nγ) reaction .... See Entry 105744

Nuclear effective interactions and spin excitations .... See Entry 105752

Spin-dependent excitations: RPA model and isobar-hole couplings .... See Entry 105754

The decay of ^{153}Tb oriented in a gadolinium host .... See Entry 105788

Decay of mass-separated ^{187}Au (8.4 min) to ^{187}Pt .... See Entry 105792

Isovector correction to the Kerman, McManus, and Thaler formalism .... See Entry 105809

Parity violation in nucleon-nucleus elastic scattering within a phenomenological single particle model .... See Entry 105864

Non-direct transitions in transfer reactions and spectroscopy .... See Entry 105870

Spectroscopy of $A=16$ from ^{13}C(^{6}Li,t)^{16}O .... See Entry 105896

Nature of molecular resonances and background in the ^{16}O+^{12}C system .... See Entry 105902

Delta-nucleon and pion-nucleus interactions .... See Entry 105937

21.10J Spectroscopic factors

The residual interaction of bound nucleons—two-nucleon matrix elements deduced from transfer experiments .... See Entry 105755

Molecular orbital model study of the ${}_{\Lambda}{}^{9}$Be, ${}_{\Lambda\Lambda}{}^{10}$Be, ${}_{3\Lambda}{}^{11}$Be and ${}_{4\Lambda}{}^{12}$Be hypernuclei .... See Entry 105783

Structure of the ${}_{\Lambda\Lambda}{}^{10}$Be hypernucleus .... See Entry 105784

Analysis of the ^{28}Si(p, γ)^{29}P reaction data in the region of the subbarrier single particle resonances .... See Entry 105810

^{24}Mg($\bar{p}$,d) reaction at 65 and 80 MeV .... See Entry 105836

Evidence of energy dependence in proton-neutron effective interaction for ^{90}Zr(p,d)^{89}Zr reactions at energies from 20 MeV to 120 MeV .... See Entry 105855

Effects of the proton-neutron hole interaction to the form factor in (*d,t*) reactions on $N=50$ target nuclei .... See Entry 105877

Ground state transitions in (d,^{6}Li) reactions on sd-shell nuclei .... See Entry 105883

Single particle strengths in A=28 nuclei via (α,t) and (α,^{3}He) reactions .... See Entry 105887

21.10K Electromagnetic moments

105740 The nuclear magnetic moment of ^{190}Ir and the directional distribution of gamma rays in ^{190}Os. A.L.Allsop, S.Hornung (Clarendon Lab., Oxford, England), D.W.Murray, N.J.Stone.
J. Phys. G (GB), vol.9, no.9, p.1125-38 (Sept. 1983).
Angular distributions of gamma transitions between the levels in ^{190}Os fed in the decay of ^{190}Ir aligned in a rhenium single crystal have been measured at temperatures down to 2 mK. Multipole mixing ratios in both gamma and electron-capture transitions are deduced and compared with various nuclear models. The angular distribution coefficients are applied to interpret very small anisotropies observed when ^{190}Ir is polarised in an iron host matrix, cooled to 2.5 mK. The deduced magnetic dipole moment of the 4^+ ground state of ^{190}Ir is $|\mu(^{190}\mathrm{Ir};\ \mathrm{GS})|=0.04(1)\mu_N$. Possible single-particle descriptions compatible with this result are suggested. (27 refs.)

105741 Exchange-current contributions to the ^{3}He magnetic properties. W.Strueve, C.Hajduk, P.U.Sauer (Inst. for Theoretical Phys., Univ. of Hannover, Hannover, Germany).
Nucl. Phys. A (Netherlands), vol.A405, no.3, p.620-6 (5 Sept. 1983).
The ^{3}He magnetic moment and form factor are calculated with momentum space wave functions of the three-nucleon ground state based on the Paris and Reid soft-core potentials. The exchange-current contributions arising from π- and ρ-exchange and from virtual Δ-excitation are included. They explain only part of the difference between the theoretical one-body prediction and the available experimental data. (17 refs.)

105742 Strong effect of the sign of the hexadecapole moment on the polarized-proton inelastic scattering to the $4_1{}^+$ states in the even $^{74\text{-}82}$Se. S.Matsuki, T.Higo, T.Ohsawa, T.Shiba, T.Yanabu (Cyclotron Lab., Inst. for Chem. Res., Kyoto Univ., Kyoto, Japan), K.Ogino, Y.Kadota, K.Haga, N.Sakamoto, K.Kume, M.Matoba.
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.265-9
Ground-band states up to the 4^+ in $^{74\text{-}82}$Se were studied with inelastic scattering of polarized protons at 65 MeV. Both the cross section angular distributions $\sigma(\theta)$ and analyzing powers A(θ) leading to the 4^+ states in the light ^{74,76,78}Se show quite different shapes from those in the heavy ^{80,82}Se. Coupled-channels calculations show that the symmetric rotational model and the second-order harmonic vibrational model with one-and two-phonon mixing in the 4^+ states describe equally well the whole distributions of $\sigma(\theta)$ and A(θ) and both give consistent values of β_4, positive for the light ^{74,76,78}Se and negative for the heavy ^{80,82}Se, indicating strong sensitivity of the A(θ) to the sign of the hexadecapole moment and a static or dynamic hexadecapole-shape transition between ^{78}Se and ^{80}Se. (9 refs.)

Equilibrium deformations for the Ra-Th region of nuclei .... See Entry 105734

The deuteron asymptotic D-state as a probe of the nucleon-nucleon force .... See Entry 105749

Nuclear moments of ^{9}Li .... See Entry 105881

21.10M Level density and structure

105743 Excitations of the states of ^{107,109}Cd from the $(p,n\gamma)$ reaction on silver isotopes. M.B.Chatterjee, B.B.Baliga, R.Bhattacharya (Saha Inst. of Nuclear Phys., Calcutta, India).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.9, p.990-1001 (1983).
The states in ^{107,109}Cd nuclei were excited in the $(p,n\gamma)$ reaction on natural silver in the subcoulomb energy region. Eighteen excited states in ^{107}Cd and thirteen excited states in ^{109}Cd were studied by the gamma-ray singles and gamma-gamma coincidence measurement. Most of the low-lying states observed earlier in decay studies and transfer reactions are excited in the $(p,n\gamma)$ reaction. The excitation cross-sections of the individual states have been measured. The measured excitation cross-sections of these states relative to the well-known $7/2_1^+$ states of ^{107}Cd and ^{109}Cd are compared with the theoretically calculated values from the Hauser-Feshbach formalism based on compound nuclear statistical theory. (19 refs.)

105744 Energy levels in ^{93}Mo populated by the ^{93}Nb$(p,n\gamma)$ reaction. S.Mitarai (Dept. of Phys., Faculty of Sci., Kyushu Univ., Fukuoka, Japan), E.Minehara.
Nucl. Phys. A (Netherlands), vol.A406, no.1, p.55-80 (12 Sept. 1983).
Energy levels of ^{93}Mo have been investigated by means of the ^{93}Nb$(p,n\gamma)^{93}$Mo reaction. The excitation functions of the level de-excitation γ-rays were measured with a Ge(Li) detector under proton bombardment in the energy range 3.0 to 5.0 MeV. A detailed γ-ray decay scheme which includes 69 levels and 123 γ-ray lines was constructed from the threshold energies for 64 γ-rays and the γ-ray excitation functions around five isobaric analogue resonances in the ^{93}Nb$(p,n\gamma)$ reaction. Spin-parity values for 59 levels and favourable values for 8 levels were assigned from the analysis of relative neutron yields via the isobaric analogue resonances of the parent odd-odd nucleus ^{94}Nb. The results of the present experiment are compared with shell-model calculations. (23 refs.)

105745 The four-nucleon problem with local realistic NN interactions. J.L.Ballot (Div. de Phys. Theorique, Inst. de Phys. Nucleaire, Orsay, France).
Phys. Lett. B (Netherlands), vol.127B, no.6, p.399-402 (11 Aug. 1983).
The ground state and the first excited 0^+ state binding energies of ^{4}He are calculated within the framework of the hyperspherical method for the Gony-Pires-de Tourreil potential (GPDT) and for the two super soft core potentials (SSC.B and SSC.C) constructed by de Tourrteil and Sprung (1973). With neglect of the Coulomb effect, the ground state energies are found to be -30.10 MeV for GPDT, -25.88 MeV for SSC.B and -21.19 MeV for SSC.C. For the two first potentials an excited 0^+ state is found. The location of this state above the ground state is found to be 25.66 MeV for GPDT and 25.11 MeV for SSC.B. The author analyses the convergence of the ground state eigenvalues versus the grand orbital ($L=2K$) in comparing the results of the coupled equation calculations (CE) with those of different approximations, giving a lower bound with the extreme adiabatic approximation (EAA), an upper bound with the uncoupled adiabatic approximation (UAA) and an accurate bound with the coupled adiabatic approximation (CAA). (21 refs.)

105746 Effective mass in nuclei and the level density parameter. M.Prakash, J.Wambach, Z.Y.Ma (Dept. of Phys., State Univ. of New York, Stony Brook, NY, USA).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.141-6 (25 Aug. 1983).
The influence of momentum and frequency dependence of the nuclear mean field Σ on the level density parameter a is studied. By introducing a local quasiparticle effective mass the authors determine the volume, surface and curvature coefficients of a, expressed as $a=a_vA+a_sA^{2/3}+a_cA^{1/3}$. It is found that the magnitude of a_c is significant due to the very nature of the surface. A purely momentum dependent field Σ determined from the nonlocality of the optical potential gives a level density close to a self-consistent Thomas-Fermi description with Skyrme III forces. An explicit frequency dependence of Σ mainly influences a_s, enhancing it considerably for medium and heavy nuclei. (12 refs.)

105747 Overlapping β decay and resonance neutron spectroscopy of levels in ^{87}Kr. S.Raman, B.Fogelberg, J.A.Harvey, R.L.Macklin, P.H.Stelson (Oak Ridge Nat. Lab., Oak Ridge, TN, USA), A.Schroder, K.-L.Kratz.
Phys. Rev. C (USA), vol.28, no.2, p.602-22 (Aug. 1983).
Energy levels in ^{87}Kr have been studied, with special emphasis on the unbound region, using two different methods. The first method comprises neutron capture and transmission measurements on an enriched gas target of ^{86}Kr using neutron time-of-flight techniques. In this way, neutron widths were determined for 39 resonances below 400 keV and capture areas for 14 resonances below 90 keV. The second method is a decay study of 56-s ^{87}Br in which a level scheme for ^{87}Kr has been established that shows 126 levels in the bound and 12 levels in the unbound region. A detailed comparison amongst the neutron resonance, the γ-ray decay, and available delayed neutron results has been made. Almost a one-to-one correspondence exists between the currently observed p-wave resonances below 250 keV and levels in ^{87}Kr studies through delayed neutron emission. The overal β-strength distribution derived from the present data shows broad resonancelike structures. However, no marked selectivity is observed in the β decay to individual levels in the unbound region of ^{87}Kr. The neutron capture cross section of ^{86}Kr is found to be about 5 mb for 30-keV neutrons with a Maxwellian energy distribution. The future of delayed neutron spectroscopy as a new tool for obtaining level-density information is discussed. (44 refs.)

105748 Nuclear level density at high excitation energies. M.Ohta, K.Hatogai, S.Okai (Dept. of Phys., Konan Univ., Kobe, Japan).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.756-60
The angular momentum dependent nuclear level density, effective at high excitation energies, is calculated by means of the partition function method with the shell model single particle state. The active size of the single particle level space for the calculation is determined in connection with the data of heavy-ion fusion reactions at high incident energies. (14 refs.)

Retarded dissipation of the $Z=64$ shell gap in $_{66}{}^{160}$Dy$_{94}$ ...... See Entry 105709

On the relative quality of the spin expansion and frequency expansion for the description of rotational level energies .... See Entry 105710

Are heavy-ion entropy production and nuclear level density discrepancies related? .... See Entry 105730

Ground state properties of actinide nuclei .... See Entry 105731

Pairing correlations at high spin and finite temperature: a modified BCS approach .... See Entry 105757

A new excited level in Th-229 at 582.1 ± 1 keV .... See Entry 105785

The spectroscopic study of ^{206,204}Pb with the $(\alpha,{}^6$He$)$ reaction .... See Entry 105786

The decay of ^{153}Tb oriented in a gadolinium host .... See Entry 105788

K-capture probabilities in the decay of ^{133}Ba .... See Entry 105790

Decay of mass-separated ^{187}Au (8.4 min) to ^{187}Pt .... See Entry 105792

Nuclear matrix elements governing the 809 keV first-forbidden beta transition in the decay of ^{147} Nd .... See Entry 105794

Study of the 18.30 and 19.40 MeV states in ^{12}C in intermediate energy proton scattering .... See Entry 105856

$1f_{7/2}$ neutron hole strength in ^{59}Ni with the ^{60}Ni$(\vec{p},d)^{59}$Ni reaction at 94 MeV . ... See Entry 105863

^{79}As via proton pickup .... See Entry 105880

Single particle strengths in $A=28$ nuclei via (α,t) and $(\alpha,{}^3$He$)$ reactions .... See Entry 105887

Spectroscopy of $A=16$ from ^{13}C$(^6$Li$,t)^{16}$O .... See Entry 105896

Intermediate-structure resonances in the ^{16}O$+^{16}$O total reaction cross section .... See Entry 105914

21.30 NUCLEAR FORCES

(see also 13.75C Nucleon-nucleon interactions)

105749 The deuteron asymptotic D-state as a probe of the nucleon-nucleon force. T.E.O.Ericson (CERN, Geneva, Switzerland), M.Rosa-Clot.
Nucl. Phys. A (Netherlands), vol.A405, no.3, p.497-435 (5 Sept. 1983).
A critical discussion is given of the various contributions to the asymptotic D/S ratio from the πNN interaction. Particular emphasis is laid on the analysis of contributions from 2π exchange, the dependence on the πNN form factor, and on the πN coupling constant, so as to assess quantitatively the model dependence of the result. From this analysis, significant restrictions are deduced on the shape of the πNN form factor and, in quark bag models the value of the quark bag radius. The results of previous theoretical approaches for the D/S ratio and quadrupole moment are shown to obey a universal and linear relation, when expressed in reduced units so as to compensate for small differences in effective range and πN coupling constant. The quadrupole moment is also quantitatively analyzed in detail. Its value is proved to be an accurate and almost model-independent consequence of the experimental D/S ratio (apart from relativistic and meson-exchange corrections) in agreement with observations. In the comparison with experiments, a critical survey of the relevant experimental data is given. In particular, a considerably improved value for the quadrupole moment is deduced. (45 refs.)

105750 The screening of the particle-hole interaction to all orders. W.H.Dickhoff, A.Faessler, H.Muther, Shi-Shu Wu (Inst. fur Theoretische Phys., Tubingen, Germany).
Nucl. Phys. A (Netherlands), vol.A405, no.3, p.534-56 (5 Sept. 1983).
Starting from Brueckner's G-matrix the effects of the induced interactions on the particle-hole interaction in nuclear matter are investigated to all orders. Although an interactive solution of the non-linear integral equations, which have to be solved, leads to divergent contributions, it can be shown that the renormalization effects summed to all orders are finite. The complete momentum dependence of the particle-hole interaction is treated which in the Landau limit results is less attractive F_0 and more repulsive G_0' parameters. For finite ph momenta these features are maintained implying that the collectivity in the pion spin-isospin channel is screened also when the renormalization is considered to all orders. (20 refs.)

105751 Validity of approximate treatments of Δ-isobar degrees of freedom. C.Hajduk, P.U.Sauer (Inst. fur Theoretical Phys., Univ. of Hannover, Hannover, Germany), Shin Nan Yang.
Nucl. Phys. A (Netherlands), vol.A405, no.3, p.605-19 (5 Sept. 1983).
A perturbative approach to Δ-isobar components of the three-nucleon ground-state wave function is developed. It is based on the transition potential connecting nucleon-nucleon partial waves and partial waves with isobars. The perturbative results with single Δ-isobar excitation are compared to those of an exact coupled-channel calculation and turn out to be satisfactory agreement for many Δ-effects. Within the perturbative method the role of the ρ-exchange in the transition potential and the importance of double Δ-excitations in the three-nucleon ground state are discussed. Effective nuclear operators such as three-nucleon forces and exchange currents, when simulating Δ-propagation in static approximation, are found to grossly overestimate Δ-effects. (25 refs.)

105752 Nuclear effective interactions and spin excitations. T.Kohmura (Nuclear Phys. Lab., Oxford Univ., Oxford, England).
Nucl. Phys. A (Netherlands), vol.A405, no.3, p.653-70 (5 Sept. 1983).
In view of the one-boson-exchange model for the nucleon-nucleon interaction and the Hartree-Fock (HF) interaction, the author formulates the effective interactions for particle-hole states in terms of the exchange of the fields which are confined in the nucleus. This theory, as an extension to the nuclear field theory (NFT), takes into account the propagation of the fields which is neglected in NFT. The effective interactions thus obtained reproduce the energies of a sequence of electric giant resonances and the core polarizabilities associated with the resonances. It is found that the coupling constants of the σ- and ω-fields are suppressed for the particle-hole interaction by 60% with respect to the HF interaction. As for the effective interactions involving nucleon spins, he considers the fields coupled to nucleon spins. The effective interactions obtained, essentially different from those in NFT, have a tensor component. The author analyses the energies and cross sections for excitation of stretched spin particle-hole states which are the most sensitive to the tensor force. The effective interaction responsible for the stretched spin states is shown to be consistent with that for the magnetic resonances observed in the (p,n) reactions. (28 refs.)

105753 Calculations of pion excess in nuclei. B.L.Friman, V.R.Pandharipande (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA), R.B.Wiringa.
Phys. Rev. Lett. (USA), vol.51, no.9, p.763-6 (29 Aug. 1983).
The authors construct, in the static potential approximation, the number operator for excess pions present in nuclei due to the pion-exchange forces between nucleons. Expectation values are calculated with use of variational wave functions obtained from a realistic Hamiltonian. Results are presented for systems ranging from the deuteron to nuclear matter: For example ^{56}Fe is estimated to have $\sim$7 extra pions, over and above the pion clouds associated with the individual nucleons. (14 refs.)

105754 Spin-dependent excitations: RPA model and isobar-hole couplings. H.Sagawa (Nat. Inst. for Nuclear Phys. & High Energy Phys., Amsterdam, Netherlands).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.342-56 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
Spin properties of Skyrme-type interactions are discussed in comparison with the renormalized G-matrix. Using the modified Skyrme interaction SGII, spin-dependent excitations are studied in the framework of RPA model taking

into account the isobar-hole couplings. Combined effects of RPA correlations and Δ-h coupling give about 35% reductions of Gamow-Teller and $M1$ transition strengths. The quenching of spin-dipole ($\sigma r Y_1$) excitations is shown to be less than that of the σ-τ modes. (24 refs.)

105755 The residual interaction of bound nucleons—two-nucleon matrix elements deduced from transfer experiments. W.W.Daehnick (Nuclear Phys. Lab., Univ. of Pittsburgh, Pittsburgh, PA, USA).
Phys. Rep. (Netherlands), vol.96, no.6, p.317-91 (July 1983).
Matrix elements for the effective two-nucleon interaction have been deduced from the population of multiplets near closed shells as observed in direct transfer reactions. In the evaluation, the limited purity of such multiplets was taken into consideration, typically by weighting the observed fractions of the two-nucleon configurations by their spectroscopic strengths and by using the resulting energy centroids. In a few cases, off-diagonal matrix elements are available from empirical wave functions. The systematic errors for particle-particle matrix elements extracted directly and those obtained from Pandya transformations were found to go in opposite directions. In some cases, this feature of the empirical method could be used to suggest upper and lower 'bounds' for the extracted matrix elements. Diagonal matrix elements for the empirical residual interaction show a number of features suggestive of an underlying simplicity in the interaction of bound nucleons. Within experimental uncertainties (of about 10% for $T=0$ matrix elements) the monopole parts of the matrix elements are fit well with a simple $A^{-0.75}$ dependence, and the data available to date do not reveal any significant monopole dependence on the quantum numbers of the interacting nucleons. The usefulness of scaling is suggested. Generally, diagonal matrix elements $E_J(j_1j_2)$ normalized by the extracted A-dependent monopole strength agree within expected experimental uncertainties whether derived from particle-particle or particle-hole multiplets and whether extracted from the beginning or the end of a major shell. (157 refs.)

105756 Calculation of effective interactions. F.Brieva (Dept. de Fisica, Univ. de Chile, Santiago, Chile).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.4-11
The role of the true non-local effective force is not well understood. Since the problem is technical in a great deal the author discusses a general method to calculate the t-matrix elements either in the coordinate or momentum-space representation. The method is independent on whether the internucleon force has a hard core or not. This is a considerable advantage over existent approaches since one can compare directly the results obtained from different nucleon-nucleon forces. (18 refs.)

Long-range behavior of nuclear forces as a manifestation of supersymmetry in nature .... See Entry 105505

Microscopic calculation of dynamical effects: the energy dependence of nucleon self-energies in ^{208}Pb .... See Entry 105714

Ground state properties of actinide nuclei .... See Entry 105731

Properties of the three-nucleon bound states with virtual Δ-isobar excitation .... See Entry 105735

Study of isotope shifts, isotone shifts and nuclear compressibility from the analysis of muonic X-ray transitions .... See Entry 105736

Exchange-current contributions to the ^{3}He magnetic properties .... See Entry 105741

The four-nucleon problem with local realistic NN interactions .... See Entry 105745

A theory for coupling between fundamental excitation modes in nuclei .... See Entry 105763

Self-consistent description of nuclear excitations .... See Entry 105779

Recent developments in the description of electric giant resonances .... See Entry 105816

Effective interaction for deuteron stripping and pick up reactions .... See Entry 105827

Evidence of energy dependence in proton-neutron effective interaction for ^{90}Zr(p,d)^{89}Zr reactions at energies from 20 MeV to 120 MeV .... See Entry 105855

Radial parameters in nucleon-nucleus scattering .... See Entry 105866

The doorway to the continuum: quasifree nucleon-nucleon interactions .... See Entry 105873

Normal and pion-condensed states in neutron star matter in a relativistic field theory constrained by bulk nuclear properties. I .... See Entry 111122

Normal and pion-condensed states in neutron star matter in a relativistic field theory constrained by nuclear bulk properties. II .... See Entry 111123

21.40 FEW-NUCLEON SYSTEMS

Properties of the three-nucleon bound states with virtual Δ-isobar excitation .... See Entry 105735

Exchange-current contributions to the ^{3}He magnetic properties .... See Entry 105741

The four-nucleon problem with local realistic NN interactions .... See Entry 105745

The deuteron asymptotic D-state as a probe of the nucleon-nucleon force .... See Entry 105749

Second-order terms in the ^{3}He-nucleus folding model .... See Entry 105808

21.60 NUCLEAR-STRUCTURE MODELS AND METHODS

(for hadronic atoms and molecules, see 36.10)

105757 Pairing correlations at high spin and finite temperature: a modified BCS approach. O.Civitarese, A.Plastino, A.Faessler (Inst. fur Theoretische Phys., Univ. Tubingen, Tubingen, Germany).
J. Phys. G (GB), vol.9, no.9, p.1063-8 (Sept. 1983).
The modified BCS approach for rotating nuclei is extended in order to include thermal excitations. The formalism is developed to take into account both high-spin and temperature-dependent effects. The method seems to be appropriate for the microscopic description of the pairing correlations at excitation energies above the yrast line. (20 refs.)

Structure functions of nucleons inside nuclei .... See Entry 105641

Properties of the three-nucleon bound states with virtual Δ-isobar excitation .... See Entry 105735

What do we learn from self-consistent models about nuclear density distributions? .... See Entry 105738

Shape coexistence and a new region of strong deformation in nuclei far from stability .... See Entry 105739

Exchange-current contributions to the ^{3}He magnetic properties .... See Entry 105741

The four-nucleon problem with local realistic NN interactions .... See Entry 105745

Effective mass in nuclei and the level density parameter .... See Entry 105746

The deuteron asymptotic D-state as a probe of the nucleon-nucleon force .... See Entry 105749

The screening of the particle-hole interaction to all orders .... See Entry 105750

Validity of approximate treatments of Δ-isobar degrees of freedom .... See Entry 105751

Nuclear effective interactions and spin excitations .... See Entry 105752

The residual interaction of bound nucleons—two-nucleon matrix elements deduced from transfer experiments .... See Entry 105755

Effect of nuclear curvature energy on the transition between nuclei and bubbles in dense matter .... See Entry 105782

Alpha decay rates of neutron deficient trans-tin isotopes .... See Entry 105797

Multiple reflections in the path-integral approach to barrier penetration .... See Entry 105803

21.60C Shell model

105758 A graphical method to evaluate vacuum expectation values of products of creation and annihilation operators. P.P.Delsanto (Dept. of Phys., Duke Univ., Durham, NC, USA).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.15, p.513-19 (13 Aug. 1983).
A graphical method for the evaluation of vacuum expectation values of products of creation and annihilation operators, is presented. This method is an adaptation of Danos' switchyard technique (1971) to the particular case of strings of only creation and annihilation operators and is easier to use and more transparent than Wick's theorem. (3 refs.)

105759 The nuclear field theory. D.R.Bes (Phys. Dept., Comision Nacional de Energia Atomica, Buenos Aires, Argentina).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.1-32 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
The nuclear field theory (NFT) is presented with particular emphasis on its foundations. The following points are discussed: i) the equivalence between pure fermion and NFT operators (including the Hamiltonian), ii) the results from an exactly soluble example, iii) the appropriate expansion parameter and the convergence of the corresponding perturbation series, and iv) the extension to deformed systems. This is accomplished through the derivation of both the deformed Hamiltonian (superfluid case) and of the perturbation treatment appropriate for deformed basis. (47 refs.)

Rotational structure and Nilsson orbitals for highly deformed odd-A nuclei in the $A\sim100$ region .... See Entry 105716

The moment of inertia of ^{130}Ce above spin 30ℏ .... See Entry 105718

Anharmonicities of gamma vibration in ^{168}Er .... See Entry 105720

Probing the nuclear structure with heavy-ion reactions .... See Entry 105725

Equilibrium deformations for the Ra-Th region of nuclei .... See Entry 105734

Nuclear level density at high excitation energies .... See Entry 105748

Boson-fermion expansions .... See Entry 105762

Vibrational and rotational flow in nuclei .... See Entry 105772

The spectroscopic study of ^{206,204}Pb with the (α,^{6}He) reaction .... See Entry 105786

Light nuclei far from stability .... See Entry 105787

Decay of mass-separated ^{187}Au (8.4 min) to ^{187}Pt .... See Entry 105792

Multicluster fractional parentage coefficients .... See Entry 105802

Inelastic electron scattering from ^{9}Be .... See Entry 105843

Electron scattering at 180° from the 'single-hole' states in ^{15}N .... See Entry 105844

Coupled channel effects in ^{26}Mg(p,p′) at 40 MeV .... See Entry 105861

$1f_{7/2}$ neutron hole strength in ^{59}Ni with the ^{60}Ni($\vec{p}$,d)^{59}Ni reaction at 94 MeV .... See Entry 105863

Effects of the proton-neutron hole interaction to the form factor in (d,t) reactions on $N=50$ target nuclei .... See Entry 105877

Study of ^{46,48}Ca(α,p) reactions .... See Entry 105884

Different regimes of dissipative collisions .... See Entry 105928

Isovector $M2$ state observed in the ^{14}C(π^-,γ) reaction .... See Entry 105935

21.60E Collective models

105760 On the theory of collective motion in nuclei. III. From Hamiltonian dynamics to vortex-free fluidity. P.Kramer, Z.Papadopolos, W.Schweizer (Inst. fur Theoretische Phys., Univ. Tubingen, Tubingen, Germany).
Ann. Phys. (USA), vol.149, no.1, p.44-57 (Aug. 1983).
For pt.II see ibid., vol.141, no.2, p.269-82 (1983). It is assumed that the Hamiltonian for collective motion in nuclei is invariant under the orthogonal group $O(n,\mathbf{R})$. For degenerate orbits in phase space it is shown that the classical Hamiltonian equations reduce to the equations of a vortex-free fluid with a velocity field determined by independent equations of motion. (18 refs.)

105761 *SU* (3) and *SU* (5) dynamical symmetries in the extended interacting boson model. Sun Hong Zhou, M.Moshinsky (Inst. de Fisica, Univ. Nacionale Autonoma de Mexico, Mexico City, Mexico), A.Frank, P.Van Isacker.
KINAM Rev. Fis. (Mexico), vol.5, no.2, p.135-62 (1983).
The authors study two possible dynamical symmetries in the extended interacting boson model where g ($L=4$) bosons are allowed besides the usual s-d bosons of the IBM. The first of these symmetries [$SU(3)$] was proposed recently and in this paper they present a thorough discussion of its mathematical properties. The second symmetry [$SU(5)$] is new. They discuss the properties of both limits concerning generators, Casimir operators, energy spectra, reduction rules, wave functions and, to some extent, electromagnetic transitions. (27 refs.)

105762 Boson-fermion expansions. E.R.Marshalek (Dept,. of Phys., Univ. of Notre Dame, Notre Dame, IA, USA).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.89-114 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
The boson expansion theory is extended so as to allow for the coupling of several fermion-like valence particles or holes to the collective vibrations of a closed shell, described in terms of boson degrees of freedom. The result is a faithful mapping of the original many-fermion problem into a certain boson-fermion subspace without redundant variables. Generalizations of the Dyson and Holstein-Primakoff representations are derived with the aid of algebraic techniques. (22 refs.)

105763 A theory for coupling between fundamental excitation modes in nuclei. T.Kishimoto (Inst. of Phys., Univ. of Tsukuba, Ibaraki, Japan), T.Tamura, T.Kammuri.
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.170-83 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
A theory to describe coupling between fundamental excitation modes in nuclei is presented. It is characterized by two important aspects. First, a technique called dynamical nuclear field theory is developed, which is not only capable of constructing fundamental excitation modes but also of deriving and solving the effects of the coupling between these modes. Secondly, the derivation of effective nuclear interactions is improved so that they can be used for the microscopic description of the above coupling. (8 refs.)

105764 Rocky paths, dead ends and smooth paths towards a theory of nuclear collective motion. F.M.H.Villars (Dept. of Phys., MIT, Cambridge, MA, USA).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.184-97 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
Summarizes the well known construction based on TDHF of a collective Hamiltonian $\mathcal{H}(p,q)$ from an A-particle Hamiltonian $\hat{H}$. This construction is stated as a prescription, that may also be applied to any one particle operator $\hat{Y}$, and its time derivative $[i\hat{H},\hat{Y}]$. The operators $\mathcal{Y}(p,q)$ and $\mathcal{Y}(p,q)$ so obtained are required to obey $\mathcal{Y}(p,q)=[i\mathcal{H}(p,q), \mathfrak{Y}(p,q)]$. It is shown that this consistency condition on collective dynamics can indeed be enforced, and leads to the same conditions as the TDHF-variational principle. The author presents an alternative to TDHF, which is quantum mechanical from the outset. Eigenfunctions of the collective 'position' operator $\hat{Q}$ are constructed by projection. In the adiabatic limit, the results obtained by variationally optimizing the trial function for the system are in substantial agreement with quantized TDHF. Zero-point energy corrections are automatically included. (14 refs.)

105765 Dynamic deformation model of nuclear collective motions. K.Kumar (Phys. Dept., Tennessee Technol. Univ., Cookeville, TN, USA).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.198-208 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
The main concept and the five main steps of the dynamic deformation model are discussed. References are given for the formalism of the model, and for the results discussed previously. A brief comparison with the other approaches is given. (42 refs.)

105766 An attempt toward quantum theory of 'maximally-decoupled' collective motion. T.Marumori (Inst. of Phys., Univ. of Tsukuba, Ibaraki, Japan), F.Sakata, T.Une, Y.Hashimoto.
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.221-36 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
A full quantum theory of 'maximally-decoupled' collective motion is proposed. The essential idea is to develop a quantum theory which is capable by itself of determining a 'maximally-decoupled' collective subspace as well as a 'maximally-decoupled' collective Hamiltonian on the basis of a fundamental principle called the invariance principle of the Schrodinger equation. (14 refs.)

105767 Current viewpoints concerning the algebraic approach to nuclear collective motion. A.Klein, Ching-Teh Li (Dept. of Phys., Univ. of Pennsylvania, Philadelphia, PA, USA).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.237-50 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
A brief survey is given of some of the salient ideas developed over the past two decades in the program on nuclear collective motion based on the equations of motion, culminating in recent work involving the direct application of a variational method and parametrization by boson mappings. The multilevel pairing model is used throughout for illustration. (18 refs.)

105768 The generalized density matrix method in the theory of nuclear collective motion. V.G.Zelevinsky (Inst. of Nuclear Phys., Novosibirsk, USSR).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.251-70 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
The brief review of the generalized density matrix (GDM) method in the theory of nuclear collective motion is given. Basic concepts of the method are formulated and relations with traditional approaches (static mean field, time-dependent mean field, random phase approximation, cranking model and so on) are established. The crucial role of conservation laws is stressed. Applications of the method to some problems of rotation and large amplitude collective motion are discussed. (44 refs.)

105769 Aspects of boson expansion theories. T.Tamura (Dept. of Phys., Univ. of Texas, Austin, TX, USA), T.Kishimoto.
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.282-95 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
The authors first emphasize that, for a boson-expansion theory (BET) to be useful, it must use the Tamm-Dancoff representation, or its equivalent, from the beginning. Further, it must be formulated in such a way that the boson expanded operators contain only linked-cluster terms and are justified to act upon ideal-boson states. They show that a new BET which they formulated recently satisfies all these requirements. They show further that their old BET is included as a part of this BET. (13 refs.)

105770 Microscopic aspects of the interacting boson model. F.Iachello (Wright Nuclear Structure Lab., Yale Univ., New Haven, CT, USA).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.296-305 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
Some microscopic aspects of the interacting boson model are reviewed. In particular, the early work of Otsuka (1978) and some recent works in Zirnbauer and Brink (1982) and Pittel, Duval and Barrett (1982) are discussed. (18 refs.)

105771 The hydrodynamic limit of the microscopic collective model: the U(3)-boson model. D.J.Rowe (Dept. of Phys., Univ. of Toronto, Toronto, Ontario, Canada).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.306-18 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
A $U(6)$-boson model is introduced which contains the Bohr-Mottelson collective model (1975) and the $U(6)$ interacting boson model as submodels, thereby extending the latter to include the giant monopole and quadrupole resonances. The $U(6)$-boson model has a $U(3)$-boson submodel which contains the BM and Elliott's (1958) $U(3)$ models as submodels, The $U(3)$-boson model is shown to be the hydrodynamic limit of the fully microscopic $Sp(3,R)$ model. (9 refs.)

105772 Vibrational and rotational flow in nuclei. A.Schuh, J.Kunz, U.Mosel (Inst. fur Theoretische Phys., Univ. Giessen, Giessen, Germany).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.402-16 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
Current and velocity distributions have been calculated for quadrupole vibrations and rotations using cranked Nilsson model with pairing correlations. For vibrations the flow pattern is similar to that obtained in recent fluid dynamical models. It is shown that the currents for low-lying states exhibit a strong vortex whereas those for the higher ones are nearly incompressible and irrotational. The microscopic reasons for this difference are discussed. For rotations it is shown that the currents can be roughly approximated as a superposition of rigid and irrotational flow but that the higher multipole components add additional structure. (21 refs.)

Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions .... See Entry 105008

A semimicroscopic model of nuclear vibrations with separable forces and the giant dipole resonance of ^{12}C .... See Entry 105711

Molecular alpha-particle clustering in ^{218}Ra; dipole collectivity in the vicinity of nuclear shell closures .... See Entry 105715

The moment of inertia of ^{130}Ce above spin $30\hbar$ .... See Entry 105718

Anharmonicities of gamma vibration in ^{168}Er .... See Entry 105720

Proton inelastic scattering by the even-Ge isotopes at $E_p=22$ MeV .... See Entry 105722

Description of high spin states .... See Entry 105726

Different treatments of pairing correlations for nuclear shapes at high spin .... See Entry 105732

Deformation changes along the yrast line in ^{160}Yb .... See Entry 105733

Strong effect of the sign of the hexadecapole moment on the polarized-proton inelastic scattering to the 4_1^+ states in the even $^{74\text{-}82}$Se .... See Entry 105742

Pairing correlations at high spin and finite temperature: a modified BCS approach .... See Entry 105757

The nuclear field theory .... See Entry 105759

An equation for the quasi-particle RPA based on the $SO(2N+1)$ Lie algebra of the fermion operators .... See Entry 105773

A microscopic theory of collective and independent-particle motions; time-dependent Hartree-Fock method and its extension .... See Entry 105775

The nuclear response function .... See Entry 105776

Path integral approach to many-body systems and classical quantization of time-dependent mean field .... See Entry 105777

An extension of TDHF and boson-fermion expansion .... See Entry 105778

Symmetry energy and isovector collective motions .... See Entry 105780

Molecular orbital model study of the $_{\Lambda}^{9}$Be, $_{\Lambda\Lambda}^{10}$Be, $_{3\Lambda}^{11}$Be and $_{4\Lambda}^{12}$Be hypernuclei .... See Entry 105783

Sum rule approach to giant resonance states .... See Entry 105814

Recent developments in the description of electric giant resonances .... See Entry 105816

Fission from saddle to exit: influence of curvature and compression energies .... See Entry 105838

A semimicroscopic calculation of the photodisintegration of the ^{32}S nucleus .... See Entry 105840

Proton scattering in the interacting boson model .... See Entry 105868

^{79}As via proton pickup .... See Entry 105880

Symmetrical fusion of heavy ions around the Coulomb barrier energy .... See Entry 105894

Dynamical thresholds for compound-nucleus formation in symmetric heavy-ion reactions .... See Entry 105908

Fission following capture reactions of ^{32}S$+^{208}$Pb .... See Entry 105916

Macroscopic implications of (N,Z) distributions for reaction mechanisms in ion-ion collisions .... See Entry 105922

Energy dependence of fission fragment angular distributions for ^{19}F, ^{24}Mg and ^{28}Si induced reactions on ^{208}Pb .... See Entry 105940

21.60F Models based on group theory

Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions .... See Entry 105008

On the theory of collective motion in nuclei. III. From Hamiltonian dynamics to vortex-free fluidity .... See Entry 105760

***SU* (3) and *SU* (5) dynamical symmetries in the extended interacting boson model** .... See Entry 105761

Microscopic aspects of the interacting boson model .... See Entry 105770

The hydrodynamic limit of the microscopic collective model: the U(3)-boson model .... See Entry 105771

An equation for the quasi-particle RPA based on the $SO(2N+1)$ Lie algebra of the fermion operators .... See Entry 105773

Path integral approach to many-body systems and classical quantization of time-dependent mean field .... See Entry 105777

Proton scattering in the interacting boson model .... See Entry 105868

21.60G Cluster models

Molecular alpha-particle clustering in ^{218}Ra; dipole collectivity in the vicinity of nuclear shell closures .... See Entry 105715

Molecular orbital model study of the ${}_{\Lambda}^{9}$Be, ${}_{\Lambda\Lambda}^{10}$Be, ${}_{3\Lambda}^{11}$Be and ${}_{4\Lambda}^{12}$Be hypernuclei .... See Entry 105783

Structure of the ${}_{\Lambda\Lambda}^{10}$Be hypernucleus .... See Entry 105784

21.60J Hartree-Fock and random-phase approximations

105773 An equation for the quasi-particle RPA based on the $SO(2N+1)$ Lie algebra of the fermion operators. S.Nishiyama (Dept. of Phys., Kochi Univ., Kochi, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1811-14 (June 1983).
A way of constructing an equation for the quasi-particle random phase approximation (RPA) including unpaired mode effects is proposed. The author obtains a Jacobi equation on the coset manifold $SO(2N+2)/U(N+1)$. Assuming the periodic Jacobi fields, one can get the $SO(2N+1)$ RPA equation applicable to odd fermion systems. (7 refs.)

105774 Time dependent Hartree-Fock and beyond. K.Goeke (Inst. fur Kernphys., KFA Julich, Julich, Germany), R.Y.Cusson, F.Grummer, P.-G.Reinhard, H.Reinhardt.
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.33-65 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
The time dependent Hartree-Fock method (TDHF) is reviewed and its success and failure are discussed following realistic numerical results. It is demonstrated that TDHF is basically able to describe the time evolution of one-body operators, the energy loss in inclusive deep inelastic collisions, and fusion reactions above the Coulomb barrier. For spontaneous fission, subbarrier fusion and the description of bound vibrations the quantized adiabatic time dependent Hartree-Fock theory (quantized ATDHF) is suggested and reviewed. Realistic three-dimensional calculations for heavy ion systems of $A_1+A_2\leq 32$ are presented. Recent theories based on path integral approaches (PIA) are discussed, which aim at quantizing TDHF in order to describe stationary vibrational states and subbarrier fission. The relationship of quantized ATDHF to PIA is explored in the case of vibrations including the fluctuations on top of the periodic TDHF orbits. For the description of width of one-body observables in inclusive reactions the time dependent generator coordinate method (TDGCM) is reviewed. (35 refs.)

105775 A microscopic theory of collective and independent-particle motions; time-dependent Hartree-Fock method and its extension. A.Kuriyama (Dept. of Phys., Kyushu Univ., Fukuoka, Japan).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.66-88 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
Reviews briefly the development in the microscopic description of collective and independent-particle motions. The author gives a review on a formal aspect of the time-dependent Hartree-Fock method as an approach to the description of collective motion, following the formulation given by Marumori et al. (1980). An emphasis is put on the utility of the canonicity condition. As a validity check of the TDHF approach to the description of the collective motion, the author applies this method to a simple but non-trivial model, i.e. the coupled Lipkin model. The microscopic theory of collective and independent-particle motions developed by Yamamura and Kuriyama (1981) is introduced. (17 refs.)

105776 The nuclear response function. G.F.Bertsch (Dept. of Phys.-Astron., Michigan State Univ., East Lansing, MI, USA).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.115-41 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
Presents the theory of the nuclear response in the random phase approximation (RPA). Various relations are derived between densities and currents which give rise to the well-known sum rules. Then RPA is derived via the time-dependent Hartree theory. The following formulations of RPA are shown: the configuration space representation, the coordinate space representation, Landau theory of finite systems and the RPA for separable interactions constrained by consistency. The remarkable success of RPA in describing the collective density oscillations of closed shell nuclei is illustrated with a few examples. The $\sigma\tau$ response is discussed with the application of simple theoretical considerations to the empirical data. The author points out several problems which remain in the response theory. (41 refs.)

105777 Path integral approach to many-body systems and classical quantization of time-dependent mean field. H.Kuratsuji (Dept. of Phys., Kyoto Univ., Kyoto, Japan), T.Suzuki.
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.209-20 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
The authors present the path integral formalism of many-body systems based on the representation of generalized coherent states. They give the path integral representation for the transition amplitude by utilizing the characteristic property of the coherent state and discuss its classical limit through the method of stationary phase. Applying to the bound state problem, they arrive at the classical quantization rule for the period mean field solutions, the utility of which is briefly discussed. (18 refs.)

105778 An extension of TDHF and boson-fermion expansion. M.Yamamura (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.271-81 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
A possible extension of the time-dependent Hartree-Fock theory is given with the aim of obtaining a classical image of the boson-fermion expansion. The extended form can be regarded as a canonical system with constraints and the Direct quantization reproduces the boson-fermion expansion given by Marshalek (1981). (10 refs.)

105779 Self-consistent description of nuclear excitations. Nguyen Van Giai (Div. de Phys. Theorique, Inst. de Phys. Nucleaire, Orsay, France).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.330-41 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
The nuclear response function is calculated in the framework of the self-consistent continuum RPA. The method is illustrated by applications to low-lying collective states, and to various isoscalar giant resonances. (17 refs.)

105780 Symmetry energy and isovector collective motions. S.Stringari (Dipartimento di Fisica, Libera Univ. degli Studi di Trento, Povo, Italy).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.367-79 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
Isovector collective modes are investigated in the framework of microscopic and macroscopic models of the nuclear motion. The schematic and hydrodynamical models are discussed in particular detail. It is shown that both models can be derived starting from the time dependent Hartree-Fock equations. The importance of the surface term of the symmetry energy in locating the dipole giant resonance is also discussed. (24 refs.)

Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions .... See Entry 105008

Transition charge and current densities of collective isoscalar quadrupole states in ^{208}Pb .... See Entry 105717

The RPA calculation of bandhead energies in many-boson systems .... See Entry 105719

Anharmonicities of gamma vibration in ^{168}Er .... See Entry 105720

Sum-rule strengths of low-lying 4^+ levels in $^{74-82}$Se nuclei .... See Entry 105723

Spin-dependent excitations: RPA model and isobar-hole couplings .... See Entry 105754

The nuclear field theory .... See Entry 105759

Rocky paths, dead ends and smooth paths towards a theory of nuclear collective motion .... See Entry 105764

The generalized density matrix method in the theory of nuclear collective motion .... See Entry 105768

Vibrational and rotational flow in nuclei .... See Entry 105772

Sum rule approach to giant resonance states .... See Entry 105814

Fluid-dynamical models for giant resonances .... See Entry 105815

Recent developments in the description of electric giant resonances .... See Entry 105816

21.65 NUCLEAR MATTER

105781 Landau-Ginzburg theory of phase transitions in heated rotating nuclei. A.L.Goodman (Phys. Dept., Tulane Univ., New Orleans, LA, USA).
Nucl. Phys. A (Netherlands), vol.A406, no.1, p.94-108 (12 Sept. 1983).
The Landau-Ginzburg theory is applied to heated rotating superfluid systems. It is demonstrated that the free energy F' is an even function of the order parameter Δ even when external fields are present. The energy surfaces $F'(\Delta)$ are calculated for various rotational frequencies and temperatures. These surfaces provide clear illustrations of first-order and second-order phase transitions, as well as a critical point. (16 refs.)

105782 Effect of nuclear curvature energy on the transition between nuclei and bubbles in dense matter. C.J.Pethick (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA), D.G.Ravenhall, J.M.Lattimer.
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.137-40 (25 Aug. 1983).
The authors show that the density at which the transition between a state with nuclei and one with bubbles occurs is unexpectedly sensitive to the nuclear curvature energy. They suggest that this may account for the fact that Bonche and Vautherin's (1982) detailed Hartree-Fock calculations lead to a transition density of about 0.04 f^{-3}, which is significantly lower than the value $\sim$0.07 f^{-3} found from calculations based on the liquid drop model of nuclei and bubbles. (9 refs.)

Meson radiation from a quark-gluon plasma by fission of chromoelectric flux tubes .... See Entry 105585

Nuclear charge and matter distributions .... See Entry 105737

The screening of the particle-hole interaction to all orders .... See Entry 105750

Calculations of pion excess in nuclei .... See Entry 105753

Normal and pion-condensed states in neutron star matter in a relativistic field theory constrained by bulk nuclear properties. I .... See Entry 111122

Normal and pion-condensed states in neutron star matter in a relativistic field theory constrained by nuclear bulk properties. II .... See Entry 111123

21.80 HYPERNUCLEI

105783 Molecular orbital model study of the ${}_{\Lambda}^{9}$Be, ${}_{\Lambda\Lambda}^{10}$Be, ${}_{3\Lambda}^{11}$Be and ${}_{4\Lambda}^{12}$Be hypernuclei. K.Miyahara, K.Ikeda (Dept. of Phys., Niigata Univ., Niigata, Japan), H.Bando.
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1717-30 (June 1983).
The Λ-hypernuclei ${}_{n\Lambda}^{8+n}$Be ($n=1\sim 4$) are systematically investigated by employing the molecular orbital model. Various Λ configurations are constructed of the gerade and ungerade orbitals around two α-clusters. The generator coordinate method is applied to the model after L^{π} projection. Energy spectra for $K^{\pi}=0^{\pm}$ bands, $B(E2)$ values and spectroscopic factors are calculated and discussed in connection with structure-changes of hypernuclei associated with the addition of Λ particles. (21 refs.)

105784 Structure of the ${}_{\Lambda\Lambda}^{10}$Be hypernucleus. H.Bando (Div. of Math. Phys., Fukui Univ., Fukui, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1731-45 (June 1983).
A microscopic $\alpha+\alpha+\Lambda+\Lambda$ four-body problem for the ${}_{\Lambda\Lambda}^{10}$Be hypernucleus is formulated and solved for the ground (positive parity) and excited (negative parity) bands. Energy properties, electric transition probabilities and reduced width amplitudes (spectroscopic factors) for the ${}_{\Lambda\Lambda}^{6}\mathrm{He}+\alpha$, ${}_{\Lambda}^{5}\mathrm{He}+{}_{\Lambda}^{5}\mathrm{He}$ and ${}_{\Lambda}^{9}\mathrm{Be}+\Lambda$ channels are calculated and discussed in comparison with those of ${}_{\Lambda}^{9}$Be. (17 refs.)

23.00 RADIOACTIVITY AND ELECTROMAGNETIC TRANSITIONS

(see also 82.55 Radiochemistry)

23.20 ELECTROMAGNETIC TRANSITIONS

105785 A new excited level in Th-229 at 582.1±1 keV. A.El-Kamshawy, M.El-Tahawy, R.Shadhan, T.El-Ani (Dept. of Phys., Univ. of Salah El-Din, Arbil, Iraq).
Iraqi J. Sci., vol.23, no.2, p.256-73 (1982). [received: Aug. 1983]
Discusses the measurements and analysis of the direct γ-spectrum as well as the (γ,γ) coincidence spectra at the gates: 146-148 keV, 163.3-164.5 keV and 217-219 keV for U. A fast-slow (γ,γ) coincidence spectrometer of 11.2 sec. time resolution was used. In order to explain the origin of eight of these lines the authors suggest a new excited level with energy 582.1±1 keV in ^{229}Th. Furthermore, places have been found for the other five γ-lines as transitions between the known excited levels of ^{229}Th. (6 refs.)

105786 The spectroscopic study of ^{206,204}Pb with the $(\alpha,^{6}$He) reaction. M.H.Tanaka, S.Kubono (Inst. for Nuclear Study, Univ. of Tokyo, Tokyo, Japan).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.386-94
Clear differences have been observed between the (p,t) and $(\alpha,^{6}$He) reactions on ^{208,206}Pb. These differences in the natural parity state excitations are well explained by including the components of relative angular momena betweent the two nucleons $1\neq 0$, suggesting that the $(\alpha,^{6}$He) reaction may be a new spectroscopic tool to study not only the shell model configuration, but also the $1\neq 0$ two-nucleon correlations in the nuclei. (10 refs.)

105787 Light nuclei far from stability. A.Dobado, A.Poves (Dept. de Fisica Teorica, Univ. Autonoma de Madrid, Madrid, Spain).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.248-55
The authors try to describe theoretically the spectra of heavy potassium isotopes (A=47 to 50) and the corresponding particle-hole spectra of calcium isotopes, within a shell model approach. (12 refs.)

Study of the lepton-violating (μ^{-},e^{+}) reaction in modern gauge theories .... See Entry 105455

Molecular alpha-particle clustering in ^{218}Ra; dipole collectivity in the vicinity of nuclear shell closures .... See Entry 105715

Rotational structure and Nilsson orbitals for highly deformed odd-*A* nuclei in the *A*~100 region .... See Entry 105716

Transition charge and current densities of collective isoscalar quadrupole states in ^{208}Pb .... See Entry 105717

Excitation modes of the γ-band in ^{24}Mg through the ^{24}Mg$(\vec{p},p')$ reaction .... See Entry 105721

Sum-rule strengths of low-lying 4^{+} levels in $^{74-82}$Se nuclei .... See Entry 105723

Excitation of low-lying collective bands in inelastic hadron scattering .... See Entry 105724

New directions in studies of nuclei far from stability with heavy ions .... See Entry 105727

Recent results on nuclei far from stability in the mass region A≃70 .... See Entry 105729

The nuclear magnetic moment of ^{190}Ir and the directional distribution of gamma rays in ^{190}Os .... See Entry 105740

Excitations of the states of ^{107,109}Cd from the $(p,n\gamma)$ reaction on silver isotopes .... See Entry 105743

Energy levels in ^{93}Mo populated by the ^{93}Nb$(p,n\gamma)$ reaction .... See Entry 105744

***SU* (3) and *SU* (5) dynamical symmetries in the extended interacting boson model** .... See Entry 105761

The decay of ^{153}Tb oriented in a gadolinium host .... See Entry 105788

Effective coupling constants for spin-flip and non spin-flip E1 transitions in A~90 nuclei .... See Entry 105811

Study of the (^{3}He,t) reaction on heavy nuclei .... See Entry 105820

The excitation and decay of isoscalar giant resonances .... See Entry 105822

Excitation of the quasi-bound state in ^{4}He by electron scattering at medium momentum transfer .... See Entry 105842

Measurement of the electron capture branching ratio of ^{7}Be .... See Entry 105865

Proton scattering in the interacting boson model .... See Entry 105868

Excitation of ^{17}O and ^{18}O scattered by ^{208}Pb in the Coulomb-nuclear interference region .... See Entry 105904

Isovector *M*2 state observed in the ^{14}C(π^{-},γ) reaction .... See Entry 105935

23.20C Lifetimes and transition probabilities

Molecular orbital model study of the $_{\Lambda}^{9}$Be, $_{\Lambda\Lambda}^{10}$Be, $_{3\Lambda}^{11}$Be and $_{4\Lambda}^{12}$Be hypernuclei .... See Entry 105783

Structure of the $_{\Lambda\Lambda}^{10}$Be hypernucleus .... See Entry 105784

Differential muon-capture rate and the deuterium form factors in the timelike region .... See Entry 105845

Strong *E*1 transitions in ^{9}Be, ^{11}Be, and ^{13}C .... See Entry 105878

23.40 BETA DECAY; ELECTRON AND MUON CAPTURE

105788 The decay of ^{153}Tb oriented in a gadolinium host. I.Prochazka, J.Konicek, M.Finger, E.Simeckova, P.Simecek, V.M.Tsupko-Sitnikov (JINR, Dubna, USSR).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.8, p.903-22 (1983).
Gamma-ray anisotropies in the decay of ^{153}Tb oriented in gadolinium at low temperatures were measured with high-resolution Ge(Li) detectors. Spins of 31 levels in ^{153}Gd were unambiguously established and multipole mixing ratios of many transitions in ^{153}Gd were determined. The results are compared with previous calculations in the framework of the particle-rotor model. (25 refs.)

105789 Neutrinoless double electron capture as a tool to measure the electron neutrino mass. J.Bernabeu, A.De Rujula, C.Jarlskog (CERN, Geneva, Switzerland).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.1, p.15-28 (15 Aug. 1983).
A nucleus (Z,A) may capture two atomic electrons to become $(Z\text{-}2,A)$. For Majorana neutrinos this may occur with no neutrino emission, the process is a virtual mixing of the parent atom and the daughter atom with two electron holes. The process becomes real as the daughter atom de-excites. In some cases where the daughter nucleus is excited, the neutrinoless decay may be enhanced by its proximity to a virtual resonance. The authors identify the ^{112}Sn→^{112}Cd transition as a good case. The no-neutrino lifetime for $m_{\nu}=30$ eV ranges from 10^{22} to 10^{27} years as a function of the insufficiently well determined distance to resonance. The signatures of the two- or no-neutrino modes are very different. (16 refs.)

105790 K-capture probabilities in the decay of ^{133}Ba. K.Singh, H.S.Sahota (Dept. of Phys., Punjabi Univ., Patiala, India).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2336-9 (July 1983).
The K-capture probabilities in the decay of ^{133}Ba to 437, 383, 161 and 81 keV levels have been determined from the analysis of the K X-ray-gamma ray sum peaks observed with an intrinsic Ge detector. The measurements on the 161 and 81 keV levels are reported for the first time in the literature. (6 refs.)

105791 Change in the beta-decay probability of polarized nuclei due to the action of an electromagnetic wave. I.M.Ternov, V.N.Rodionov, A.E.Lobanov, O.F.Dorofeev (M.V. Lomonosov State Univ., Moscow, USSR).
JETP Lett. (USA), vol.37, no.6, p.342-5 (20 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.6, p.288-90 (20 March 1983). [received: Sept. 1983]
A study is made of the total and differential probabilities of the beta decay of polarized nuclei in the field of a circularly polarized electromagnetic wave in the case where the energy of the wave quantum is small compared to the rest energy of the electron. (6 refs.)

105792 Decay of mass-separated ^{187}Au (8.4 min) to ^{187}Pt. B.E.Gnade, R.W.Fink (School of Chem., Georgia Inst. of Technol., Atlanta, GA, USA), J.L.Wood.
Nucl. Phys. A (Netherlands), vol.A406, no.1, p.29-54 (12 Sept. 1983).
The decay of ^{187}Au to ^{187}Pt has been studied with mass-separated sources from the UNISOR facility. Multiscaled spectra of γ-rays, X-rays, and conversion electrons, as well as $\gamma\gamma t$, $X\gamma t$, $e\gamma t$, and eXt coincidences were obtained. The half-life of the ^{187}Au ground state was measured to be 8.4±0.3 min. A decay scheme has been constructed incorporating 88% of the decay intensity assigned to ^{187}Au. The $i_{13/2}$ band in ^{187}Pt is populated through low-spin band members. The levels at 260 and 288 keV are found to de-excite by E0 transitions. From a γ-ray gated K/β^{+} ratio, the β-decay energy of 8.4 min ^{187}Au is deduced to be $Q_{EC}=3.90\pm0.15$ MeV. The positive-parity states in ^{187}Pt are compared with calculations made using the Nilsson model with a triaxial degree of freedom. The possibility that shape coexistence is present at low energy in ^{187}Pt is discussed. (38 refs.)

105793 Ultralow-energy *K*-capture decay of ^{158}Tb: a new neutrino 'balance'. R.S.Raghavan (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. Lett. (USA), vol.51, no.11, p.975-8 (12 Sept. 1983).
An ultralow-energy *K*-capture branch has been discovered in the decay of ^{158}Tb with an energy release of only 156(17) eV above the *K*-shell threshold, the smallest known so far for a weak-decay process. It thus offers a new neutrino 'balance' with close-to-ideal decay energetics. (7 refs.)

105794 Nuclear matrix elements governing the 809 keV first-forbidden beta transition in the decay of ^{147} Nd. S.Lakshminarayana, M.Srinivasa Rao, V.Seshagiri Rao, D.L.Sastry (Lab. for Nuclear Res., Andhra Univ., Waltair, Visakhapatnam, India).
Phys. Rev. C (USA), vol.28, no.2, p.852-61 (Aug. 1983).
Energy dependence of the $^{5}/_{2}{}^{-}(809\text{ keV }\beta)^{5}/_{2}{}^{+}(91\text{ keV }\gamma)^{7}/_{2}{}^{+}$ angular correlation was measured with a fast-slow scintillation spectrometer applying the necessary attenuation correction due to the finite lifetime of the intermediate state. The present results were used in conjunction with the other available experimental observables to determine the beta matrix elements, employing Buhring's formalism as modified by Simms. The sizes of the matrix elements indicate a 'cancellation effect'. The vector matrix element ratio Λ_{CVC} following the present analysis shows a deviation from Fujita's prediction and is consistent with the theory of Damgaard and Winther. The structure of the involved levels is discussed in the framework of the one-quasiparticle phonon coupling model together with the shell model predictions. (35 refs.)

105795 Some new contributions to neutrinoless double-β decay in an SU(2)×U(1) model. C.O.Escobar (Inst. de Fisica, Univ. de Sao Paulo, Sao Paulo, Brazil), V.Pleitez.
Phys. Rev. D (USA), vol.28, no.5, p.1166-9 (1 Sept. 1983).
Considers an SU(2)×U(1) model having both Dirac and Majorana mass terms for the neutrinos, with an extended Higgs sector without natural flavor conservation. Under these conditions, the author shows that for a certain range of the mass parameters of the model, some new contributions become important for neutrinoless double-β decay $[(\beta\beta)_{0\nu}]$. (8 refs.)

Lepton-number violation with quasi-Dirac neutrinos .... See Entry 105536

Overlapping β decay and resonance neutron spectroscopy of levels in ^{87}Kr .... See Entry 105747

Direct proton decay of ^{147}Tm .... See Entry 105799

Differential muon-capture rate and the deuterium form factors in the timelike region .... See Entry 105845

Measurement of the electron capture branching ratio of ^{7}Be .... See Entry 105865

23.60 ALPHA DECAY

105796 A basic set of experimental data on the strong alpha transitions. D.N.Poenaru, M.Ivascu (Inst. for Phys. & Nuclear Engng., Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.4, p.309-29 (1983).
The experimental data Q, $T_{1/2}$ concerning the most probable (ground state to ground state or favoured) alpha transitions for 123 even-even, 111 even-odd, 83 odd-even and 59 odd-odd nuclei are selected to meet, in each of the four groups, the criteria of best fitting the systematics of Q-value, log $T_{1/2}$, of the quantity χ_{exp} versus neutron number and the Geiger-Nuttall plot. This basic set of data can be used to find the parameters of a semiempirical formula allowing to obtain the best estimate of the alpha decay half-life, if the Q-value is known. (21 refs.)

105797 **Alpha decay rates of neutron deficient trans-tin isotopes.** I.Silisteanu (Inst. for Phys. & Nuclear Engng., Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.4, p.331-8 (1983).
The many-body (shell model) and one-body α-decay rates are calculated by using the methods of unified theory of nuclear reactions. The influence of the structure on the one body rates is analysed. The calculated α-decay data are compared with experimental data and previous predictions. (17 refs.)

105798 **Systematics of alpha decay life times.** H.Sato (Inst. for Nuclear Study, Univ. of Tokyo, Tanashi, Japan).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.751-5
The relationship between α Q-values and α decay life times of even-even nuclei is studied. Assuming a simple Woods-Saxon potential having a radial shape determined by the electron scatterings for the α-A relative motion, the potential depth is determined from the α Q value for each node quantum number N_r. The α decay life times are calculated with the potential obtained, and overall agreements are obtained between the calculation and experimental value. (10 refs.)

Radioactive half-life measurements in a freshman or sophomore laboratory ....See Entry 105080

Numerical model of radionuclide migration in geologic media ....See Entry 105961

23.90 OTHER TOPICS IN NUCLEAR DECAY AND RADIOACTIVITY

105799 **Direct proton decay of ^{147}Tm.** D.Schardt (GSI Darmstadt, Darmstadt, Germany).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.256-66
Using on-line mass separation of evaporation residues from the reaction $^{58}\mathrm{Ni}+^{92}\mathrm{Mo}\rightarrow^{150}\mathrm{Yb}^*$, a proton line of 1055±6 keV energy and 0.56±0.04 s half-life was observed. The activity was assigned to the direct proton decay of ^{147}Tm. Beta-delayed protons registered at the same mass position were found to arise from the decays of $^{147}\mathrm{Er}(T_{1/2}=2.5\pm0.2\ \mathrm{s})$ and $^{147m}\mathrm{Dy}(T_{1/2}=57\pm4\ \mathrm{s})$. (19 refs.)

24.00 NUCLEAR REACTIONS AND SCATTERING: GENERAL

24.10 NUCLEAR REACTION AND SCATTERING MODELS AND METHODS

105800 **An effective energy-dependent one-body potential for the low-energy particle-nucleus scattering problem. The one open channel case.** J.Toke, T.Matulewicz (Inst. of Experimental Phys., Warsaw Univ., Warsaw, Poland).
Acta Phys. Pol. B (Poland), vol.B14, no.8, p.609-16 (Aug. 1983).
A simple method of generating the relative motion continuum wave functions in the region of isolated resonances by using an energy-dependent effective one-body potential is proposed. The method accounts for the effects of the configuration mixing and predicts splitting of the single-particle resonances in quantitative agreement with the shell model diagonalisation approach. (10 refs.)

105801 **Remarks on the proximity scaling applied to heavy ion interaction potentials.** M.Pi, M.Barranco, X.Vinas (Facultad de Fisica, Univ. de Barcelona, Barcelona, Spain), C.Ngo, E.Tomasi, H.Ngo.
J. Phys. Lett. (France), vol.44, no.16, p.L685-8 (15 Aug. 1983).
Two heavy ion interaction potentials have been computed using the same nuclear force. One has been obtained from symmetric semi-infinite nuclear matter slabs and the other one from finite nuclei. After a proximity scaling, two rather different universal functions are obtained. The authors argue that this is due to the different surface thickness of semi-infinite nuclear matter and finite nuclei. Consequently, it is the universal function obtained from the nucleus-nucleus systematics that should be used in the applications. (12 refs.)

105802 **Multicluster fractional parentage coefficients.** L.Ya.Glozman, Yu.M.Tchuvil'sky (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
J. Phys. G (GB), vol.9, no.9, p.1033-45 (Sept. 1983).
The notion of a multicluster fractional parentage coefficient (MCFPC) is introduced to study reactions with the emission of several composite particles. A compact formalism has been developed for calculating MCFPC in the harmonic-oscillator translationally invariant shell model (TISM) which is based on the relation between the TISM and the conventional shell model. Tables of MCFPC for the disintegration of ^{16}O into three fragments of 11, 3 and 2 nucleons are given by way of example. (21 refs.)

105803 **Multiple reflections in the path-integral approach to barrier penetration.** D.M.Brink (Dept. of Theoretical Phys., Univ. of Oxford, Oxford, England), U.Smilansky.
Nucl. Phys. A (Netherlands), vol.A405, no.2, p.301-12 (29 Aug. 1983).
A primitive saddle-point evaluation of a path integral for the amplitude for penetrating a potential barrier is inaccurate if the incident energy is near the top of the barrier. A careful summation of contributions from a sequence of saddles corresponding to multiple reflections under the barrier gives some improvement. The effect of all multiple reflections can be taken into account accurately by evaluating the path integral by a Γ-function uniform approximation. (10 refs.)

105804 **Reduced nuclear amplitudes in quantum chromodynamics.** S.J.Brodsky (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA), J.R.Hiller.
Phys. Rev. C (USA), vol.28, no.2, p.475-82 (Aug. 1983).
The authors present a new formalism which systematically accounts for nucleaon compositeness in nuclear scattering amplitudes, consistent with quantum chromodynamics and covariance. Reduced gauge-invariant nuclear amplitudes are defined which have elementary quantum chromodynamic scaling properties. The procedure is applied to the photodisintegration and electrodisintegration of the deuteron as a test of nuclear chromodynamics and as a method to isolate contributions of dibaryon resonances. (19 refs.)

105805 **On a combined model of direct and compound-resonant nuclear reactions.** V.Olkhovskii, S.Chinarov.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1141-6 (Aug. 1983). In Russian.
A method of a combined description of direct and resonant processes of nucleon-light nucleus collision is developed as based on a unitary representation of Simonius (1974) for the *S*-matrix. The nonresonant *S*-matrix factor is modelled by the potential scattering or by the coupled channel method with the zero imaginary potential part. Energies and configurations of the resonant states are constructed from collective and one-particle statesdetermined energies. Corrections for the resonant energies and with experimentally widths are modelled using the random matrix method. The ergodicity hypothesis in a supposition of the random processes' local stationarity is also used. Calculation results are compared with experimental data for neutron scattering by ^{12}C nuclei. Two resonances with energies of about 2.45 and 4.70 MeV in the proton scattering by ^{12}C nuclei are predicted. (12 refs.)

105806 **Estimates of multistep processes.** M.A.Nagarajan (Daresbury Lab., Warrington, England).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.395-419
A variational principle, based on microscopic trial wavefunctions to calculate the corrections to the Born Amplitude, is discussed. The formalism can be applied to the case of transitions to many body final channels. Applications of the formalism to some model calculations is discussed. (12 refs.)

105807 **Microscopic study of local potential between nuclei on the basis of the resonating group method.** H.Horiuchi, K.Aoki, T.Wada (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.806-25
In order to study the inter-nucleus interaction in a local potential picture, the equivalent local potentials to the non-local potentials of the resonating group method have been derived by using the WKB method. On the basis of the analyses of the localized potentials, the authors discuss several problems including the potential shape, its energy-dependence, contributions from many types of the exchange process, comparison with other approaches to derive the local potential, and the foundation of the orthogonality condition model. (47 refs.)

Heavy-Ion Collisions. Proceedings of the International Summer School ....See Entry 105028

Proton inelastic scattering by the even-Ge isotopes at $E_p=22$ MeV ....See Entry 105722

Excitation of low-lying collective bands in inelastic hadron scattering ....See Entry 105724

What do we learn from self-consistent models about nuclear density distributions? ....See Entry 105738

Strong effect of the sign of the hexadecapole moment on the polarized-proton inelastic scattering to the 4_1^+ states in the even $^{74-82}$Se ....See Entry 105742

Time dependent Hartree-Fock and beyond ....See Entry 105774

Non-orthogonality and overcompleteness in direct nuclear reactions ....See Entry 105823

Direct and direct-fusion reaction approach to continuum spectra of nuclear reactions ....See Entry 105826

High-momentum-transfer processes with polarized deuterons ....See Entry 105835

$^{24}\mathrm{Mg}(\vec{p},d)$ reaction at 65 and 80 MeV ....See Entry 105836

Polarization phenomena in heavy ion transfer reactions ....See Entry 105837

A semimicroscopic calculation of the photodisintegration of the ^{32}S nucleus ....See Entry 105840

Relation between coherent π^0 photoproduction and π-nucleus elastic scattering ....See Entry 105841

Response functions for deep inelastic scattering from ^{40}Ca ....See Entry 105846

Target nucleus excitation dependence of correlation in the multiple production on nuclei at 400 GeV and the additive quark model ....See Entry 105847

Study of the low-energy neutron inelastic scattering in deformed transitional nuclei: ^{186}W ....See Entry 105848

High-resolution investigation of the $^{116}\mathrm{Sn}(p,p')$ reaction ....See Entry 105849

Evidence of energy dependence in proton-neutron effective interaction for $^{90}\mathrm{Zr}(p,d)^{89}\mathrm{Zr}$ reactions at energies from 20 MeV to 120 MeV ....See Entry 105855

Study of the 18.30 and 19.40 MeV states in ^{12}C in intermediate energy proton scattering ....See Entry 105856

$1f_{7/2}$ neutron hole strength in ^{59}Ni with the $^{60}\mathrm{Ni}(\vec{p},d)^{59}\mathrm{Ni}$ reaction at 94 MeV . ...See Entry 105863

Radial parameters in nucleon-nucleus scattering ....See Entry 105866

Proton scattering in the interacting boson model ....See Entry 105868

A perspective on sequential transfer reactions ....See Entry 105869

Non-direct transitions in transfer reactions and spectroscopy ....See Entry 105870

Extended study of (p-d-t) process in the (p,t) reactions including the unbound state channels ....See Entry 105871

Breakup reaction of ^{3}He with protons at 65 MeV ....See Entry 105872

The doorway to the continuum: quasifree nucleon-nucleon interactions ....See Entry 105873

Relations between the simultaneous and sequential transfer of two nucleons ....See Entry 105875

Vector analyzing powers for valence and inner shell pickup in the $^{116}\mathrm{Sn}(\vec{d},t)^{115}\mathrm{Sn}$ and $^{116}\mathrm{Sn}(\vec{d},^3\mathrm{He})^{115}\mathrm{In}$ reactions ....See Entry 105876

Effects of the proton-neutron hole interaction to the form factor in (d,t) reactions on $N=50$ target nuclei ....See Entry 105877

^{79}As via proton pickup ....See Entry 105880

Precise determination of two-step contributions in (d,α) reaction by using vector and tensor analyzing powers for the $^{208}\mathrm{Pb}(d,\alpha)^{206}\mathrm{Tl}(g.s;0^-)$ reaction ....See Entry 105882

Ground state transitions in $(d,^6\mathrm{Li})$ reactions on sd-shell nuclei ....See Entry 105883

Study of $^{46,48}\mathrm{Ca}(\alpha,p)$ reactions ....See Entry 105884

High energy $(^3\mathrm{He},d)$ proton stripping by ^{27}Al and ^{28}Si nuclei: Transitions to excited states ....See Entry 105885

Single particle strengths in A=28 nuclei via (α,t) and (α,^{3}He) reactions .... See Entry 105887

Breakup process for the 100 MeV ^{3}He interacting with the ^{165}Ho and ^{166,167}Er nuclei .... See Entry 105888

A model for alpha particle induced reactions .... See Entry 105890

Channel-coupling effects in heavy-ion fusion reactions .... See Entry 105897

Mechanism of neon-induced reactions studied between 7.5 and 20 MeV/nucleon: inclusive cross sections .... See Entry 105898

Large-angle ^{6}Li+^{28}Si elastic and inelastic scattering at 27 and 34 MeV .... See Entry 105899

The absolute normalization of three-nucleon transfer reactions .... See Entry 105905

Analysis of low energy heavy ion multiparticle transfer reactions in terms of entrance and exit doorways .... See Entry 105907

Reaction cross sections for ^{14}N+^{10}B .... See Entry 105909

Energy dependence of ^{9}Be+^{12}C cross sections: nonstatistical component of the mean cross section .... See Entry 105910

^{12}C on ^{48}Ca transfer reactions: a test of the effective *Q*-value model .... See Entry 105912

Influence of the nuclear autocorrelation function on the positron production in heavy-ion collisions .... See Entry 105915

Tensor interactions and projectile excitations in the scattering of ^{7}Li by ^{58}Ni .... See Entry 105917

Two-step contributions and non-orthogonality effects in deuteron and ^{17}O reactions on lead .... See Entry 105918

Breakup effects of ^{7}Li on the elastic and inelastic scatterings .... See Entry 105919

^{12}C$\rightarrow$3α breakup effect on ^{12}C+^{12}C scattering at E_{LAB}=140$\sim$300 MeV studied by microscopic coupled channels methods .... See Entry 105920

Sequential projectile-breakup process in ^{20}Ne induced reactions at 92, 149 and 213 MeV .... See Entry 105921

Fragmentation processes in nucleus-nucleus collisions .... See Entry 105924

Potential model description of heavy ion scattering using spline techniques .... See Entry 105926

Different regimes of dissipative collisions .... See Entry 105928

Neutron-proton asymmetry and fast fission: two extreme time evolutions in dissipative heavy ion reactions .... See Entry 105930

Nuclear 'molecular' states .... See Entry 105932

Systematics of pion double-charge-exchange reactions on T=0 nuclei .... See Entry 105934

K^+ and K^- elastic scattering within the framework of multiple scattering theory .... See Entry 105936

Delta-nucleon and pion-nucleus interactions .... See Entry 105937

Fusion near and below the barrier for the systems ^{32,34}S+^{24,25,26}Mg and ^{32}S+^{27}Al .... See Entry 105944

24.10H Optical and diffraction models

105808 Second-order terms in the ^{3}He-nucleus folding model. F.Duggan (Dept. of Phys., Wheatstone Lab., King's Coll., London, England).
J. Phys. G (GB), vol.9, no.9, p.1047-61 (Sept. 1983).
The ^{3}He-nucleus optical potential has been calculated in an extended folding model in which the first- and second-order terms are calculated separately, the internal motion of the ^{3}He nucleons is included, the break-up of the projectile is simulated and the target excited states are coupled to the imaginary potential. An improved version of the Kuo effective interaction including odd-state forces and the projectile energy in the second order terms is used in this model. The data analysis indicates that, in this model, the second-order potential must be calculated more accurately if agreement with experiment is to be obtained and that the backward-angle data are sensitive to the imaginary potential. A comparison has been made with previous analyses. (53 refs.)

105809 Isovector correction to the Kerman, McManus, and Thaler formalism. L.Ray (Dept. of Phys., Univ. of Texas, Austin, TX, USA), P.C.Tandy, R.M.Thaler.
Phys. Rev. C (USA), vol.28, no.2, p.506-12 (Aug. 1983).
In the derivation of the scaled, first order optical potential of Kerman, McManus, and Thaler it is assumed that all target nucleons have identical isospin character. This makes possible the scaling by $(A-1)/A$ that is characteristic of the Kerman-McManus-Thaler formalism. In applications, the difference between the interactions of the projectile with target neutrons and protons is imposed upon the scaled optical potential. The nuclear scattering amplitude calculated in this way differs from the correct first order result which can be obtained by recognizing the isospin difference at the onset of the derivation. A new expression for the Kerman-McManus-Thaler optical potential is obtained. The result is the usual isospin weighted sum of the projectile-proton and projectile-neutron interactions, plus a correction to the scaled first order optical potential which is proportional to the square of the projectile-nucleon isovector interaction. Numerical estimates of the volumes and root mean square radii of this isovector correction are given for proton and pion projectiles. Relative to the usual first order term, the volume integral of this correction is found to be neglible in most cases, except for (3,3) resonant energy pion-nucleus scattering where it can contribute several percent. (25 refs.)

Effective mass in nuclei and the level density parameter .... See Entry 105746

Optical model analysis of intermediate energy p-^{4}He scattering .... See Entry 105850

Resonance averaged channel radiative neutron capture cross sections .... See Entry 105852

An interference effect in the channel radiative neutron capture process .... See Entry 105853

Evidence of energy dependence in proton-neutron effective interaction for ^{90}Zr(p,d)^{89}Zr reactions at energies from 20 MeV to 120 MeV .... See Entry 105855

Coupled channel effects in ^{26}Mg(p,p′) at 40 MeV .... See Entry 105861

Parity violation in nucleon-nucleus elastic scattering within a phenomenological single particle model .... See Entry 105864

Ground state transitions in (d,^{6}Li) reactions on sd-shell nuclei .... See Entry 105883

Refractive effects in ^{9}Be scattering and nuclear rainbow ghosts .... See Entry 105903

The absolute normalization of three-nucleon transfer reactions .... See Entry 105905

Elastic scattering of ^{16}O by ^{28}Si .... See Entry 105913

Folding models for elastic and inelastic scattering .... See Entry 105927

Pionic 3d$\rightarrow$2p X-ray measurements in ^{50,52,54}Cr, ^{45}Sc, ^{51}V, ^{55}Mn and Fe .... See Entry 106637

24.30 RESONANCE REACTIONS AND SCATTERING

105810 Analysis of the ^{28}Si(p, γ)^{29}P reaction data in the region of the subbarrier single particle resonances. T.Matulewicz, P.Decowski, M.Kicinska-Habior, B.Sikora, J.Toke (Inst. of Experimental Phys., Warsaw Univ., Warsaw, Poland).
Acta Phys. Pol. B (Poland), vol.B14, no.8, p.617-24 (Aug. 1983).
The ^{28}Si(p, γ)^{29}P reaction data have been analysed in terms of a modified direct-semidirect capture model which accounts for the presence of broad shape (single-particle) resonances in the entrance channel. Values of the spectroscopic factors for the ground state and 1.65 MeV and 2.88 MeV resonances in ^{29}P nuclei were extracted and found to be consistent with those obtained in other experiments. The modified theoretical analysis scheme was found to provide a convenient tool for analysing the radiative capture reaction data. (23 refs.)

105811 Effective coupling constants for spin-flip and non spin-flip E1 transitions in A$\sim$90 nuclei. S.Nakayama, T.Shibata, T.Kishimoto, M.Sasao, H.Ejiri (Dept. of Phys., Osaka Univ., Osaka, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2325-31 (July 1983).
Radiative proton capture reactions through two isobaric analogue resonances (IAR) in ^{89}Y were studied; one was the 12.07 MeV 2d$_{5/2}$ state lying just above the neutron threshold energy B_n and another was the 14.48 MeV 2d$_{3/2}$ state lying well above B_n. E1 transitions from these IARs were studied for favoured cases with no spin-flip and no change of radial nodes, and for unfavoured cases spin-flip and/or change of radial nodes. At the 2d$_{3/2}$ IAR lying well above B_n, the favoured transitions show the resonance feature, but the unfavoured ones do not. At the 2d$_{5/2}$ IAR near B_n, however, both the favoured and unfavoured transitions show the resonance feature. The anomalous resonant feature of the unfavoured transitions is interpreted as being mainly due to the compound process. Favoured transitions are all found to be reduced by factors $\sim$0.3 over the shell model values. (26 refs.)

105812 Proton spin-orbit splittings in the continuum. M.Tohyama (Cyclotron Lab., Inst. of Phys. & Chem. Res., Saitama, Japan), N.Onishi.
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2332-5 (July 1983).
The spin-orbit splittings are calculated for the proton single-particle resonances in ^{91}Nb, ^{121}Sb and ^{209}Bi nuclei. Many sets of spin-orbit partners with narrow widths are obtained in these nuclei. It is suggested that the proton single-particle resonances provide a useful tool of studying the origin of the spin-orbit coupling. (6 refs.)

105813 Widths of giant resonances. S.Yoshida (Dept. of Phys., Tohoku Univ., Sendai, Japan).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.142-56 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
Theories of giant resonances are reviewed. The Green's functions and response functions are introduced in connection with inelastic scattering cross sections for giant resonance excitations. The Green's function is calculated in terms of the effective Hamiltonian in a truncated bound configuration space. A few examples of existing calculations are reviewed, their methods of the calculations are examined and the results are compared with each other. (21 refs.)

105814 Sum rule approach to giant resonance states. T.Suzuki (Res. Inst. for Fundamental Phys., Kyoto Univ., Kyoto, Japan).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.319-29 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
On the basis of sum rules for the nuclear four-current, structure of isoscalar giant resonance states is discussed. A qualitative argument on spin-isospin-dependent excitations of nuclei is also provided with the aid of sum rules in the quark model. (20 refs.)

105815 Fluid-dynamical models for giant resonances. G.Holzwarth (Siegen Univ., Siegen, Germany).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.357-66 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
Presents a survey of nuclear fluid dynamics as derived from the generalized scaling approach. The essential feature is the dynamical distortion of the local Fermi surface which leads to additional restoring forces for the elementary modes. Application to giant resonances resolves previous discrepancies, satisfies two essential quantum mechanical sum rules and leads to detailed predictions for transition densities, flow patterns and strength distributions. (18 refs.)

105816 Recent developments in the description of electric giant resonances. O.Bohigas (Div. de Phys. Theorique, Inst. Phys. Nucleaire, Orsay, France).
Prog. Theor. Phys. Suppl. (Japan), no.74-75, p.380-401 (1983). (Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions, Kyoto, Japan, 12-16 July 1982).
The experimental situation concerning electric isovector dipole and isoscalar monopole strengths is reviewed. When describing the giant resonance region, emphasis is put on self-consistent RPA theories. The role of the effective interaction is examined. The photoabsorption cross-section in the region 40$\sim$140 MeV is also discussed as well as evaluations of the dipole enhancement factor. (63 refs.)

105817 The distribution of the low-energy octupole strength in ^{48}Ca, ^{90}Zr and ^{208}Pb. Y.Fujita, M.Fujiwara, S.Morinobu, I.Katayama, T.Yamazaki (Res. Center for Nuclear Phys., Osaka Univ., Ibaraki, Osaka, Japan), T.Itahashi, S.I.Hayakawa, H.Ikegami.
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.275-9
The fine structure of the low-energy octupole resonance has been studied for ^{48}Ca, ^{90}Zr and ^{208}Pb by inelastic scattering of 65 MeV protons. The energy-weighted sum rule fractions of 11-15% were found in every nucleus including ^{208}Pb. An accurate spreading width Γ was obtained for these nuclei. It was found that the interaction V which causes the spreading was fairly constant irrespective of the large difference in mass number. (13 refs.)

105818 Low energy octupole resonance in deformed nuclei. T.Tohei, J.I.Hirota, T.Nakagawa (Dept. of Phys., Tohoku Univ., Sendai, Japan), T.Saito, Y.Fujii, M.H.Tanaka.
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.285-8
Inelastic α-particle scattering at $E_\alpha=65$ MeV has been measured to study the splitting of the resonance strength in the isoscalar low energy octupole resonance (LEOR) in Sm isotopes. Two bumps in the LEOR are found in the deformed nuclei ^{154}Sm and ^{152}Sm. The centre-of-gravity energy of the LEOR is systematically lower than the expected one in Sm isotopes. The effect of quadrupole deformation is more obvious for the LEOR than for the GQR. (5 refs.)

105819 Hexadecapole component in giant quadrupole resonance region of ^{208}Pb. T.Yamagata, S.Kishimoto, K.Iwamoto, K.Yuasa (Dept. of Phys., Konan Univ., Higashinada, Kobe, Japan), M.Tanaka, S.Nakayama, T.Fukuda, M.Inoue, M.Fujiwara, Y.Fujita, I.Miura, H.Ogata.
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.289-93
The L=4 component located at $E_x\sim2\hbar\omega$ in ^{208}Pb was studied using the inelastic scattering of ^{3}He at 140 MeV. An energy-weighted sum-rule fraction of 23-29% was found in the giant quadrupole resonance region. (10 refs.)

105820 Study of the (^{3}He,t) reaction on heavy nuclei. H.P.Morsch, G.P.A.Berg, P.Decowski, J.L.Tain, M.Rogge, L.Zemlo, P.Turek, J.Meissburger, J.G.M.Romer (Inst. fur Kernphys., Kernforschungsanlage Julich, Julich, Germany).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.294-8
In order to investigate isovector giant resonances and spin-flip excitations the authors have studied the (^{3}He,t) reaction on ^{120}Sn and ^{208}Pb using a 135 MeV ^{3}He beam from the Julich isochronous cyclotron. The outgoing particles were momentum analysed using the magnetic spectrometer BIG KARL. Data have been taken at extreme forward angles between 0^0 and 5^0. Spectra taken at 0^0 are shown for ^{120}Sn and ^{208}Pb. The strong excitation of the isobaric analog state and the underlying 1^+ Gamow-Teller resonance is clearly seen. (3 refs.)

105821 Proton strength functions in the mass region of 30 to 70. E.Arai, T.Matsuzaki (Nuclear Reactor Res. Lab., Tokyo Inst. of Technol., Tokyo, Japan).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.741-5
Theoretical values of s- and p-wave proton strength functions were calculated for the target mass region between 30 and 70, and were compared with experimental results. A reasonable agreement was obtained for s-wave proton strength function. (14 refs.)

105822 The excitation and decay of isoscalar giant resonances. A.Van Der Woude (Kernfysisch Versneller Inst., Groningen, Netherlands).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.351-87
Gives a survey of the present knowledge on isoscalar giant resonances. Attention is paid to the problems involved in the analysis of inelastic hadron scattering data. One of the main open questions, namely the behaviour of the monopole resonances in light nuclei, is discussed in some detail. The excitation of giant resonances by inelastic heavy ion scattering is discussed. It is shown that at present no new information on giant resonances has come out of heavy ion scattering. Future prospectives, when higher energy heavy ion beams with better quality become available are discussed. The damping and decay of giant resonances are described. The trend observed for the width of the giant resonances is summarised. An extensive discussion of the fission width of giant resonances in ^{238}U is presented. (48 refs.)

Proceedings of the 5th Kyoto Summer Institute on Microscopic Theories of Nuclear Collective Motions .... See Entry 105008

Heavy-Ion Collisions. Proceedings of the International Summer School .... See Entry 105028

A semimicroscopic model of nuclear vibrations with separable forces and the giant dipole resonance of ^{12}C .... See Entry 105711

Microscopic calculation of dynamical effects: the energy dependence of nucleon self-energies in ^{208}Pb .... See Entry 105714

Excitation of low-lying collective bands in inelastic hadron scattering .... See Entry 105724

Probing the nuclear structure with heavy-ion reactions .... See Entry 105725

Energy levels in ^{93}Mo populated by the ^{93}Nb(p,nγ) reaction .. See Entry 105744

Nuclear effective interactions and spin excitations .... See Entry 105752

The hydrodynamic limit of the microscopic collective model: the U(3)-boson model .... See Entry 105771

Self-consistent description of nuclear excitations .... See Entry 105779

Symmetry energy and isovector collective motions .... See Entry 105780

An effective energy-dependent one-body potential for the low-energy particle-nucleus scattering problem. The one open channel case .... See Entry 105800

On a combined model of direct and compound-resonant nuclear reactions .... See Entry 105805

A semimicroscopic calculation of the photodisintegration of the ^{32}S nucleus .... See Entry 105840

Resonance averaged channel radiative neutron capture cross sections .... See Entry 105852

Resonant and nonresonant particle decay following α-bombardment on medium heavy nuclei .... See Entry 105889

Nature of molecular resonances and background in the ^{16}O+^{12}C system .... See Entry 105902

Intermediate-structure resonances in the ^{16}O+^{16}O total reaction cross section .... See Entry 105914

24.50 DIRECT REACTIONS

105823 Non-orthogonality and overcompleteness in direct nuclear reactions. M.C.Birse, E.F.Redish (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA).
Nucl. Phys. A (Netherlands), vol.A406, no.1, p.149-92 (12 Sept. 1983).
When rearrangement reactions are too strong to be treated by a one-step DWBA, they must be described by coupled reaction channel (CRC) equations or by a multistep DWBA derived from them. The derivation of these equations requires the use of projection operators on subspaces which are in general not orthogonal and which may be linearly dependent. The authors consider the case of many coupled two-cluster channels, and show how solving the non-orthogonality kernel to give an orthogonalized CRC formally simplifies the structure of the equation and clarifies the relations between different methods, including connected kernel approaches. They use the requirement that the distorted Faddeev (N=3) or LBRS equations (general N) be satisfied in the two-cluster model space. They demonstrate that this determines the distortion potentials and that the resulting pole approximation yields the orthogonalized CRC equations. A modified one- and two-step DWBA is written in which non-orthogonality corrections are summed to all orders in each step. Methods of generating the non-orthogonality correction operator are discussed. (57 refs.)

105824 Deuteron D-state effects on the vector polarization observables in (d,p) reactions at 55.4 MeV. T.Kubo (Inst. of Phys. & Chem. Res., Saitama, Japan), H.Ohnuma, T.Kishimoto, M.A.Brennan, Y.Yoshida, M.Sugitani, T.Suehiro.
Phys. Lett. B (Netherlands), vol.127B, no.6, p.403-6 (11 Aug. 1983).
The vector analyzing power A_y and polarization P_y have been measured for the $l_n=0$ transitions ^{116}Sn(d,p)^{117}Sn(gs) and ^{117}Sn(d,p)^{118}Sn(gs) at E_d=55.4 MeV to obtain the quantities $S_p=2P_y-2A_y$ and $S_d=3A_y-2P_y$. The deuteron D-state effects which are clearly observable for S_d are found to arise primarily from contributions quadratic in the D-state amplitude. (17 refs.)

105825 Knock-out effects in (p,p′) reactions. B.T.Kim (Dept. of Phys., Sung Kyun Kwan Univ., Suwon, Korea), T.Udagawa, T.Tamura.
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.280-4
The knock-out mechanism is considered to account for the forward-angle peaking angular distribution of (p,p′) reactions, which multi-step direct reaction theories could not explain. The formulations including spin and isospin dependent central interactions as well as tensor forces are presented. Exchange effects are also taken into account. The results of ^{54}Fe(p,p′) at 62 MeV are given. It turns out that the knock-out processes can be responsible for the forward-angle peaking cross sections. (8 refs.)

105826 Direct and direct-fusion reaction approach to continuum spectra of nuclear reactions. T.Udagawa (Dept. of Phys., Univ. of Texas, Austin, TX, USA).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.322-39
The multistep direct reaction approach to nuclear reactions leading to the continuum is extended so as to also include partial fusion taking place in channels reached via direct reactions. The calculation of cross sections of particles emitted from such reactions is briefly discussed, showing particularly that these can be evaluated by utilizing the same ingredients as those used in the usual direct reaction calculations. As an example, the author considers the breakup-fusion reaction (i.e. breakup followed by fusion of one of the broken-up pair with the target nucleus) and applies it to analyze spectra of protons emitted from α-induced reactions. It is shown that many features of the observed spectra can be accounted for by this machine. (19 refs.)

105827 Effective interaction for deuteron stripping and pick up reactions. R.C.Johnson (Dept. of Phys., Univ. of Surrey, Guildford, England).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.340-7
The distinctions between nucleon-nucleon effective interactions for inelastic scattering and rearrangement collisions is clarified. Calculations relevant to recent (d,p) and (p,d) data are reported. (20 refs.)

105828 Direct and pre-equilibrium deexcitations following the (α,α') reaction studied by discrete γ-α' correlations. H.Ohsumi, K.Okada, T.Shibata, Y.Nagai, T.Motobayashi, N.Fujishita, H.Ejiri (Dept. Phys., Osaka Univ., Osaka, Japan).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.736-40
The α'-Γ coincidence measurements for the ^{118}Sn(α,$\alpha'x\gamma$) reaction showed for the first time that the rather low excitation region (Ex=20-50 MeV) of the medium-heavy nuclei once excited by the 109 MeV alpha inelastic scattering, decays by emitting fast direct and/or pre-equilibrium neutrons. (3 refs.)

Structures revealed in the neutron-proton mass spectrum in the deuteron break-up reaction .... See Entry 105662

The residual interaction of bound nucleons−two-nucleon matrix elements deduced from transfer experiments .... See Entry 105755

On a combined model of direct and compound-resonant nuclear reactions .... See Entry 105805

Analysis of the ^{28}Si(p, γ)^{29}P reaction data in the region of the subbarrier single particle resonances .... See Entry 105810

Large-angle proton emission in the ^{9}Be(p,2p) reaction at 300 MeV .... See Entry 105851

Evidence of energy dependence in proton-neutron effective interaction for ^{90}Zr(p,d)^{89}Zr reactions at energies from 20 MeV to 120 MeV .... See Entry 105855

Single particle strengths in A=28 nuclei via (α,t) and (α,^{3}He) reactions .... See Entry 105887

Resonant and nonresonant particle decay following α-bombardment on medium heavy nuclei .... See Entry 105889

Sequential projectile-breakup process in ^{20}Ne induced reactions at 92, 149 and 213 MeV .... See Entry 105921

Fragmentation processes in nucleus-nucleus collisions .... See Entry 105924

Evaluation of computational models for fission and spallation reactions used in accelerator breeding and transmutation analysis code .... See Entry 106073

24.60 STATISTICAL THEORY AND FLUCTUATIONS

105829 Time dependence of pre-equilibrium reactions. K.W.McVoy (Dept. of Phys., Univ. of Wisconsin, Madison, WI, USA).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.649-64
Discusses fluctuations in doorway dominated reactions, which can be described as a kind of diffusion process. The author studies the time dependence of this diffusion process. (10 refs.)

105830 Application of the statistical multistep compound theory to light ion induced reactions. R.Bonetti (Istituto di Fisica Generale Appl., Univ. di Milano, Milano, Italy).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.665-73
The applications of the SMCE theory to the experimental data of cross-sections and correlation widths are briefly reviewed. Particular emphasis is given to the extraction from experimental data of the two-body residual interaction strength V_0. It is shown that the use of matrix elements of a density-dependent interaction of the Yukawa form makes possible reproduction of the experimental data of SMCE reactions with a V_0 value which turns out to be consistent with the one used in independent work. (16 refs.)

105831 A test of validity of the Markovian hypothesis in the theory of pre-equilibrium processes in nucleon induced reactions. M.Kawai, H.A.Weidenmuller (Dept. of Phys., Kyushu Univ., Fukuoka, Japan).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.718-26
The Markovian hypothesis in the theory of pre-equilibrium processes in nucleon induced reactions is examined. An estimate of the time between successive collisions, t, and the time for a single collision, τ, shows that the necessary condition, $t \gg \tau$, for the hypothesis is reasonably well satisfied for the incident energy ≤ 150 MeV, in contrast to some recent claims. Some medium corrections to the estimate of t and τ are also discussed. (11 refs.)

105832 Preequilibrium reaction cross section including angular momentum conservation. G.Keeni, S.Yoshida (Dept. of Phys., Tohoku Univ., Sendai, Japan).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.746-50
A method is described for calculating the preequilibrium reaction cross-section taking into account energy and angular momentum conservation. The escape and spreading widths are calculated in a method resembling that of Feshbach et al. (1979). But the exciton number decreasing intranuclear transitions are also taken into account in the calculation of the spreading widths. The master equation is then solved following a prescription given by Yoshida (1982) which gives both the preequilibrium and equilibrium reaction cross-sections. (4 refs.)

105833 Statistical aspects of multistep process in nuclear reactions. M.S.Hussein (Inst. de Fisica, Univ. de Sao Paulo, Sao Paulo, Brazil).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.774-85
Several statistical aspects of nuclear multistep processes are discussed. The connection between the cross-section auto-correlation function and the average number of maxima in the excitation function is emphasized in the case of multistep compound (pre-compound) processes. The energy averaged angular distributions of transitions to specific final states proceeding through these processes are discussed in light- and heavy-ion induced reactions. (13 refs.)

105834 Pre-equilibrium processes in nuclear reactions. P.E.Hodgson (Nuclear Phys. Lab., Oxford, England).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.220-47 (38 refs.)

Heavy-Ion Collisions. Proceedings of the International Summer School .... See Entry 105028

Are heavy-ion entropy production and nuclear level density discrepancies related? .... See Entry 105730

Direct and pre-equilibrium deexcitations following the (α,α′) reaction studied by discrete γ-α′ correlations .... See Entry 105828

Angle-energy correlated model of preequilibrium angular distributions .... See Entry 105862

Extension of generalized exciton model and calculation of (p,p′) angular distribution .... See Entry 105874

Neutron-multiplicity distributions for (α,$xn\gamma$) reactions with E_α=50-120 MeV and the pre-equilibrium neutron deexcitation processes .... See Entry 105886

Resonant and nonresonant particle decay following α-bombardment on medium heavy nuclei .... See Entry 105889

A model for alpha particle induced reactions .... See Entry 105890

Analysis of the statistical *S* matrix generated in fitting ^{16}O+^{28}Si elastic scattering .... See Entry 105891

Macroscopic implications of (N,Z) distributions for reaction mechanisms in ion-ion collisions .... See Entry 105922

Pre-equilibrium effects in heavy-ion induced reactions .... See Entry 105923

Light particle emission in the reaction of ^{93}Nb+^{14}N at 132, 159 and 208 MeV .... See Entry 105925

Charge equilibration in deep-inelastic peripheral collisions .... See Entry 105929

Neutron-proton asymmetry and fast fission: two extreme time evolutions in dissipative heavy ion reactions .... See Entry 105930

24.70 POLARIZATION IN REACTIONS AND SCATTERING

105835 High-momentum-transfer processes with polarized deuterons. L.L.Frankfurt, M.I.Strikman (Leningrad Nuclear Phys. Inst., Gatchina, USSR).
Nucl. Phys. A (Netherlands), vol.A405, no.3, p.557-80 (5 Sept. 1983).
On the basis of the nuclear core hypothesis the authors predict that cross sections for high-energy (e,e′), (e,e′N), (h,N) inclusive reactions and the cross sections for the high-momentum-transfer $e+D \rightarrow e+N+N$ reaction off polarized deuterons should strongly depend on the deuteron polarization in the kinematics forbidden for the scattering off a free nucleon. A problem of the polarized neutron structure function extraction from $\vec{e}\vec{D}$ data is analysed. They demonstrate also that the measurement of the $D+N \rightarrow \vec{p}+X$ reaction is sufficient to reconstruct the spin-density matrix of a rapid deuteron. On the basis of the perturbative QCD the rule of the minimal change of helicity for leading hadron production in high-energy inclusive hadron processes is suggested. (26 refs.)

105836 ^{24}Mg($\vec{p}$,d) reaction at 65 and 80 MeV. K.Hatanaka, N.Matsuoka, H.Sakai, M.Fujiwara, T.Saito, K.Hosono (Res. Center for Nuclear Phys., Osaka Univ., Osaka, Japan).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.430-7
The differential cross sections and analyzing powers were measured for the ^{24}Mg($\vec{p}$,d)^{23}Mg reaction at 65 and 80 MeV. DWBA calculations were performed for the transitions to the $5/2^+$, 0.45 MeV, the $1/2^+$, 2.36 MeV and the $1/2^+$, 4.36 MeV states including the data at 33.6 and 94.8 MeV. The adiabatic approximation could reproduce the cross section in the same quality over all the energies investigated. As to the analyzing power for the $1/2^+$ states, the large values and energy dependence observed around θcm=20° were well reproduced without introduction of any arbitrary radial or angular momentum cutoff. The extracted spectroscopic factors were smaller than the theoretical predictions by a factor 2 to 4, but did not show a strong energy dependence. (24 refs.)

105837 Polarization phenomena in heavy ion transfer reactions. F.D.Santos (Centro de Fisica Nuclear, Univ. de Lisboa, Lisboa, Portugal).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.54-69
Discusses polarisation phenomena using $^7\vec{\mathrm{Li}}$ projectiles, concentrating on the analysing power. DWBA analyses are described. (36 refs.)

Heavy-Ion Collisions. Proceedings of the International Summer School .... See Entry 105028

$(f_{7/2})_{7,0}^{-2}$ configuration high-spin states in ^{60}Co strongly excited in the ^{62}Ni(d,α) reaction .... See Entry 105713

Excitation modes of the γ-band in ^{24}Mg through the ^{24}Mg($\vec{p}$,p′) reaction .... See Entry 105721

Strong effect of the sign of the hexadecapole moment on the polarized-proton inelastic scattering to the 4_1^+ states in the even $^{74\text{-}82}$Se .... See Entry 105742

Deuteron D-state effects on the vector polarization observables in (d,p) reactions at 55.4 MeV .... See Entry 105824

Study of the 18.30 and 19.40 MeV states in ^{12}C in intermediate energy proton scattering .... See Entry 105856

Sensitivity of N-d polarization observables on the off-shell behaviour of the N-N interaction .... See Entry 105860

1$f_{7/2}$ neutron hole strength in ^{59}Ni with the ^{60}Ni($\vec{p}$,d)^{59}Ni reaction at 94 MeV .... See Entry 105863

Analysing power-polarization inequality in the inelastic scattering of protons on ^{12}C for incident energies from 22.0 to 29.0 MeV. In beam proton-gamma ray coincidence studies using polarized beam .... See Entry 105867

Vector analyzing powers for valence and inner shell pickup in the ^{116}Sn($\vec{d}$,t)^{115}Sn and ^{116}Sn($\vec{d}$,^{3}He)^{115}In reactions .... See Entry 105876

Proton hole states in ^{95}Y and ^{95,97,99}Nb .... See Entry 105879

Nuclear moments of ^{9}Li .... See Entry 105881

Precise determination of two-step contributions in (d,α) reaction by using vector and tensor analyzing powers for the ^{208}Pb(d,α)^{206}Tl(g.s;0^-) reaction .... See Entry 105882

Tensor interactions and projectile excitations in the scattering of ^{7}Li by ^{58}Ni .... See Entry 105917

Fragmentation processes in nucleus-nucleus collisions .... See Entry 105924

24.75 GENERAL PROPERTIES OF FISSION

105838 Fission from saddle to exit: influence of curvature and compression energies. J.Treiner, R.W.Hasse (Inst. Laue-Langevin, Grenoble, France), P.Schuck.
J. Phys. Lett. (France), vol.44, no.17, p.L733-9 (1 Sept. 1983).
The authors investigate the influence of terms beyond the standard Liquid Drop Model on the slope of the fission valley. An important reduction of the slope is obtained when using values of the curvature energy calculated from effective forces currently in use, thus corroborating a recent microscopic calculation by Berger et al. (1981). (25 refs.)

25.00 NUCLEAR REACTIONS AND SCATTERING: SPECIFIC REACTIONS

25.10 NUCLEAR REACTIONS AND SCATTERING INVOLVING FEW-NUCLEON SYSTEMS

105839 The rate of the ^{3}He(p,$e^+\nu$)^{4}He reaction. P.E.Tegner (Dept. of Phys., Univ. of Stockholm, Stockholm, Sweden), C.Bargholtz.
Astrophys. J. (USA), vol.272, no.1, pt.1, p.311-16 (1 Sept. 1983).
The $p+{}^3$He reaction rate is calculated by comparing the matrix element to the matrix element for thermal neutron capture. Meson exchange contributions amount to approximately 20%. The authors predict a cross section factor $S(E_p=0)$ between 4 and 25×10^{-20} keV barns and an upper limit to the corresponding neutrino capture rate in ^{37}Cl and ^{71}Ga of 0.1 and 0.03 SNU, respectively. (23 refs.)

Structures revealed in the neutron-proton mass spectrum in the deuteron break-up reaction .... See Entry 105662

Second-order terms in the ^{3}He-nucleus folding model .... See Entry 105808

High-momentum-transfer processes with polarized deuterons .... See Entry 105835

Optical model analysis of intermediate energy p-^{4}He scattering .... See Entry 105850

Effects of the ^{3}He *D* state in the reaction ^{2}H(p,γ)^{3}He .... See Entry 105854

Absolute cross section for the reaction ^{3}H(p,γ_0)^{4}He and a review of ^{4}He(γ,p_0)^{3}H measurements .... See Entry 105857

Mesonic exchange currents and radiative thermal neutron capture by the deuteron .... See Entry 105859

Sensitivity of N-d polarization observables on the off-shell behaviour of the N-N interaction .... See Entry 105860

Breakup reaction of ^{3}He with protons at 65 MeV .... See Entry 105872

25.20 PHOTONUCLEAR REACTIONS AND PHOTON SCATTERING

105840 A semimicroscopic calculation of the photodisintegration of the ^{32}S nucleus. B.S.Ishkhanov, V.G.Kanzyuba, I.M.Kapitonov, V.N.Orlin, V.I.Shvedunov (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).

Nucl. Phys. A (Netherlands), vol.A405, no.2, p.287-300 (29 Aug. 1983).

Using the semimicroscopic nuclear vibration model and the combined model for giant resonance decay, the authors have calculated the giant dipole resonance structure and the partial photonucleon cross sections for ^{32}S. The theoretical parameters were estimated from the spectroscopic data. The calculation satisfactorily describes the structure and decay characteristics of the ^{32}S giant resonance. It has been shown that the statistical mechanism plays a significant role in the photodisintegration of ^{32}S. (24 refs.)

105841 Relation between coherent π^0 photoproduction and π-nucleus elastic scattering. P.Hoodbhoy, G.A.Miller (Dept. of Phys., Univ. of Washington, Seattle, WA, USA).

Phys. Rev. C (USA), vol.28, no.2, p.848-51 (Aug. 1983).

The authors show that, at energies of the (3,3) resonance, the angular distributions for coherent, nuclear π^0 photoproduction and elastic π-nucleus scattering are approximately related through simple geometric and kinematic factors. (10 refs.)

A semimicroscopic model of nuclear vibrations with separable forces and the giant dipole resonance of ^{12}C ....See Entry 105711

Reduced nuclear amplitudes in quantum chromodynamics ......See Entry 105804

Recent developments in the description of electric giant resonances ....
....See Entry 105816

25.30 LEPTON-INDUCED REACTIONS AND SCATTERING

105842 Excitation of the quasi-bound state in ^{4}He by electron scattering at medium momentum transfer. G.Kobschall, C.Ottermann, K.Maurer, K.Rohrich, C.Schmitt, V.H.Walther (Inst. fur Kernphys., Univ. Mainz, Mainz, Germany).

Nucl. Phys. A (Netherlands), vol.A405, no.3, p.648-52 (5 Sept. 1983).

The cross sections of inelastic electron scattering on ^{4}He leading to the quasi-bound state (0^+, $\epsilon=20.1$ MeV) were measured in the momentum transfer range 0.8 $\mathrm{fm}^{-2}<q^2<2.4\ \mathrm{fm}^{-2}$. The authors found it to be a pure longitudinal transition and give the form factor of this CO transition. (12 refs.)

105843 Inelastic electron scattering from ^{9}Be. R.W.Lourie, W.Bertozzi, T.N.Buti, J.M.Finn, F.W.Hersman, C.Hyde, J.Kelly, M.A.Kovash, S.Kowalski (Dept. of Phys., MIT, Cambridge, MA, USA), M.V.Hynes, B.E.Norum, B.L.Berman.

Phys. Rev. C (USA), vol.28, no.2, p.489-96 (Aug. 1983).

The electromagnetic form factors have been measured for the lowest two $T={}^3/_2$ states in ^{9}Be at 14.393 and 16.976 MeV, the positive-parity state at 17.490 MeV, and a level of a previously unknown J^π at 16.671 MeV. The range of effective momentum transfer is $0.9\leq q_e\leq 2.5\ \mathrm{fm}^{-1}$. The data for the $T={}^3/_2$ states show considerable deviation from the results of intermediate-coupling shell-model calculations. In particular, for $q_e\leq 1.5\ \mathrm{fm}^{-1}$, where the $M1$ multipole dominates, the data lie well above these calculated values. There is some evidence that the state at 16.671 MeV has positive parity. The results of single-particle shell-model and Nilsson-model calculations are compared with the data for this state. The experimental form factor for the 17.490-MeV state can be fitted with single-particle shell-model results in the $2s$-$1d$ space. (30 refs.)

105844 Electron scattering at 180° from the 'single-hole' states in ^{15}N. R.P.Singhal (Dept. of Natural Philosophy, Univ. of Glasgow, Glasgow, Scotland), J.Dubach, R.S.Hicks, R.A.Lindgren, B.Parker, G.A.Peterson.

Phys. Rev. C (USA), vol.28, no.2, p.513-20 (Aug. 1983).

Results are presented for the scattering of electrons through 180° from the ${}^1/_2{}^-$ ground state and the ${}^3/_2{}^-$ excited state at 6.32 MeV in ^{15}N. The range of the momentum transfer q is from 0.70 to 3.25 fm^{-1}. Comparisons are made with the predictions of the $0p$-shell proton-hole model, a large basis $2\hbar\omega$ shell model calculation, and core polarization models. In general, it was found that the theoretical description of the data improved markedly as the model space was expanded, but the predicted cross sections were consistently below the data for $q>2.4\ \mathrm{fm}^{-1}$. The present data rule out the low value of the Migdal parameter g' needed to described the (e,e′) data for ^{12}C and ^{13}C, and do not support the previous suggestion that pion-condensation effects are important in finite nuclear systems. (26 refs.)

105845 Differential muon-capture rate and the deuterium form factors in the timelike region. S.L.Mintz (Dept. of Phys. Sci., Florida Internat. Univ., Miami, FL, USA).

Phys. Rev. C (USA), vol.28, no.2, p.556-60 (Aug. 1983).

The differential muon-capture rate, $d\Gamma/dE_n$, is obtained over the total allowed range of E_n, the neutron energy for both F_A, the axial current form factor, analytically continued to the timelike region, and for F_A under the condition that $F_A(q^2$, timelike$)=F_A(q^2$, spacelike). It is found that a difference of approximately 10% exists in the extreme timelike region. The contribution from the timelike region to the muon-capture rate, Γ, is calculated and found to be negligible. (16 refs.)

105846 Response functions for deep inelastic scattering from ^{40}Ca. M.Deady, C.F.Williamson, J.Wong (Dept. of Phys., MIT, Cambridge, MA, USA), P.D.Zimmerman, C.Blatchley, J.M.Finn, J.LeRose, P.Sioshansi, R.Altemus, J.S.McCarthy, R.R.Whitney.

Phys. Rev. C (USA), vol.28, no.2, p.631-4 (Aug. 1983).

Deep inelastic electron scattering cross sections have been measured from ^{40}Ca at energies between 100 and 375 MeV and at scattering angles of 90° and 140°. Longitudinal and transverse response functions at three-vector momentum transfers of 330, 370, and 410 MeV/c were extracted from these data using a Rosenbluth separation. The integrated longitudinal response functions for the three momentum transfer are found to have, respectively, 65%, 75%, and 90% of the longitudinal strength predicted by the Fermi gas model. (14 refs.)

Study of the lepton-violating (μ^-,e$^+$) reaction in modern gauge theories ....
....See Entry 105455

Transition charge and current densities of collective isoscalar quadrupole states in ^{208}Pb ....See Entry 105717

Nuclear charge and matter distributions ....See Entry 105737

Reduced nuclear amplitudes in quantum chromodynamics ......See Entry 105804

High-momentum-transfer processes with polarized deuterons ....
....See Entry 105835

25.40 NUCLEON-INDUCED REACTIONS AND SCATTERING

(see also 28.20 Neutron physics)

105847 Target nucleus excitation dependence of correlation in the multiple production on nuclei at 400 GeV and the additive quark model. D.Ghosh, J.Roy, D.Banerjee, K.Sengupta, S.Naha, M.Basu, T.G.Thakurta (Dept. of Phys., Jadavpur Univ., Calcutta, India).

Can. J. Phys. (Canada), vol.61, no.9, p.1308-10 (Sept. 1983).

The authors present a comparison of the data on the target nucleus excitation dependence of two-particle rapidity correlations among relativistic particles in hadron-nucleus interactions at 400 GeV/c with the additive quark model (AQM) for multiple production of particles off nuclei. The number of grey tracks (n_g) has been taken as the parameter characterizing the degree of excitation. The dependence has been found to agree quantitatively with the predictions of the AQM. (4 refs.)

105848 Study of the low-energy neutron inelastic scattering in deformed transitional nuclei: ^{186}W. J.R.Fernandez Diaz, R.Cabezas Solorzano (Hat. Inst. for Nuclear Res., Navana, Cuba).

J. Phys. G (GB), vol.9, no.9, p.1115-23 (Sept. 1983).

A study of inelastic neutron scattering by the nucleus ^{186}W at an incident energy of 2.75 MeV using the coupled-channel method has been made. Consideration is made of the 2^+(0.122 MeV), 4^+(0.3966 MeV), 2^+(0.7375 MeV), 3^+(0.8618 MeV) and 4^+(1.031 MeV) excited states. It is shown that in this energy range the process may be described satisfactorily by the Davydov-Filippov model, considering ^{186}W as a deformed nucleus with non-axial symmetry, given the quadrupole and hexadecapole deformations. The scattering process through the compound nucleus is calculated according t the Hauser-Feshbach formula. It is shown that the presence of direct excitation processes may be partly due to the non-axiality of ^{186}W. (19 refs.)

105849 High-resolution investigation of the ^{116}Sn(p,p′) reaction. H.Wienke, H.P.Blok, J.Blok (Natuurkundig Lab., Vrije Univ., Amsterdam, Netherlands).

Nucl. Phys. A (Netherlands), vol.A405, no.2, p.237-51 (29 Aug. 1983).

Angular distributions for states up to 4.0 MeV excitation energy have been measured with the ^{116}Sn(p,p′) reaction at $E_p=25$ MeV. They were compared with macroscopic DWBA calculations in order to extract L-values and deformation parameters. Coupled-channels calculations were performed to investigate two-phonon excitations and the mixing between one- and two-phonon states. The results of the present study are compared with other experimental results and with model calculations. (19 refs.)

105850 Optical model analysis of intermediate energy p-^{4}He scattering. J.M.Greben, R.Gourishankar (Phys. Dept., Univ. of Alberta, Edmonton, Alberta, Canada).

Nucl. Phys. A (Netherlands), vol.A405, no.3, p.445-62 (5 Sept. 1983).

Recent Wolfenstein R-parameter data are used to explain and resolve previous problems with optical model descriptions p-^{4}He elastic scattering at 500 MeV. An essential component in this optical model analysis is a qualitative interpretation of different features of the elastic data in terms of the Born approximation. First the authors show that the R-data require the real spin-orbit potential to have certain geometrical properties which were missing in previous analyses. They can then show that the fast fall-off of the cross section for small angles, together with the rapid increase and subsequent decrease of the polarization, establishes the need for an attractive tail in the real central potential. Other properties of the potentials can also be inferred from this qualitative analysis in particular a strong reduction of the spin-orbit potential. The final potential gives a reduction of the χ^2/datapoint by about 20 in comparison to previous potentials, and underlines the usefulness of the qualitative Born analysis. (27 refs.)

105851 Large-angle proton emission in the ^{9}Be(p,2p) reaction at 300 MeV. R.E.L.Green, D.H.Boal, R.L.Helmer, K.P.Jackson, R.G.Korteling (Simon Fraser Univ., Burnaby, Canada).

Nucl. Phys. A (Netherlands), vol.A405, no.3, p.463-96 (5 Sept. 1983).

A ^{9}Be(p,2p) coincidence experiment performed to further elucidate the reaction mechanism for the production of energetic wide-angle protons in intermediate-energy proton-induced reactions is reported. Detectors in a coplanar geometry were used to measure coincidences between trigger protons at 90° to the beam and forward-angle protons on the opposite side of the beam. The incident proton energy was 300 MeV. The authors report both the inclusive spectra for the trigger protons and the differential mean multiplicities for the coincidence events. The present results are compared with two previous experiments which covered a more restrictive kinematical range. Calculations are performed with both phase-space and direct knockout models, and compared with experiment. Observation of angle and energy correlation effects suggested by knockout models indicate that such direct mechanisms provide a significant contribution to energetic wide-angle inclusive proton spectra. (52 refs.)

105852 Resonance averaged channel radiative neutron capture cross sections. Y.K.Ho, M.A.Lone (Chalk River Nuclear Labs., AECL, Chalk River, Ontario, Canada).

Nucl. Phys. A (Netherlands), vol.A406, no.1, p.1-17 (12 Sept. 1983).

In order to apply Lane and Lynn's channel capture model (1960) in calculations with a realistic optical model potential, the authors have derived an approximate wave function for the entrance channel in the neutron-nucleus reaction, based on the intermediate interaction model. With this formalism the averaged channel radiative neutron capture cross section in the resonance region is written as the sum of three terms. The authors obtain an expression for the average valence radiative width similar to that of Lane and Mughabghab (1974). They have investigated the magnitude and energy dependence of the three terms as a function of the neutron incident energy. Calculated results for ^{98}Mo and ^{55}Mn show that the averaged channel radiative capture cross section in the giant resonance region of the neutron strength function may account for a considerable fraction of the total (n,γ) cross section; at lower neutron energies a large part of this channel capture arises from the fluctuation term. They have also calculated the partial capture cross section in ^{98}Mo and ^{55}Mn at 2.4 keV and 24 keV, respectively, and compared the ^{98}Mo results with the experimental data. (19 refs.)

105853 An interference effect in the channel radiative neutron capture process. Y.K.Ho, M.A.Lone (Chalk River Nuclear Labs., AECL, Chalk River, Ontario, Canada).

Nucl. Phys. A (Netherlands), vol.A406, no.1, p.18-28 (12 Sept. 1983).

The authors show that the small thermal neutron radiative capture cross sections in ^{12}C and neighbouring nuclides are the result of destructive interference between the potential scattering wave and the resonance scattering wave near the nuclear surface, resulting in a drastic cancellation in the radial integral. The behaviour of the scattering wave function is examined, and the general condition for the occurrence of such cancellation is discussed. The expression for the channel radiative capture cross section which has been derived has the same structure as the Lane-Lynn formula but is expressed in terms of different parameters. In addition, this investigation shows that if the optical model well depth is adjusted so that the binding energy of the $p_{1/2}$ orbit in ^{12}C is kept at the experimental value, then the calculated results for the potential and channel radiative neutron capture cross sections are insensitive to the value of the nuclear radius. (8 refs.)

105854 Effects of the ^{3}He D state in the reaction ^{2}H(p,γ)^{3}He. S.E.King, N.R.Roberson, H.R.Weller (Duke Univ., Durham, NC, USA), D.R.Tilley.
Phys. Rev. Lett. (USA), vol.51, no.10, p.877-80 (5 Sept. 1983).
Angular distributions of the reaction ^{2}H(p,γ)^{3}He have been measured for E_p from 6.5 to 16 MeV. A comparison of the extracted a_2 coefficients with an effective two-body direct calculation indicates a sensitivity to the inclusion of D-state components in the ^{3}He wave function. These calculations use ^{3}He bound-state wave functions generated from Faddeev-type equations. The theoretical three-body ^{3}He ground-state wave functions having D-state probabilities of 5%-9% ($D_2=-0.224$ to -0.236) are consistent with the present data. (17 refs.)

105855 Evidence of energy dependence in proton-neutron effective interaction for ^{90}Zr(p,d)^{89}Zr reactions at energies from 20 MeV to 120 MeV. S.Kosugi (Div. of Reactor Safety Evaluation, JAERI, Ibaraki, Japan), T.Kosugi.
Phys. Lett. B (Netherlands), vol.127B, no.6, p.389-92 (11 Aug. 1983).
Exact-finite-range distorted-wave Born approximation (EFR-DWBA) calculations are performed for the reactions ^{90}Zr(p,d)^{89}Zr [9/2$^+$ (gs), 1/2$^-$ (0.588 MeV) and 3/2$^-$ (1.095 MeV)] at the incident energies 22.9, 31, 55, 65 and 121 MeV. When the energy-independent p-n interaction is used in the DWBA integral, the extracted spectroscopic factor shows a noticeable incident energy dependence which is quite similar to that of the proton optical-model potential used as distorting potentials. This fact supports the recent suggestion that the p-n effective interaction which is consistent with the proton optical-model potential should be used for (d,p) and (p,d) reactions. (16 refs.)

105856 Study of the 18.30 and 19.40 MeV states in ^{12}C in intermediate energy proton scattering. K.W.Jones, C.Glashausser, S.Nanda, R.de Swiniarski (Rutgers Univ., New Brunswick, NJ, USA), T.A.Carey, W.Cornelius, J.M.Moss, J.B.McClelland, S.J.Seestrom-Morris, J.R.Comfort, J.-L.Escudie, M.Gazzaly, N.Hintz, G.Igo, M.Haji-Saeid, C.A.Whitten.
Phys. Lett. B (Netherlands), vol.128B, no.5, p.281-4 (1 Sept. 1983).
Angular distributions of the cross section and analysing power have been measured for proton inelastic scattering from ^{12}C at 398, 597, and 698 MeV. Angular distributions of the spin-flip probability have been measured at 398 MeV. Comparison of these data with DWIA calculations strongly suggests $2^-(T=0)$ and $2^-(T=1)$ assignments to states at 18.30 and 19.40 MeV, respectively; their wave functions are well described by recent calculations of Millener. (22 refs.)

105857 Absolute cross section for the reaction ^{3}H(p,γ_0)^{4}He and a review of ^{4}He(γ,p$_0$)^{3}H measurements. J.R.Calarco, S.S.Hanna, C.C.Chang, E.M.Diener, E.Kuhlmann, G.A.Fisher (Dept. of Phys., Stanford Univ., Stanford, CA, USA).
Phys. Rev. C (USA), vol.28, no.2, p.483-8 (Aug. 1983).
Accurate differential cross sections have been measured at 90° for the reaction ^{3}H(p,γ)^{4}He at E_p=8.34 and 13.6 MeV. Previously published results for both ^{3}H(p,γ)^{4}He and ^{4}He(γ,p)^{3}H are reviewed and compared with the present data. The theoretical implications of the results are briefly discussed. (37 refs.)

105858 Double differential inclusive hydrogen and helium spectra from neutron-induced reactions on carbon at 27.4, 39.7, and 60.7 MeV. T.S.Subramanian, J.L.Romero, F.P.Brady, J.W.Watson, D.H.Fitzgerald, R.Garrett, G.A.Needham, J.L.Ullmann, C.I.Zanelli (Dept. of Phys., Univ. of California, Davis, CA, USA), D.J.Brenner, R.E.Prael.
Phys. Rev. C (USA), vol.28, no.2, p.521-8 (Aug. 1983).
Double differential cross sections for the neutron-induced production of p, d, t, ^{3}He, and alpha particles from carbon have been measured using unpolarized neutrons. Neutron beam energies of 27.4, 39.7, and 60.7 MeV were used. The charged particle energy spectra at nine laboratory angles—15, 20, 35, 40, 45, 65, 90, 130, and 150 deg—range up to the kinematic maximum, from a lower energy cutoff of 4 MeV for p, d, t, and alpha and 8 MeV for ^{3}He. A CH target was used so that the absolute normalization was obtained simultaneously from the n-p cross sections. Intranuclear cascade plus deexcitation calculations were carried out. The data are compared with these calculations and with available proton induced (charge symmetric) reaction spectra. (24 refs.)

105859 Mesonic exchange currents and radiative thermal neutron capture by the deuteron. J.Torre (Inst. des Sci. Nucleaires, Grenoble, France), B.Goulard.
Phys. Rev. C (USA), vol.28, no.2, p.529-37 (Aug. 1983).
Radiative capture of thermal neutrons by the deuteron: n+d$\rightarrow$^{3}H+γ is investigated. Wave functions built upon definite nucleon-nucleon forces are used to describe both the bound state and the scattering two-body state. The role of mesonic exchange currents and of two-nucleon forces are investigated in detail. Finally, the bearing of genuine three-nucleon forces on the cross sections and other related properties is exhibited. (14 refs.)

105860 Sensitivity of N-d polarization observables on the off-shell behaviour of the N-N interaction. H.Zankel, W.Plessas, J.Haidenbauer (Inst. fur Theoretische Phys., Karl-Franzens-Univ. Graz, Graz, Austria).
Phys. Rev. C (USA), vol.28, no.2, p.538-41 (Aug. 1983).
The authors demonstrate the off-shell sensitivity of second-order polarization observables in elastic N-d scattering by means of the spin-correlation parameter $C_{y,y}$. For the N-N interaction they start with the Paris potential and then generate on-shell equivalent separable potentials with different off-shell properties. The results for E_d=10 and 20 MeV reported here show sizeable off-shell effects, which can be related to the different potential behavior in the inner region $r\lesssim1.2$ fm. (16 refs.)

105861 Coupled channel effects in ^{26}Mg(p,p′) at 40 MeV. B.Zwieglinksi, G.M.Crawley, J.A.Nolen,Jr., R.M.Ronningen (Cyclotron Lab., Michigan State Univ., East Lansing, MI, USA).
Phys. Rev. C (USA), vol.28, no.2, p.542-55 (Aug. 1983).
Angular distributions for the elastic and inelastic scattering of 40 MeV protons for the 2_1^+ 1.809, 2_2^+ 2.938, 3_1^+ 3.940, 4_1^+ 4.318, 4_2^+ 4.900, 4_3^+ 5.474, and 4_4^+ 5.716 MeV states in ^{26}Mg have been measured to provide a test for the collective properties of these states as predicted by the wave functions of Chung and Wildenthal. Because of interference of the direct one-step 0_1^+-J_f excitation, with the two step 0^+-J_{int}-J_f excitations through the possible intermediate states J_{int}, coupled-channel effects are observable in the angular distribution for the state J_f. The effects of strongly constructive (for the 2_2^+ and 4_3^+ states), weakly constructive (for the 4_1^+ state), weakly destructive (for the 4_4^+ state), and strongly destructive (for the 4_2^+ state) interference are observed in the measured angular distributions. The experimental results are compared with coupled-channel calculations which utilize the shell-model-predicted multipole (L=2 and 4) matrix elements as coupling amplitudes. It is demonstrated that this approach can reproduce the observed patterns, the type of interference being governed by the relative phase between the direct 0_1^+-J_f and the dominant J_{int}-J_f matrix elements(s). The neutron and proton components for seven inelastic transitions are determined by combining the known electromagnetic transition rates with the proton inelastic transition rates measured in the present work. For most transitions the dominant is correctly indicated by the shell model. In particular, the 0_1^+-2_2^+ transition is confirmed to be predominantly a neutron transition. (36 refs.)

105862 Angle-energy correlated model of preequilibrium angular distributions. C.Costa, H.Gruppelaar, J.M.Akkermans (Netherlands Energy Res. Found., Petten, Netherlands).
Phys. Rev. C (USA), vol.28, no.2, p.587-601 (Aug. 1983).
The authors present a new version of the generalized exciton model of preequilibrium angular distributions is proposed to predict the energy dependence of inelastic neutron-scattering angular distributions. The Kikuchi-Kawai expression is used for the scattering of the followed 'fast particle' in nuclear matter, whereby its full angle-energy correlation is taken into account to describe the emission at the first collision. For the higher steps an energy-averaged scattering kernel is employed for the description of the changes in direction of the fast particle on its way inside the nucleus. The refraction of the incident and outgoing beam is described by the approximation of geometrical optics. This model retains the simple mathematical structure previously introduced by Akkermans et al., providing an easy interpretation of the observed energy-dependence of angular-distribution coefficients without the use of fit parameters. A comparison with experimental neutron-emission data and with the empirical Kalbach-Mann systematics illustrates the predictive ability of the present physical model. (19 refs.)

105863 $1f_{7/2}$ neutron hole strength in ^{59}Ni with the ^{60}Ni($\vec{p}$,d)^{59}Ni reaction at 94 MeV. H.Nann, D.W.Miller, W.W.Jacobs, D.W.Devins, W.P.Jones (Dept. of Phys., Indiana Univ., Bloomington, IN, USA).
Phys. Rev. C (USA), vol.28, no.2, p.642-51 (Aug. 1983).
The ^{60}Ni($\vec{p}$,d)^{59}Ni reaction has been studied with 94-MeV polarized protons. Angular distributions of the differential cross section and analyzing power have been measured for states in ^{59}Ni up to an excitation energy of 4.8 MeV. A characteristic j dependence of the ($\vec{p}$,d) analyzing powers was observed for l=1 and l=3 transfers, which allowed reliable spin determinations to be made for hole states in ^{59}Ni. As a result, spins of 7/2$^-$ were assigned to the levels at 2.63, 3.04, 3.73, 4.16, 4.23, 4.56, and 4.69 MeV in ^{59}Ni. Standard distorted-wave Born approximation calculations have been performed and their predictive power to describe the shape of the differential cross section and analyzing power angular distributions was tested as a function of the input parameters. No large discrepancies between calculated and experimental cross sections were found. Relative spectroscopic factors for the neutron pickup from the $1f_{7/2}$ orbital were extracted and compared to recent shell-model predictions. These shell-model calculations account quite well for the centroid of the observed $1f_{7/2}$ neutron hole distribution but fail to reproduce the strength distribution. (33 refs.)

105864 Parity violation in nucleon-nucleus elastic scattering within a phenomenological single particle model. Y.Avishai (Phys. Dept., Ben-Gurion Univ. of the Negev, Beer-Sheva, Israel).
Phys. Rev. C (USA), vol.28, no.2, p.656-9 (Aug. 1983).
Using a phenomenological neutron-^{40}Ca strong and weak potentials at low energy the author calculates the asymmetry A in the total cross section between positive and negative incoming helicity states, the asymmetry I in the differential elastic cross sections, and the neutron spin rotation angle $d\phi/dz$. In general, max $|I/A|\gg1$. Taking into account the relevant cross sections, it turns out that sometimes, measuring I (instead of A) can save a substantial amount of beam time. (16 refs.)

105865 Measurement of the electron capture branching ratio of ^{7}Be. T.R.Donoghue, E.Sugarbaker, M.Wiescher, T.C.Rinckel, K.E.Sale (Dept. of Phys., Ohio State Univ., Columbus, OH, USA), C.P.Browne, E.D.Berners, R.W.Tarara, R.E.Warner.
Phys. Rev. C (USA), vol.28, no.2, p.875-8 (Aug. 1983).
The value of the electron capture branching ratio of ^{7}Be to the 478 keV state in ^{7}Li has been measured using sources of determinable intensity fabricated by capturing in silicon surface barrier detectors ^{7}Be recoils from the ^{10}B(p,α)^{7}Be reaction at E_p=1.5 MeV and 4.5 MeV. Results from independent measurements utilizing detectors implanted in a scattering chamber and in the focal plane of a magnetic spectrograph are in good agreement. An absolute determination of the rate at which the 478 keV gamma rays were emitted from each source yielded a weighted average value of 10.6±0.5% for the branching ratio. This result is in agreement with the previously accepted value of 10.37±0.12% and does not support the recent suggestion that the branching ratio is appreciably larger. (14 refs.)

105866 Radial parameters in nucleon-nucleus scattering. G.Faldt, A.Ingemarsson (Gustaf Werner Inst., Uppsala, Sweden).
Phys. Scr. (Sweden), vol.28, no.2, p.136-8 (Aug. 1983).
The authors investigate the effects of the strength of the nucleon-nucleon interaction on the nucleon-nucleus reaction cross section and on the diffractive angular pattern of the elastic differential cross section. (8 refs.)

105867 Analysing power-polarization inequality in the inelastic scattering of protons on ^{12}C for incident energies from 22.0 to 29.0 MeV. In beam proton-gamma ray coincidence studies using polarized beam. T.Fujisawa (Cyclotron Lab., Inst. of Phys. & Chem. Res., Saitama, Japan).
Sci. Pap. Inst. Phys. & Chem. Res. (Japan), vol.77, no.2, p.113-70 (June 1983).
The difference between the analyzing power and polarization in the inelastic scattering of protons on ^{12}C(4.44 MeV 2$^+$ state) is determined by measuring the spin flip probability of polarised protons with a (p,$p'\gamma$) coincidence technique. The analyzing power (A), spin flip probability (SF), spin flip asymmetry (SFA) and partial differential cross section are also determined. The angular distributions are measured at incident energies of 24.1, 26.2, and 28.7 MeV at intervals of lab. angles of 7.5° or 15°. The excitation functions are measured from 22 to 29 MeV at intervals of about 0.5 MeV for lab. scattering angles of 45°, 60°, 75°, 105°, 120°, 135°, and 150°. The (A-P) and SFA show pronounced interference-like energy dependence. The (A-P) has large values of more than 50% at 135° and 150° for 26.2 MeV. The macro- and microscopic distorted wave Born approximation (DWBA) and coupled channel calculation are carried out for the 28.7 MeV data. They could not reproduce the angular distributions of SFA and (A-P) at 28.7 MeV. On the other hand, the coupled channel calculation with Breit-Wigner resonance terms (CCBW) well reproduced the angular distributions of (A-P) and SFA at 28.7 and 24.1 MeV. The assigned spins and parities (J^π=3/2$^-$ at E_{cm}=26.5 MeV and J^π=3/2$^+$ at E_{cm}=22 MeV) are consistent with those obtained by Geramb and Gaillard (1979). The (A-P) and SFA are very sensitive to the spin, parity, phase, amplitude and resonance energy in the CCBW calculation. (42 refs.)

105868 Proton scattering in the interacting boson model. E.Cereda, M.Pignanelli, S.Micheletti (Dipartimento di Fisica, Univ. di Milano, Milano, Italy), M.N.Harakeh, S.Y.Van Der Werf, R.De Leo.
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.270-4
Differential cross sections for proton scattering on ^{100}Mo and ^{112}Cd have been measured at $E_p=51$ MeV. The data are analyzed by coupled channel calculations, with coupling amplitudes taken from the interacting boson approximation. Information on transition densities is obtained. The reliability of the method is discussed. (5 refs.)

105869 A perspective on sequential transfer reactions. P.D.Kunz (Nuclear Phys. Lab., Univ. of Colorado, Boulder, CO, USA).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.304-21
The inclusion of some higher order effects in charge exchange and inelastic scattering of nucleons from nuclei has been treated by two primary methods. The first is the use of the nucleon-nucleon G matrix in an impulse approximation framework for nucleon projectile energies above 100 MeV projectile, and the second is the sequential transfer method which has been generally used at the lower energies. The implications for the applications of the sequential transfer method to the (p,t) reaction indicate that the sequential transfer terms used for this reaction may be replaced by using effective interactions for the transfer operator. The implications are discussed. (42 refs.)

105870 Non-direct transitions in transfer reactions and spectroscopy. S.Fortier (Inst. de Phys. Nucleaire, Orsay, France).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.357-65
A number of (^{3}He,α),(α,^{3}He) and (α,t) transitions in the f 7/2 region appear to be dominated by a pure two-step mechanism. Based on the J^π dependence of theoretical angular distributions, spin and parity assignments have been tenatively proposed. A strong inhibition of the direct process is also observed for some $L=0$ transitions in the (p,t) and (t,p) reactions to Ge isotopes. The data are in agreement with the assumption of a predominant two-step process with inelastic excitation in the proton channel. (10 refs.)

105871 Extended study of (p-d-t) process in the (p,t) reactions including the unbound state channels. M.Igarashi (Dept. of Phys., Tokyo Medical Coll., Shinjuku, Tokyo, Japan), K.-I.Kubo.
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.376-85
The roles of simultaneous (p-t) and sequential (p-d-t) transfer processes are investigated for (p,t) reactions. For the intermediate channels in the sequential transfer process, the $^1S_0$ and $^3S_1+^{33}D_1$ unbound deuteron states as well as the ground state are taken into account. One-step and sequential transfer processes are accurately evaluated employing the realistic wave functions and finite-range interactions. The sequential transfer process is found to be dominant for both natural and unnatural parity transitions in the reaction investigated here; ^{208}Pb(p,t)^{206}Pb at 22 and 35 MeV. The analyzing-power function does not get small even when the unbound deuteron states are included in the calculation with the realistic wave functions. (16 refs.)

105872 Breakup reaction of ^{3}He with protons at 65 MeV. S.Kakigi, K.Fukunaga, T.Ohsawa (Inst. for Chem. Res., Kyoto Univ., Kyoto, Japan), A.Okihana, H.Nakamura-Yokota, T.Sekioka, S.Tanaka, S.Kato.
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.631-4
In quasifree scattering (QFS), the experimental differential cross section ($d^5\sigma_{exp}$) is found to be smaller than the value calculated in the plane-wave impulse approximation ($d^5\sigma_{PWIA}$). The difference can be accounted for by multiple-scattering effect. A multiple-scattering factor $|\eta|^2$ has been compared with the normalization factor $N=d^5\sigma_{exp}/d^5\sigma_{PWIA}$ as a function of the incident energy or the correlation angles, and both are well reproduced. In the present work, the multiple-scattering effect is studied for the p-p QFS in the ^{3}He(p,pp)^{2}H reaction. (6 refs.)

105873 The doorway to the continuum: quasifree nucleon-nucleon interactions. H.D.Holmgren, G.Ciangaru, C.C.Chang, P.G.Roos (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.704-17
In 1975 the University of Maryland group launched a program to identify the dominant mechanisms by which medium energy light ions interact with nuclei. Various analyses using an initial quasifree nucleon-nucleon interaction have been reasonably successful in accounting for the spectral shapes of both (p,p′) and (p,n) reactions at angles up to 60°. Several particle-particle (p,2p) and particle-gamma coincidence studies have recently been carried out in the continuum region using 100-200 MeV protons which provide a clearer picture of the dominant reaction mechanisms. The authors focus on proton induced reactions, particularly coincidence (p,2p) studies cm ^{58}Ni, ^{27}Al, ^{90}Zr and ^{208}Bi, and recent theoretical advances. (19 refs.)

105874 Extension of generalized exciton model and calculation of (p,p′) angular distribution. A.Iwamoto, K.Harada (JAERI, Ibaraki, Japan).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.727-35
A model to extend the generalized exciton model is proposed. It takes into account the reaction kinematics more properly than the previous models, and yet the solution is obtained in a very simple form. Numerical calculations for the (p,p′) reaction on several targets show an improvement of the fitting in the angular distribution at forward angles. (7 refs.)

105875 Relations between the simultaneous and sequential transfer of two nucleons. G.R.Satchler (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.44-53
Discusses the relationship between one-step (simultaneous) and two-step (sequential) reactions in terms of a perturbation theory expansion such as DWBA. (t,p), (p,t) and (γ,d) reactions are analysed. (23 refs.)

Structures revealed in the neutron-proton mass spectrum in the deuteron break-up reaction .... See Entry 105662

Excitation modes of the γ-band in ^{24}Mg through the ^{24}Mg($\vec{p}$,p′) reaction .... See Entry 105721

Proton inelastic scattering by the even-Ge isotopes at $E_p=22$ MeV .... See Entry 105722

Sum-rule strengths of low-lying 4^+ levels in $^{74\text{-}82}$Se nuclei .... See Entry 105723

Excitation of low-lying collective bands in inelastic hadron scattering .... See Entry 105724

Nuclear charge and matter distributions .... See Entry 105737

Strong effect of the sign of the hexadecapole moment on the polarized-proton inelastic scattering to the 4_1^+ states in the even $^{74\text{-}82}$Se .... See Entry 105742

Excitations of the states of ^{107,109}Cd from the (p,nγ) reaction on silver isotopes .... See Entry 105743

Energy levels in ^{93}Mo populated by the ^{93}Nb(p,nγ) reaction .... See Entry 105744

Overlapping β decay and resonance neutron spectroscopy of levels in ^{87}Kr .... See Entry 105747

The spectroscopic study of ^{206,204}Pb with the (α,^{6}He) reaction .... See Entry 105786

On a combined model of direct and compound-resonant nuclear reactions .... See Entry 105805

Analysis of the ^{28}Si(p, γ)^{29}P reaction data in the region of the subbarrier single particle resonances .... See Entry 105810

Effective coupling constants for spin-flip and non spin-flip E1 transitions in $A\sim90$ nuclei .... See Entry 105811

The distribution of the low-energy octupole strength in ^{48}Ca, ^{90}Zr and ^{208}Pb .... See Entry 105817

Proton strength functions in the mass region of 30 to 70 .... See Entry 105821

Knock-out effects in (p,p′) reactions .... See Entry 105825

Effective interaction for deuteron stripping and pick up reactions .... See Entry 105827

Application of the statistical multistep compound theory to light ion induced reactions .... See Entry 105830

A test of validity of the Markovian hypothesis in the theory of pre-equilibrium processes in nucleon induced reactions .... See Entry 105831

Statistical aspects of multistep process in nuclear reactions .... See Entry 105833

High-momentum-transfer processes with polarized deuterons .... See Entry 105835

^{24}Mg($\vec{p}$,d) reaction at 65 and 80 MeV .... See Entry 105836

The rate of the ^{3}He(p,$e^+\nu$)^{4}He reaction .... See Entry 105839

Delayed neutron yield and decay constants for thermal neutron-induced fission of ^{235}U .... See Entry 105939

Evaluation of computational models for fission and spallation reactions used in accelerator breeding and transmutation analysis code .... See Entry 106073

Neutronic evaluations of activations in graphite-thorium assemblies, 14 MeV neutron sources: Comparisons with measurements .... See Entry 106171

Inelasticity of nucleus-nucleus collisions and composition of high-energy cosmic rays .... See Entry 110834

Slow neutron capture origin for ^{180}Ta^m .... See Entry 110898

25.50 ^{2}H- AND ^{3}H-INDUCED REACTIONS AND SCATTERING

105876 Vector analyzing powers for valence and inner shell pickup in the ^{116}Sn($\vec{d}$,t)^{115}Sn and ^{116}Sn($\vec{d}$,^{3}He)^{115}In reactions. R.H.Siemssen (Kernfysisch Versneller Inst., Groningen, Netherlands), C.C.Foster, W.W.Jacobs, W.P.Jones, D.W.Miller, M.Saber, F.Soga.
Nucl. Phys. A (Netherlands), vol.A405, no.2, p.205-20 (29 Aug. 1983).
Differential cross-section and vector analyzing-power angular distributions were measured at $E_d=50$ MeV for the ^{116}Sn($\vec{d}$,t)^{115}Sn and ^{116}Sn($\vec{d}$,^{3}He)^{115}In reactions in the angular range from 6° to 26° for excitation energies up to 25 MeV. In addition to transitions to low-lying states in ^{115}Sn and ^{115}In, data were obtained for the deep-lying hole states in ^{115}Sn. DWBA calculations in general give a good account of the analyzing powers for pickup of the valence shell nucleons. For states at 1.47 MeV (unresolved multiplet) and at 1.65 MeV in ^{115}In, new spin assignments could be made on the basis of the analyzing-power measurements. Analyzing powers for the deeply bound hole states indicate a strong overlap of the different subshell orbitals, although the gross structure peaks still contain characteristic analyzing-power signatures. (30 refs.)

105877 Effects of the proton-neutron hole interaction to the form factor in (*d*,*t*) reactions on $N=50$ target nuclei. R.Namai (Dept. of Phys., Tokyo Inst. of Technol., Tokyo, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1704-16 (June 1983).
The proton-neutron hole interaction is included in the calculation of form factors for (*d*,*t*) reactions on ^{90}Zr and ^{92}Mo targets. The form factor is generated by the Green function method in which the results of shell model calculations are fully used. The interaction causes the form factor to be enhanced in the nuclear interior and depressed beyond the nuclear surface. It is shown that the isotone dependence of the spectroscopic factor deduced from the experiment is well reproduced by the present model. (23 refs.)

105878 Strong *E*1 transitions in ^{9}Be, ^{11}Be, and ^{13}C. D.J.Millener, J.W.Olness, E.K.Warburton (Brookhaven Nat. Lab., Upton, NY, USA).
Phys. Rev. C (USA), vol.28, no.2, p.497-505 (Aug. 1983).
The Doppler shift attenuation method has been used to make two measurements of the mean life of the ^{11}Be 320-keV level. The results are 150±30 fs from the ^{9}Be(t,pγ)^{11}Be reaction and 168±17 fs from the ^{3}H(^{9}Be,pγ)^{11}Be reaction. The adopted value of 166±15 fs, from the present and previous measurements, corresponds to an extremely strong *E*1 transition of 0.36±0.03 W.u. The adopted energy of the ground state transition from this and previous measurements is 320.04±0.10 keV. It is shown that the magnitude of this *E*1 transition can be understood on the basis of the shell-model calculations only if realistic single-particle wave functions are used. A similar theoretical treatment is given for strong *E*1 transitions in ^{9}Be and ^{13}C. (28 refs.)

105879 Proton hole states in ^{95}Y and ^{95,97,99}Nb. E.R.Flynn, R.E.Brown (Los Alamos Nat. Lab., Los Alamos, NM, USA), F.Ajzenberg-Selove, J.A.Cizewski.
Phys. Rev. C (USA), vol.28, no.2, p.575-86 (Aug. 1983).
The proton hole states of ^{95}Y and ^{95,97,99}Nb have been studied by the ($\vec{t}$,α) reaction using a polarized beam of 17 MeV tritons on targets of ^{96}Zr and ^{96,98,100}Mo. The results yield a number of new levels as well as numerous new spin assignments based on the large analyzing powers characteristic of the ($\vec{t}$,α) reaction. Examination of the systematics of the resulting level schemes indicates a tendency towards deformation with increasing neutron number, which is expected given the known deformed region above $A=100$. However, ^{97}Nb is also clearly affected by the $N=56$ subshell closure. This subshell

closure has a major effect on the level structure of ^{96}Zr but is completely washed out in ^{98}Mo. (21 refs.)

105880 ^{79}As via proton pickup. S.Mordechai (Univ. of Pennsylvania, Philadelphia, PA, USA), S.LaFrance, H.T.Fortune.
Phys. Rev. C (USA), vol.28, no.2, p.623-30 (Aug. 1983).
The reaction ^{80}Se(t,α)^{79}As has been investigated with an 18-MeV triton beam. Twenty-six levels of ^{79}As (many of them previously unreported) have been identified up to about 3.5 meV excitation energy. Angular distributions were measured and compared with distorted-wave Born-approximation calculations, in order to extract L values and spectroscopic factors. Most of the expected strength for pickup from the $2p$ and $1f_{5/2}$ orbitals is observed. Behaviour of the low-lying negative-parity states for various As isotopes is presented and compared with the predictions of a rotational model with prolate deformation and Coriolis coupling. The observed first and second $9/2^+$ states in odd-A isotopes give further evidence for the shape transition suggested recently for this mass region. (25 refs.)

105881 Nuclear moments of ^{9}Li. F.D.Correll, L.Madansky (Dept. of Phys., Johns Hopkins Univ., Baltimore, MD, USA), R.A.Hardekopf, J.W.Sunier.
Phys. Rev. C (USA), vol.28, no.2, p.862-74 (Aug. 1983).
The ground-state magnetic dipole and electric quadrupole moments of the β emitter ^{9}Li($J^\pi={}^3/_2{}^-$, $T_{1/2}=0.176$ s) have been measured for the first time. Polarized ^{9}Li nuclei were produced in the ^{7}Li(t,p) reaction, using 5-6 MeV polarized tritons. The recoiling ^{9}Li nuclei were stopped either in Au foils or in LiNbO$_3$ single crystals, and their polarization was detected by measuring the β-decay asymmetry. Nuclear magnetic resonance techniques were used to depolarize the nuclei, and the resonant frequencies were deduced from changes in the asymmetry. The ^{9}Li dipole moment was deduced from the measured Larmor frequency in Au; the result, including corrections for diamagnetic shielding and the Knight shift, is $|\mu|=3.4391(6)\ \mu_N$. The ratio of the ^{9}Li quadrupole moment to that of ^{7}Li was derived from their respective quadrupole couplings in LiNbO$_3$; the value is $|Q(^9\mathrm{Li})/Q(^7\mathrm{Li})|=0.88\pm0.18$. Both results are in agreement with shell model predictions. (65 refs.)

105882 Precise determination of two-step contributions in (d,α) reaction by using vector and tensor analyzing powers for the ^{208}Pb(d,α)^{206}Tl(g.s;0$^-$) reaction. K.Hashimoto, Y.Aoki, H.Iida, K.Nagano, H.Tanaka, M.Takei, Y.Tagishi, K.Yagi (Inst. of Phys. & Tandem Accelerator Center, Univ. of Tsukuba, Ibaraki, Japan).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.366-75
Vector and tensor analyzing powers and cross sections for the ^{208}Pb(d,α)^{206}Tl(g.s;0$^-$) reaction at E$_d$=21.5 MeV have been measured in order to study contributions of the sequential transfer two-step processes (d,t) (t,α) and (d,^{3}He) (^{3}He,α). Intensities of the two-step processes have been determined so as to reproduce each of the intensity of the one-nucleon transfer reactions involved. The first- and second-order DWBA calculations reproduce the (d,α) data very well. The intensities of the two-step processes are less than that of the experimental (d,α) data by about one order in magnitude. (12 refs.)

105883 Ground state transitions in (d,^{6}Li) reactions on sd-shell nuclei. W.Oelert, G.Palla (Inst. fur Kernphys., Kernforschungsanlage Julich, Julich, Germany).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.420-9
Alpha spectroscopic factors for nuclei of the sd shell are investigated in the case of (d,^{6}Li) reaction at E$_d$=80 MeV. The importance of a careful choice of optical potentials and the necessity of employing coupled channel calculations are demonstrated for transitions leading to the ground states. (11 refs.)

$(f_{7/2})_{7,0}{}^{-2}$ configuration high-spin states in ^{60}Co strongly excited in the ^{62}Ni(d,α) reaction .... See Entry 105713

Deuteron D-state effects on the vector polarization observables in (d,p) reactions at 55.4 MeV .... See Entry 105824

Effective interaction for deuteron stripping and pick up reactions .... See Entry 105827

Non-direct transitions in transfer reactions and spectroscopy .... See Entry 105870

Relations between the simultaneous and sequential transfer of two nucleons .... See Entry 105875

Two-step contributions and non-orthogonality effects in deuteron and ^{17}O reactions on lead .... See Entry 105918

25.60 ^{3}HE- AND ^{4}HE-INDUCED REACTIONS AND SCATTERING

105884 Study of ^{46,48}Ca(α,p) reactions. C.Ellegaard, J.D.Garrett, O.Hansen, S.Y.Van Der Werf (Niels Bohr Inst., Univ. of Copenhagen, Copenhagen, Denmark), R.R.Betts, S.B.Dicenzo, B.F.Bayman.
Nucl. Phys. A (Netherlands), vol.A406, no.1, p.134-48 (12 Sept. 1983).
The ^{46}Ca(α,p)^{49}Sc and ^{48}Ca(α,p)^{51}Sc reactions have been studied at a bombarding energy of 25 MeV. The data are compared with the results of DWBA calculations using simple shell-model form factors—the overall agreement is, however, quite poor. The expectation that a state corresponding to an 1f$_{7/2}$ proton coupled to a neutron pairing vibration would be excited in the ^{46}Ca(α,p)^{49}Sc reaction is borne out although the observed strength is somewhat smaller than expected. (18 refs.)

105885 High energy (^{3}He,d) proton stripping by ^{27}Al and ^{28}Si nuclei: Transitions to excited states. A.Djaloeis, S.Gopal, J.Bojowald, W.Oelert, P.Turek, C.Mayer-Boricke (Inst. fur Kernphys., KFA Julich, Julich, Germany).
Phys. Rev. C (USA), vol.28, no.2, p.54-74 (Aug. 1983).
Angular distributions for the ^{27}Al(^{3}He,d)^{28}Si* and ^{28}Si(^{3}He,d)^{20}P* reactions have been measured at $E_{3(\mathrm{He})}=130$ MeV in the angular range of $9°\lesssim\theta_{\mathrm{c.m.}}\lesssim40°$. In the proton-unbound excitation energy region, four prominent peaks (E_x=11.61, 12.67, 13.26, and 14.33 MeV) from the ^{27}Al(^{3}He,d)^{28}Si reaction and three peaks (E_x=6.59, 8.08, and 10.17 MeV) from the ^{28}Si(^{3}He,d)^{29}P reaction, are reported and analyzed for the first time. The data have been analyzed in terms of the DWBA theory, using optical model and other relevant parameters determined in a previous paper on the ground state transitions. In general, satisfactory fits to the experimental angular distributions are obtained. Spectroscopic information has been extracted and compared with the results available in the literature. (15 refs.)

105886 Neutron-multiplicity distributions for (α,xnγ) reactions with E_α=50-120 MeV and the pre-equilibrium neutron deexcitation processes. K.Maeda, T.Shibata, H.Ejiri (Dept. of Phys., Osaka Univ., Osaka, Japan), H.Sakai.
Phys. Rev. C (USA), vol.28, no.2, p.635-41 (Aug. 1983).
Pre-equilibrium and equilibrium deexcitation processes for (α,x,nγ) reactions induced by 50-120 MeV α particles were studied. Reaction channels were identified by measuring rotational γ rays characteristic of the reaction residues. The branching of the reaction channels gave neutron multiplicity distributions. Features characteristic of the pre-equilibrium process were seen in the reaction channels with small neutron multiplicity x. An exciton model calculation code was developed so as to incorporate both multiparticle emission at the fast pre-equilibrium stage and multiparticle evaporation at the slow equilibrium stage. The calculation reproduced the neutron multiplicity distributions in the whole range of E_α=50-120 MeV. The pre-equilibrium fractions and the entry lines from the pre-equilibrium stage to the equilibrium one were deduced. The pre-equilibrium fractions were found to be approximately 40-60%, being rather independent of the individual reaction channel. The entry lines slowly increase from 25 to 35 MeV with increasing projectile energy. (25 refs.)

105887 Single particle strengths in A=28 nuclei via (α,t) and (α,^{3}He) reactions. M.Yasue, T.Tanabe, S.Kubono, M.Sugitani, J.Kokame (Inst. for Nuclear Study, Univ. of Tokyo, Tokyo, Japan), Y.Kadota, Y.Taniguchi.
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.438-45
The ^{27}Al(α,t) and (α,^{3}He) reactions have been measured at E$_\alpha$=64.5 MeV. The experimental angular distributions have been analyzed by exact finite-range DWBA calculations, assuming a nucleon stripping mechanism. The distributions of spectroscopic strengths for the single-particle transitions with transferred angular momenta L=0, 1, 2, 3 and 4 have been obtained. (15 refs.)

105888 Breakup process for the 100 MeV ^{3}He interacting with the ^{165}Ho and ^{166,167}Er nuclei. T.Motobayashi (Dept. of Phys., Osaka Univ., Osaka, Japan), SA.Shimizu, H.Ejiri, T.Shibata, K.Okada, M.Sasao, K.Maeda, H.Suzuki, H.Sakai.
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.626-30
The projectile breakup process for 100 MeV ^{3}He interacting with ^{165}Ho and ^{166,167}Er was studied by measuring singles and coincidence spectra of the breakup fragments and following gamma-rays. Comparison of the charge particle spectra for ^{3}He induced reactions with those of ^{4}He induced reactions showed a large contribution of the breakup process for ^{3}He. Contributions of the elastic breakup, inelastic breakup and breakup fusion processes were deduced individually from the particle-gamma coincidence measurements at forward angles. (10 refs.)

105889 Resonant and nonresonant particle decay following α-bombardment on medium heavy nuclei. T.Shibata, K.Okada, M.Noumachi, H.Ohsumi, Y.Nagai, T.Motobayashi (Dept. of Phys., Osaka Univ., Osaka, Japan), H.Ejiri, H.Sakai, A.Shimizu, K.Maeda.
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.674-89
Nonstatistical particle decay from resonant and nonresonant states excited by α-induced reactions were studied using various kinds of correlation measurements. Protons and neutrons emitted from ^{165}Ho(α,xnypγ) and ^{164}Dy(α,xnγ) reactions show the pre-equilibrium particle decay. Inclusive proton spectrum, cross sections of individual reaction channels, and proton and neutron spectra for each reaction channel were analyzed by using an exciton model. The ratio of escape width to total width was determined to be ~0.3 for E$_x$~100 MeV at the beginning of the reaction so as to fit the experimental results. Neutrons emitted from the ^{119}Sn(α,α'n) and ^{92}Zr(α,α'n) reactions show contributions of three different reaction mechanisms as follows: (1) fast neutron emission from the giant quadrupole resonance, (2) pre-equilibrium neutrons and (3) knocked-out neutrons. (29 refs.)

105890 A model for alpha particle induced reactions. E.Gadioli, E.Gadioli Erba (Istituto de Fisica, Univ. di Milano, Milano, Italy).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.690-703
Calculations of particle spectra and excitation functions of several reactions induced by alpha particles with energy up to 160 MeV on A~60 and A~90 nuclei, which satisfactorily reproduce the experimental data are presented. Different alpha-nucleus interaction mechanisms have been considered. The interaction of the alpha particle with individual nucleons of the target nucleus leading to a pre-equilibrium cascade of alpha-nucleon scatterings during which the alpha may be reemitted or may breakup to four nucleons seem to be the dominant process. The calculations allow one to reproduce the experimental data with an accuracy comparable with that of previous calculations of nucleon induced reactions, without introducing new free parameters. (29 refs.)

The spectroscopic study of ^{206,204}Pb with the (α,^{6}He) reaction .... See Entry 105786

Low energy octupole resonance in deformed nuclei .... See Entry 105818

Hexadecapole component in giant quadrupole resonance region of ^{208}Pb .... See Entry 105819

Study of the (^{3}He,t) reaction on heavy nuclei .... See Entry 105820

Direct and direct-fusion reaction approach to continuum spectra of nuclear reactions .... See Entry 105826

Direct and pre-equilibrium deexcitations following the (α,α') reaction studied by discrete γ-α' correlations .... See Entry 105828

Application of the statistical multistep compound theory to light ion induced reactions .... See Entry 105830

Statistical aspects of multistep process in nuclear reactions ..See Entry 105833

Non-direct transitions in transfer reactions and spectroscopy .... See Entry 105870

Relations between the simultaneous and sequential transfer of two nucleons .... See Entry 105875

The absolute normalization of three-nucleon transfer reactions .... See Entry 105905

25.70 HEAVY ION INDUCED REACTIONS AND SCATTERING

105891 Analysis of the statistical *S* matrix generated in fitting $^{16}O+^{28}Si$ elastic scattering. R.J.W.Hodgson (Phys. Dept., Univ. of Ottawa, Ottawa, Ontario, Canada).
Can. J. Phys. (Canada), vol.61, no.9, p.1362-9 (Sept. 1983).
An *S* matrix, which gives very good fits for the elastic scattering of $^{16}O+^{28}Si$ over the angular range $15°<\theta<180°$, has been generated at six energies (21 MeV$<E$(centre of mass)$<$35 MeV). The *S* matrix is composed of a parametric form plus a small statistical term for each partial wave. The properties of the *S* matrix have been examined in order to deduce the mechanisms involved in the reaction. The 180° excitation function has also been computed. (12 refs.)

105892 Coupled-channel effects in elastic ^{12}C-^{12}C scattering at 1016 MeV. G.Faldt, A.Ingemarsson (Gustaf Werner Inst., Uppsala, Sweden).
J. Phys. G (GB), vol.9, no.9, p.L191-3 (Sept. 1983).
Coupled-channel calculations for elastic and inelastic scattering of ^{12}C by ^{12}C at 1016 MeV have been performed within the vibration model. (6 refs.)

105893 Origin of the molecular-resonance-like structures in the $^{12}C(^{16}O,\alpha)$ reaction studied by an alpha-HI correlation measurement. T.Shimoda (Lab. of Nuclear Studies, Osaka Univ., Osaka, Japan), S.Shimoura, T.Fukuda, M.Tanaka, H.Ogata, I.Miura, E.Takada, M.-K.Tanaka, K.Takimoto, K.Katori.
J. Phys. G (GB), vol.9, no.9, p.L199-205 (Sept. 1983).
An alpha-HI correlation measurement was performed to see whether the ^{12}C-^{12}C molecular resonance states can be populated in the $^{12}C(^{16}O,\alpha)$ reaction. The cross sections of such processes were small, if any. Instead, the sequential alpha-decay processes of $^{20}Ne^*$ and $^{16}O^*$ mainly contribute to the molecular-resonance-like structures in the alpha spectra. (12 refs.)

105894 Symmetrical fusion of heavy ions around the Coulomb barrier energy. G.Royer, B.Remaud (Inst. de Phys., Nantes, France).
J. Phys. G (GB), vol.9, no.9, p.1103-13 (Sept. 1983).
Using the liquid-drop model, the authors have performed a systematic study of symmetrical fusion with a neck degree of freedom and tunnelling effects, the nuclear potential being calculated with the proximity approach. Barrier heights and positions are in very good agreement with experimental data when they are known (light-medium systems); the recent experimental data for the reactions $^{58}Ni+^{58}Ni$ and $^{64}Ni+^{64}Ni$ are investigated particularly. For heavier systems double-humped fusion barriers and isomeric states are predicted which strongly limit the complete fusion probability. (23 refs.)

105895 The $(^{14}C,^{14}O)$reaction considered as simultaneous pair-exchange or double-charge-exchange processes. D.R.Bes, O.Dragun, E.E.Maqueda (Dept. de Fisica, Comision Nacionale de Energia Atomica, Buenos Aires, Argentina).
Nucl. Phys. A (Netherlands), vol.A405, no.2, p.313-47 (29 Aug. 1983).
Pair-exchange or double-charge-exchange reactions are studied from the point of view of one-step processes. Two possible mechanisms are analyzed, involving either the simultaneous exchange of a dineutron and a diproton between the target and the projectile or the simultaneous transformation of the charge of the dinucleon in each system. Although the formalism is explicitly developed for the $(^{14}C,^{14}O)$ reaction, its extension to other projectiles is straightforward. The possibility of populating collective states which otherwise are very difficult to attain is stressed. Application is made to the cases of the $^{208}Po(^{14}C,^{14}O)^{208}Pb$ and $^{40}Ca(^{14}C,^{14}O)^{40}Ar$ reactions. (14 refs.)

105896 Spectroscopy of $A=16$ from $^{13}C(^{6}Li,t)^{16}O$. K.W.Kemper (Dept. of Phys., Florida State Univ, Tallahassee, FL, USA), G.G.Shute, C.H.Atwood, L.K.Fifield, T.R.Ophel.
Nucl. Phys. A (Netherlands), vol.A405, no.2, p.348-62 (29 Aug. 1983).
The $^{13}C(^{6}Li,t)^{16}O$ reaction has been studied at ^{34} MeV. Selective population of narrow states is observed up to 21 MeV excitation in ^{16}O. This reaction populates strongly both unnatural- and natural-parity states that have little or no $^{12}C+\alpha_0$ width. The measured angular distributions and compared with Hauser-Feshbach and finite-range DWBA calculations. Reasonable agreement with the DWBA calculations is found for most of the states strongly populated. The widths of the narrow states populated in the 16-20MeV excitation region are presented. Comparison of the present data with that from medium-energy inelastic scattering and other multiparticle transfer reactions is made. (32 refs.)

105897 Channel-coupling effects in heavy-ion fusion reactions. C.H.Dasso, S.Landowne (Nordita, Copenhagen, Denmark), A.Winther.
Nucl. Phys. A (Netherlands), vol.A405, no.2, p.381-96 (29 Aug. 1983).
A coupled-channel framework for fusion reactions is considered where an ingoing-wave boundary condition allows the effect of strong coupling in the barrier region to be studied. It is shown analytically within the sudden limit and, more generally, with model calculations that the couplings to reaction channel act to enhance the transmission through the barrier at low energies. This appears to be a natural mechanism for explaining the relatively large sub-barrier heavy-ion fusion cross sections which have recently been observed. (13 refs.)

105898 Mechanism of neon-induced reactions studied between 7.5 and 20 MeV/nucleon: inclusive cross sections. Ch.Egelhaaf, M.Burgel, H.Fuchs, A.Gamp, H.Homeyer, D.Kovar, W.Rauch (Hahn-Meitner-Inst. fur Kernforschung Berlin, Bereich Kern- und Strahlenphys, Berlin, Germany).
Nucl. Phys. A (Netherlands), vol.A405, no.2, p.397-428 (29 Aug. 1983).
Light and projectile-like fragments as well as fission fragments have been observed from the $^{20}Ne+^{197}Au$ system at 150, 220, 290 and 400 MeV beam energy. Inclusive cross sections are given, and characteristic parameters like the centroids and the widths of momentum, *Z*- and *A*- distributions were derived. For comparison, some results of measurements on the $^{22}Ne+^{197}Au$ and $^{20,22}Ne+^{58}Ni$ systems are included. The qualitative behaviour of the cross sections and the derived parameters show that with increasing bombarding energy the incomplete-fusion mechanism (massive transfer) and the sequential decay of projectile transfer residues (sequential break-up) appear in addition to the complete-fusion and ordinary transfer reactions predominant at the lowest bombarding energies. Other mechanisms do not contribute significantly in the energy range up to 20 MeV/nucleon. (71 refs.)

105899 Large-angle $^{6}Li+^{28}Si$ elastic and inelastic scattering at 27 and 34 MeV. M.F.Vineyard, J.Cook, K.W.Kemper (Dept. of Phys., Florida State Univ., Tallahassee, FL, USA).
Nucl. Phys. A (Netherlands), vol.A405, no.2, p.429-44 (29 Aug. 1983).
Elastic and inelastic scattering data extending to $\theta_{c.m}\approx175°$ are reported for $^{6}Li+^{28}Si$ at 27 and 34 MeV. Optical model analyses of the elastic data were made using a variety of real potential forms. The large-angle data cannot be fitted with a Woods-Saxon real potential, but are well described by Wood-Saxon squared, double-folded or Fourier-Bessel potentials. The real potential is the same at both energies, but the imaginary potential is weaker at 27 MeV. The inelastic data were analyzed using the DWBA and coupled channels techniques with folded real form factors and deformed Wood-Saxon imaginary potentials, with the deformations taken from electron scattering. The 2^+ state was fitted well at both energies with the DWBA, while the prediction decreased too rapidly at large angles for the 4^+ state. The large-angle 4^+ data were better described when two-step excitations were included in the coupled-channels calculations. The forward-angle 2^+ data are sensitive to the interference between Coulomb and nuclear scattering and show that the nuclear and Coulomb deformation parameters β_2 are equal for this transition. (28 refs.)

105900 Contribution of two-step processes to the elastic scattering of ^{9}Be on ^{12}C. B.Kamys, L.Jarczyk, Z.Rudy, A.Strzalkowski (Inst. of Phys., Jagellonian Univ., Cracow, Poland), H.H.Wolter, J.Lang, R.Muller, J.Sromicki.
Nucl. Phys. A (Netherlands), vol.A406, no.1, p.193-204 (12 Sept. 1983).
The elastic scattering of ^{9}Be on ^{12}C at energies between 20 and 45 MeV is analysed, taking into account the interference between potential scattering and direct reactions and the incoherent compound nucleus contribution. The direct processes included are the one-step ^{3}He transfer, the two-step inelastic-excitation ^{3}He transfer and the sequential $n\alpha$ transfer. The inelastic scattering and the transfer to the $^{8}Be+^{13}C$ channel are also analysed in order to determine all parameters entering the two-step processes. It is found that the effect of the higher-order processes is to increase the cross section somewhat in the interference angular region, particularly at higher energies. Together with the statistical contribution this leads to a reasonable description of the elastic scattering data. (20 refs.)

105901 Onset of damping in energetic heavy-ion interactions. L.Kowalski, P.E.Haustein, J.B.Cumming (Chem. Dept., Brookhaven Nat. Lab., Upton, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.8, p.642-5 (22 Aug. 1983).
Measurements of longitudinal momenta transferred to mass-identified products of the fragmentation of Cu by ^{12}C ions give clear evidence for a change in reaction mechanism between 22 and 84 MeV/u. Results at 84 MeV/u are generally consistent with peripheral interactions. However, at 22 MeV/u large momentum transfers observed for near-target products suggest that strongly damped processes have become important. Limits to momentum transfer of the type reported by Galin et al. (1982) are shown to arise in a natural way from this transition. (16 refs.)

105902 Nature of molecular resonances and background in the $^{16}O+^{12}C$ system. E.C.Schloemer, M.Gai, J.F.Ennis, M.Ruscev, B.Shivakumar, S.M.Sterbenz, N.Tsoupas, D.A.Bromely (A.W. Wright Nuclear Structure Lab., Yale Univ., New Haven, CT, USA).
Phys. Rev. Lett. (USA), vol.51, no.10, p.881-4 (5 Sept. 1983).
High-resolution total reaction excitation functions for $^{16}O+^{12}C$ and detailed angular distributions for the reaction $^{12}C(^{16}O,\alpha)^{24}Mg$ have been measured. The interplay between (fifteen) resonance amplitudes and *l*-window (background) amplitudes is emphasized. Spin assignments, obtained from the α_0 data, are dominated by values of 8 ħ and 9 ħ while the grazing partial wave varies from $l=5$ to $l=10$ over the energy range studied. Elastic widths for the low-energy resonances indicate a dinuclear molecular nature; higher-energy resonances appear to originate from a more complex nuclear configuration. (12 refs.)

105903 Refractive effects in ^{9}Be scattering and nuclear rainbow ghosts. G.R.Satchler, C.B.Fulmer, R.L.Auble, J.B.Ball, F.E.Bertrand, K.A.Erb, E.E.Gross, D.C.Hensley (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.147-52 (25 Aug. 1983).
Data for the elastic scattering of ^{9}Be on ^{12}C and ^{16}O at 158 MeV provide evidence of refractive effects that allow the optical potentials to be determined with little ambiguity. The real potentials are deep. Large angle data indicate dominance of negative-angle scattering from the far side of the target nucleus. The analysis also implies a residual rainbow phenomenon, contrary to what has been seen previously in heavy-ion scattering. The authors suggest this be called a rainbow ghost. (15 refs.)

105904 Excitation of ^{17}O and ^{18}O scattered by ^{208}Pb in the Coulomb-nuclear interference region. J.S.Lilley, B.R.Fulton (Daresbury Lab., Sci. & Engng. Res. Council, Warrington, England), D.Banes, T.M.Cormier, I.J.Thompson, S.Landowne, H.H.Wolter.
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.153-6 (25 Aug. 1983).
Inelastic scattering of ^{17}O and ^{18}O by ^{208}Pb has been measured at 78 MeV, and compared with theoretical predictions. In both cases the nuclear amplitude is dominated by the valence nucleon contribution. Direct excitation is the principal mechanism in ^{18}O scattering, while for ^{17}O excitation, two-step transfer is more important. Recoil and non-orthogonality effects must be taken into account. (7 refs.)

105905 The absolute normalization of three-nucleon transfer reactions. J.J.Hamill, P.D.Kunz (Nuclear Phys. Lab., Univ. of Colorado, Boulder, CO, USA).
Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.5-10 (15 Sept. 1983).
Data for (α,p) and $(^{6}Li,t)$ reactions on ^{40}Ca targets are re-analyzed using microscopic form factors and the DWBA in exact range. The absolute magnitudes predicted for $(^{6}Li,t)$ cross sections agree with data, while the (α,p) cross sections calculated with a deep alpha particle optical model are more than one hundred times smaller than data. The agreement for (α,p) magnitudes is greatly improved when a shallow optical potential is used. (24 refs.)

105906 Charged particle production in peripheral reactions induced by 118 MeV ^{12}C ions on ^{118}Sn. S.E.Arnell, S.Mattsson, H.A.Roth, O.Skeppstedt (Chalmers Univ. of Technol., Goteborg, Sweden), S.A.Hjorth, A.Johnson, A.Kerek, J.Nyberg, L.Westerberg.
Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.23-6 (15 Sept. 1983).
The multiplicities of γ-cascades observed in coincidence with fast charged ejectiles from $^{118}Sn+118$ MeV ^{12}C collisions are measured. The analysis gives evidence for a peripheral nature of these reactions and supports the sum-rule model for incomplete (and complete) fusion. (11 refs.)

105907 Analysis of low energy heavy ion multiparticle transfer reactions in terms of entrance and exit doorways. M.U.Ahmed, W.P.Beres (Dept. of Phys., Wayne State Univ., Detroit, MI, USA).
Phys. Rev. C (USA), vol.28, no.2, p.660-6 (Aug. 1983).
A projection operator method is developed for the analysis of low energy heavy ion multiparticle transfer reactions. Entrance doorways introduce structure which is transferred sequentially via reaction (or exit) doorways to the reaction channel of interest. The theory treats both gross and intermediate structure, and the coupling from entrance to exit doorways introduces additional spreading and rather narrow structure in the reaction cross section. Consistent with experiment energy shifts of reaction channel resonances relative to each other and to the elastic are present. The theory is suggested as a means of studying, for example, $^{12}C+^{12}C\rightarrow^{20}Ne^*+\alpha$ in the range of 10-30 MeV (c.m.) where the $O_2{}^+$ state of $^{12}C^*$ would play an important role. (17 refs.)

105908 Dynamical thresholds for compound-nucleus formation in symmetric heavy-ion reactions. K.T.R.Davies (Phys. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA), A.J.Sierk, J.R.Nix.
Phys. Rev. C (USA), vol.28, no.2, p.679-91 (Aug. 1983).
The authors study the effect of the nuclear macroscopic energy, nuclear dissipation, and shape parametrization on dynamical thresholds for compound-nucleus formation in symmetric heavy-ion reactions. This is done by solving numerically classical equations of motion for head-on collisions to determine whether the dynamical trajectory in a multidimensional deformation space passes inside the fission saddle point and forms a compound nucleus, or whether it passes outside the fission saddle point and reseparates. Specifying the nuclear shape in terms of smoothly joined portions of three quadratic surfaces of revolution, they take into account three symmetric deformation coordinates. However, in some cases they reduce the number of coordinates to two by requiring the ends of the fusing system to be spherical in shape. The nuclear potential energy of deformation is determined in terms of a Coulomb energy and a nuclear macroscopic energy that is usually taken to be a double volume energy of a Yukawa-plus-exponential folding function, although a double volume integral of a single-Yukawa folding function and ordinary surface energy are also considered. The collective kinetic energy is calculated for incompressible, nearly irrotational flow by means of the Werner-Wheeler approximation. Four possibilities are studied for the transfer of collective kinetic energy into internal single-particle excitation energy: (1) zero dissipation, (2) ordinary two-body viscosity, (3) one-body wall-formula dissipation, and (4) one-body wall-and-window dissipation. (65 refs.)

105909 Reaction cross sections for ^{14}N+^{10}B. P.A.DeYoung, J.J.Kolata, L.J.Satkowiak, M.A.Xapsos (Phys. Dept., Univ. of Notre Dame, Notre Dame, IN, USA).
Phys. Rev. C (USA), vol.28, no.2, p.692-9 (Aug. 1983).
Excitation functions for the yields of nineteen residual nuclei from the the ^{14}N+^{10}B reaction have been measured over the range $E_{c.m.}$=8.00-25.75 MeV in steps of 250 keV with γ-ray techniques. The magnitude and energy dependence of the excitation functions for the partial yields are very different from those of the ^{12}C+^{12}C system. The total fusion cross section appears to saturate at an energy and a magnitude which are lower than expected from previous systematics. Small, regular fluctuations can be seen in the fusion cross section, one of which is very narrow. However, the structure observed by L'Ecuyer et al. was not seen in this work. (15 refs.)

105910 Energy dependence of ^{9}Be+^{12}C cross sections: nonstatistical component of the mean cross section. L.Jarczyk, B.Kamys, Z.Rudy, A.Strzalkowski, H.Witala (Inst. of Phys., Jagellonian Univ., Cracow, Poland), M.Hugi, J.Lang, R.Muller, J.Sromicki, H.H.Wolter.
Phys. Rev. C (USA), vol.28, no.2, p.700-5 (Aug. 1983).
The mean cross section for the elastic scattering and the ^{8}Be and the α-particle channels in the ^{9}Be+^{12}C system considerably exceeds the Hauser-Feshbach model predictions for the compound nucleus cross section. It is shown that the magnitude as well as the energy and angle dependence of this nonstatistical contribution to the mean cross section can be explained satisfactorily as being produced in a direct transfer reaction. One step ^{3}He, n, and α transfer processes are adequate for the description of the ^{9}Be and ^{8}Be channel while a contribution of two-step sequential processes should be taken into account for the ^{5}He and ^{8}Be transfers in the α-particle exit channel. (24 refs.)

105911 Total inclusive neutron cross sections and multiplicities in nucleus-nucleus collisions at intermediate energies. R.Madey, B.D.Anderson, R.A.Cecil, P.C.Tandy (Dept. of Phys., Kent State Univ., Kent, OH, USA), W.Schimmerling.
Phys. Rev. C (USA), vol.28, no.2, p.706-9 (Aug. 1983).
The total integrated inclusive cross section, $\sigma(T>T_0)$, for the emission of neutrons above an energy T_0 by neon ions with an average energy of 337 MeV per nucleon reacting in targets of uranium, copper, aluminum, and carbon is described by $\bar{\sigma}_{NN}(\bar{R}_G/r_0)^{\alpha(T0)}$. Here $\bar{\sigma}_{NN}$ is the isospin-averaged nucleon-nucleon cross section evaluated at an energy equal to the bombarding energy per nucleon, and R_G is the arithmetic mean value of the radii of the projectile and the target measured in units of the radius parameter r_0(=1.2 fm). In the limit $T_0=0$, the exponent $\alpha(T_0)=5$. A useful formula is derived for calculating mean neutron multiplicities in nucleus-nucleus collisions. (16 refs.)

105912 ^{12}C on ^{48}Ca transfer reactions: a test of the effective *Q*-value model. J.F.Petersen (A.W. Wright Nuclear Structure Lab., Yale Univ., New Haven, CT, USA), R.J.Ascuitto, D.G.Kovar, W.Henning, S.J.Sanders.
Phys. Rev. C (USA), vol.28, no.2, p.710-16 (Aug. 1983).
Angular distributions for the ^{48}Ca(^{12}C,^{11}B)^{49}Sc and ^{48}Ca(^{12}C,^{13}C)^{47}Ca transfer reactions at E_{lab}=45 MeV are presented. The data are analyzed in the context of the effective *Q*-value model, which has previously been applied successfully to ^{16}O induced reactions on ^{48}Ca. The model accounts equally well for the observed behaviors of the ^{12}C+^{48}Ca system, provided the influence of the strong inelastic transition to the first excited 2^+ (4.43 MeV) state in ^{12}C is taken into account. (15 refs.)

105913 Elastic scattering of ^{16}O by ^{28}Si. V.Shkolnik, D.Dehnhard, M.A.Franey (J.H. Williams Lab. of Nuclear Phys., Univ. of Minnesota, Minneapolis, MN, USA).
Phys. Rev. C (USA), vol.28, no.2, p.717-34 (Aug. 1983).
Differential cross sections were measured in small angular steps at forward angles for the elastic scattering of ^{16}O from ^{28}Si, ^{29}Si and ^{30}Si at E_{lab}=60 MeV and from ^{28}Si at six other incident energies between 45 and 63 MeV. The angular position of a peak in the diffraction pattern at $\theta_{c.m.}\simeq 75°$ was measured as a function of the incident energy between 55 and 63 MeV in 0.5 MeV steps. Close fits to these angular distributions and those of other authors at energies between 41 and 81 MeV, some spanning the whole angular range up to 180°, and the excitation functions at 90° and 180°, were obtained in an optical model analysis. A consistent description of the data was found by the use of a surface-transparent and parity-dependent potential with a real part able to generate a pocket in the total potential. The real and imaginary strengths depend quite strongly and smoothly on the incident energy. This potential shows a transition from surface transparency to strong absorption as E_{lab} approaches 81 MeV. The ambiguities in the strengths of the potential are discussed. The broad dispersive potential resonances which are present in several partial waves at every energy are also discussed and their relative importance is examined. (60 refs.)

105914 Intermediate-structure resonances in the ^{16}O+^{16}O total reaction cross section. W.Tiereth, Z.Basrak, H.Voit, N.Bischof, R.Caplar, P.Duck, H.Frohlich, B.Nees, E.Nieschler, W.Schuster (Phys. Inst., Univ. Erlangen-Nurnberg, Erlangen, Germany).
Phys. Rev. C (USA), vol.28, no.2, p.735-8 (Aug. 1983).
The ^{16}O+^{16}O total reaction cross section has been deduced from the elastic data in the energy region from 15.5-18 MeV (c.m.) using the sum-of-differences method. It exhibits intermediate-width resonant structures which are attributed to quasimolecular resonances in the A=32 system. Reduced partial widths of three resonances have been calculated. They indicate that the structure of the resonant states may not be that of a dinuclear molecule. (19 refs.)

105915 Influence of the nuclear autocorrelation function on the positron production in heavy-ion collisions. T.Tomoda, H.A.Weidenmuller (Max-Planck-Inst. fur Kernphys., Heidelberg, Germany).
Phys. Rev. C (USA), vol.28, no.2, p.739-46 (Aug. 1983).
The influence of a nuclear reaction on atomic positron production in heavy-ion collisions is investigated. Using statistical concepts, the authors describe the nuclear S matrix for a heavy-ion induced reaction as a statistically fluctuating function of energy. The positron production rate is then dependent on the autocorrelation function of this S matrix, and on the ratio of the 'direct' versus the 'fluctuating' part of the nuclear cross section. Numerical calculations show that in this way, current experimental results on positron production in heavy-ion collisions can be reproduced in a semiquantitative fashion. (10 refs.)

105916 Fission following capture reactions of ^{32}S+^{208}Pb. M.B.Tsang, D.Ardouin, C.K.Gelbke, W.G.Lynch, Z.R.Xu (Nat. Superconducting Cyclotron Lab., Michigan State Univ., East Lansing, MI, USA), B.B.Back, R.Betts, S.Saini, P.A.Baisden, M.A.McMahan.
Phys. Rev. C (USA), vol.28, no.2, p.747-60 (Aug. 1983).
Fission fragment mass and angular distributions were measured for ^{32}S induced reactions on ^{208}Pb at the laboratory energies of 180, 210, 250, and 266 MeV. By measuring the folding angle distributions between coincident fissionlike fragments at several beam energies it is shown that essentially the entire mass of the projectile is transferred to the composite system, which subsequently decays via symmetric fission. With increasing projectile energy the width of the mass distribution increases approximately as the square root of the nuclear temperature. The energy dependence of the angle integrated fusion-fission cross sections can be well described by classical trajectory calculations using the proximity potential and one-body dissipation. The fission fragment angular distributions become more anisotropic with increasing beam energy. Even at the lowest energy of 180 MeV, the angular distributions are more anisotropic than expected from statistical model calculations using saddle point shapes of the rotating liquid drop model. A simple parameterization of the angular momentum dependence of the effective moment of inertia gives a consistent description of the energy dependence of the angular distributions. (38 refs.)

105917 Tensor interactions and projectile excitations in the scattering of ^{7}Li by ^{58}Ni. H.Ohnishi, M.Tanifuji (Dept. of Phys., Hosei Univ., Tokyo, Japan), M.Kamimura, M.Yahiro, Y.Sakuragi.
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.299-303
Elastic and inelastic scattering of polarized ^{7}Li by ^{58}Ni targets at E_{lab}=20.3 MeV is investigated in two ways; namely, the invariant-amplitude method and the coupled-channel method. (4 refs.)

105918 Two-step contributions and non-orthogonality effects in deuteron and ^{17}O reactions on lead. I.J.Thompson (Sci. & Engng. Res. Council, Daresbury Lab., Warrington, England).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.348-56
A numerically stable and accurate method to calculate non-orthogonality terms has been incorporated in a general coupled-channels program that allows finite range transfer couplings between any number of light or heavy ions. The non-orthogonality terms have been calculated for the two-step transfer contributions to deuteron elastic scattering and to ^{17}O inelastic scattering on lead, at energies near the Coulomb barrier. It is found that the sequential amplitudes through the weekly bound states in ^{209}Pb are especially affected, as these amplitudes are over-estimated by between 30% and 150% in simple post-prior calculations. These effects are observable because the more direct processes are not too strong, and a good fit is now obtained to the data of Lilley et al. (22 refs.)

105919 Breakup effects of ^{7}Li on the elastic and inelastic scatterings. K.Katori, T.Shimoda, T.Fukuda (Lab. of Nuclear Studies, Osaka Univ., Osaka, Japan), S.Shimoura, A.Sakaguchi, T.Yamagata, M.Tanaka, H.Ogata, Y.Sakuragi, M.Kamimura.
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.635-8
The differential cross sections for the elastic and inelastic scattering of 132 MeV ^{7}Li from ^{12}C can be well described by coupled-channel calculations taking into account the breakup effect of ^{7}Li. (3 refs.)

105920 ^{12}C→3α breakup effect on ^{12}C+^{12}C scattering at E_{LAB}=140~300 MeV studied by microscopic coupled channels methods. Y.Sakuragi (Dept. of Phys., Kyushu Univ., Fukuoka, Japan), Y.Fukushima, M.Kamimura.
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.639-44 (9 refs.)

105921 Sequential projectile-breakup process in ^{20}Ne induced reactions at 92, 149 and 213 MeV. T.Shimoda, K.Katori (Lab. of Nuclear Studies, Osaka Univ., Osaka, Japan), T.Fukuda, H.Ogata, S.Shimoura, E.Takada.
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.645-8
The authors have studied the energy dependence of the direct and sequential breakup processes of the ^{20}Ne induced reactions in coincidence measurements of ^{40}Ca, ^{208}Pb(^{20}Ne,α^{16}O) at 92, 149 and 213 MeV. (7 refs.)

105922 Macroscopic implications of (N,Z) distributions for reaction mechanisms in ion-ion collisions. J.J.Griffin (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.761-73
Discrete Random Walk calculations of the (N-Z) evolution of a liquid drop dinucleus are reported for various assumptions about the transfer dynamics. Transition probabilities are assumed which correspond to the transferred nucleons being able to reach (a) any energy conserving state of the final dinucleus, (b) any energy conserving state more complicated by not more than 1p and 1h than the initial state, and (c) any one-particle one-hole excitation of the initial state. Physically these assumptions correspond to restricting the transfer, not at all, somewhat, and totally to be a pure one-body process. In every case, the Pauli exclusion principle is honored in the allowed final states. One finds that the assumption (c) generally leads to predictions easily distinguishable from those of (a) and (b), which do not differ substantially. (17 refs.)

105923 Pre-equilibrium effects in heavy-ion induced reactions. K.Niita (Dept. of Phys., Tohoku Univ., Sendai, Japan).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.786-94
Proposes a master equation to describe the time evolution of the intrinsic state during heavy-ion collisions. It takes into account two different kinds of processes. One is the relaxation of the relative motion, and the other is the equilibration process of the excited nuclei. The author then calculates the energy spectrum of the emitted nucleon. The angular distribution is also calculated using phase-space considerations. (12 refs.)

105924 Fragmentation processes in nucleus-nucleus collisions. G.Baur (Inst. fur Kernphys., KFA Julich, Julich, Germany).
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.795
Abstract form only given. A review of fragmentation processes in nuclear collisions is given. There are two types of DWBA-matrix elements which describe different physics: one, where the projectile as a whole is excited to an unbound (continuum) state which decays subsequently (sequential break-up), another one, where a constituent of the projectile is directly knocked out in a quasifree reaction (spectator break-up). The relative importance of these mechanisms is estimated semiclassically for Coulomb- and nuclear collisions. The direct measurement of the deuteron polarizability in subcoulomb elastic scattering is discussed. It constitutes a definite signature of the presence of intermediate break-up states in elastic scattering: due attention has to be paid to other small effects like vacuum polarization, electron screening and nuclear effects. (3 refs.)

105925 Light particle emission in the reaction of $^{93}Nb+^{14}N$ at 132, 159 and 208 MeV. T.Fukuda (Dept. of Phys., Osaka Univ., Osaka, Japan), M.Ishihara, H.Ogata, I.Miura, T.Shimoda, K.Katori, S.Shimoura, M.-K.Tanaka, E.Takada, T.Otsuka.
Proceedings of the 1983 RCNP International Symposium on Light Ion Reaction Mechanism, Osaka, Japan, 16-20 May 1983 (Osaka, Japan: Osaka University 1983), p.796-805
Describes a systematic study of the inclusive measurement of energetic light particle emission of p, d, t, α in the reactions of $^{93}Nb+^{14}N$ at 132, 159 and 208 MeV. The light particle spectra are discussed in terms of three models: (i) an extended exciton model in which the finiteness of the time needed for the fusion process is included, (ii) a generalized coalescence model which takes into account the Coulomb repulsion from the target nucleus, and (iii) a moving thermal source model. (9 refs.)

105926 Potential model description of heavy ion scattering using spline techniques. A.M.Kobos, R.S.Mackintosh (Open Univ., Milton Keynes, England).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.12-24
Discusses the spline model inversion procedure and its application to heavy ion scattering potential models. The reactions $^{16}O+^{40}Ca$, $^{16}O+^{28}Si$ and $^{6}Li+^{12}C$ are analysed. (8 refs.)

105927 Folding models for elastic and inelastic scattering. G.R.Satchler (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.25-43
Discusses folding procedures and their application to the elastic and inelastic scattering of heavy ions from nuclei. (42 refs.)

105928 Different regimes of dissipative collisions. A.Gobbi (Gesellschaft fur Schwerionenforschung, Darmstadt, Germany).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.159-74
The author discusses three topics: the energy dissipation under the influence of the single particle shell structure, large rearrangement of masses during the fusion process, and the dynamical splitting of heavy nuclei ($A>86$) at incident energies of 12-15 MeV/u. (22 refs.)

105929 Charge equilibration in deep-inelastic peripheral collisions. D.H.E.Gross, K.M.Hartmann (Bereich Kern- und Strahlenphys., Hahn-Meitner-Inst. fur Kernforschung, Berlin, Germany).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.175-84
Deep-inelastic collisions between heavy ions are being used to study the relaxation of various macroscopic degrees of freedom. These include mass, charge, scattering angle, angular momentum and shape. The energy loss undergone during the reaction is usually employed as the time scale. No theory exists as yet which combines quantal fluctuations with stochastic ones. The authors develop a model, appropriate for peripheral collisions, which treats rigorously, at a microscopic level, both quantal and classical contributions to the fluctuation. (13 refs.)

105930 Neutron-proton asymmetry and fast fission: two extreme time evolutions in dissipative heavy ion reactions. C.Ngo (DPh-N/MF, CENS, Gif-sur-Yvette, France).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.185-219
Reviews two different phenomena occurring in dissipative heavy ion collisions: neutron-proton asymmetry and fast fission. The first one is very fast and exhibits quantum fluctuations. The second one is very slow and dominated by statistical fluctuations. A dynamical model treating both these processes is also described. (21 refs.)

105931 Fusion and compound nuclei decay for light and intermediate-mass systems: ^{24}Mg, $^{28}Si+^{12}C$; $^{24}Mg+^{24,26}Mg$; $^{28}Si+^{24}Mg$, $^{28,29,30}Si$. S.Gary, C.Volant (DPh-N/BE, CENS, Gif-sur-Yvette, France).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.327
Astract form only given. Complete fusion or residue distributions have been measured with several experimental techniques for the following systems: ^{24}Mg, $^{28}Si+^{12}C$; $^{24}Mg+^{24,26}Mg$; $^{28}Si+^{24}Mg$, $^{28,29,30}Si$. The range of energies spreads from 1 to 3 times the Coulomb barrier. None of these systems presents structures in its fusion excitation function as pronounced as the ones observed for lighter entrance channels. The intensities of the residue distribution are generally in agreement with the predictions of the multiple deexcitation code CASCADE. The shape and absolute values of complete excitation functions are compared to macroscopic models and to the predictions of a coupled-channel approach of the reaction, which gives a more satisfactory account of experimental data. (no refs.)

105932 Nuclear 'molecular' states. U.Mosel, O.Tanimura, R.Wolf (Inst. fur Theoretische Phys., Univ. Giessen, Giessen, Germany).
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.328-50
In the first part some models for the description of inelastic scattering of light heavy ions are discussed based on a reaction-theoretical approach. In the second part, the structure aspects of a nucleus-nucleus collision are treated based on an analysis of two center correlation diagrams. (34 refs.)

105933 Spectroscopy of superheavy quasimolecules and quasiatoms. U.Muller, N.Aboul-El-Naga, J.Reinhardt, T.de Reus, P.Schluter, M.Seiwert (Inst. fur Theoretische Phys., Johann Wolfgang Goethe-Univ., Frankfurt am Main, Germany), G.Soff, K.H.Wietschorke, B.Muller, W.Greiner.
Heavy-Ion Collisions. Proceedings of the International Summer School, La Rabida, Spain, 7-18 June 1982 (Berlin, Germany: Springer-Verlag 1982), p.388-425
Collisions of very heavy ions at energies close to the Coulomb barrier are discussed as a unique tool to study the behaviour of the electron-positron field in the presence of strong external electromagnetic fields. Theoretical predictions for K-hole production, δ-electron and positron emission rates are compared with experimental results. Emphasize is laid on effects due to nuclear reactions close to the Coulomb barrier. Internal electron-positron pair production from electric monopole transitions is investigated for atoms with charge numbers up to $Z\simeq170$. The effect of field theoretical corrections to the binding energy of the deepest bound state, here the self-energy, is also discussed. (64 refs.)

Heavy-Ion Collisions. Proceedings of the International Summer School ....See Entry 105028

The moment of inertia of ^{130}Ce above spin $30\hbar$ ....See Entry 105718

Probing the nuclear structure with heavy-ion reactions ....See Entry 105725

New directions in studies of nuclei far from stability with heavy ions ....See Entry 105727

Multiple discontinuities of the moment of inertia at high spin ....See Entry 105728

Recent results on nuclei far from stability in the mass region $A\simeq70$ ....See Entry 105729

Are heavy-ion entropy production and nuclear level density discrepancies related? ....See Entry 105730

What do we learn from self-consistent models about nuclear density distributions? ....See Entry 105738

Nuclear level density at high excitation energies ....See Entry 105748

Calculation of effective interactions ....See Entry 105756

Direct proton decay of ^{147}Tm ....See Entry 105799

Remarks on the proximity scaling applied to heavy ion interaction potentials ....See Entry 105801

The excitation and decay of isoscalar giant resonances ....See Entry 105822

Statistical aspects of multistep process in nuclear reactions ..See Entry 105833

Pre-equilibrium processes in nuclear reactions ....See Entry 105834

Polarization phenomena in heavy ion transfer reactions ....See Entry 105837

Strong $E1$ transitions in ^{9}Be, ^{11}Be, and ^{13}C ....See Entry 105878

Energy dependence of fission fragment angular distributions for ^{19}F, ^{24}Mg and ^{28}Si induced reactions on ^{208}Pb ....See Entry 105940

Fusion near and below the barrier for the systems $^{32,34}S+^{24,25,26}Mg$ and $^{32}S+^{27}Al$ ....See Entry 105944

Inelasticity of nucleus-nucleus collisions and composition of high-energy cosmic rays ....See Entry 110834

25.80 MESON- AND HYPERON-INDUCED REACTIONS AND SCATTERING

105934 Systematics of pion double-charge-exchange reactions on $T=0$ nuclei. L.C.Bland, R.Gilman, M.Carchidi, K.Dhuga (Univ. of Pennsylvania, Philadelphia, PA, USA), C.L.Morris, H.T.Fortune, S.J.Greene, P.A.Seidl, C.F.Moore.
Phys. Lett. B (Netherlands), vol.128B, no.3-4, p.157-9 (25 Aug. 1983).
Pion induced double charge exchange on ^{12}C, ^{16}O, ^{24}Mg, ^{28}Si, ^{32}S, and ^{40}Ca exhibits forward-angle cross sections that vary rapidly with pion energy and fall off roughly as $A^{-4/3}$. Angular distributions at 164 MeV appear diffractive for targets of ^{12}C, ^{16}O, and ^{40}Ca. (6 refs.)

105935 Isovector $M2$ state observed in the $^{14}C(\pi^-,\gamma)$ reaction. H.W.Baer (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA), J.A.Bistirlich, K.M.Crowe, W.Dahme, C.Joseph, J.P.Perroud, M.Lebrun, C.J.Martoff, U.Straumann, P.Truol.
Phys. Rev. C (USA), vol.28, no.2, p.761-71 (Aug. 1983).
The photon spectrum of the pion capture reaction $^{14}C(\pi^-,\gamma)^{14}B$ was measured with a resolution of 0.9 MeV full width at half maximum. A single strong transition is observed with γ-ray energy 115.70 ± 0.17 MeV, corresponding to a state in ^{14}B at 2.15 ± 0.17-MeV excitation. Comparisons with previous experiments and theoretical calculations identify this as the second $T=2,2^-$ state in mass-14 nuclei. The single strong transition has a measured branching ratio $(11.1\pm3.0)\times10^{-4}$, which equals one-fifth of the shell-model prediction. The total radiative capture branching ratio is $0.68\pm0.16\%$, which is a factor of 2 to 3 smaller than for other 1-p-shell nuclei. (35 refs.)

105936 K^+ and K^- elastic scattering within the framework of multiple scattering theory. A.Chaumeaux, M.-C.Lamaire (Dept. de Phys. Nucleaire/Moyennes Energies, CENS, Gif-sur-Yvette, France).
Phys. Rev. C (USA), vol.28, no.2, p.772-84 (Aug. 1983).
$^{12}C(K^{\pm},K^{\pm})$ and $^{40}Ca(K^{\pm},K^{\pm})$ 800 MeV/c elastic scattering data are analyzed within the framework of Kerman-McManus-Thaler theory. To that purpose the elementary t matrix is derived directly from the $K^{\pm}N$ experimental observables. The relative sensitivity of K^+, K^-, and 1 GeV protons to the neutron density distribution is investigated. (39 refs.)

105937 Delta-nucleon and pion-nucleus interactions. M.Hirata (Swiss Inst. for Nuclear Res., Villigen, Switzerland), F.Lenz, M.Thies.
Phys. Rev. C (USA), vol.28, no.2, p.785-810 (Aug. 1983).
The effect of the Δ-N interaction in elastic and inelastic pion scattering is discussed. In elastic scattering, the two-body Δ-N interaction generates both Δ self-energy and Δ-h vertex corrections. The relative importance of these two kinds of medium corrections is discussed analytically. Numerical calculations are presented which show in detail the role of the Δ-N interaction in elastic

scattering. In pion-nucleus inelastic scattering, a new reaction mechanism appears due to the two-body nature of the Δ-N interaction. The qualitative characteristics of these processes induced by Δ-N collisions are discussed. Deviations from quasifree isospin ratios in knockout reactions and excitations of specific nuclear levels are signatures of the interference between processes generated by the π-N and Δ-N interaction, respectively. In the formalism presented, the order of magnitude of these modifications can be related to the size of the experimentally observed true pion absorption cross sections. (19 refs.)

105938 On the production of the six-quark H dibaryon in the (K^-,K^+) reaction. A.T.M.Aerts, C.B.Dover (Brookhaven Nat. Lab., Upton, NY, USA).
Phys. Rev. D (USA), vol.28, no.3, p.450-63 (1 Aug. 1983).
The authors investigate several ways of producing the stable doubly strange six-quark dibaryon H predicted by the MIT bag model. Various kinematical and dynamical arguments indicate that the (K^-,K^+) double-strangeness-exchange reaction on nuclear targets affords the best chance for observing the H. Cross sections for the prototype reaction $^3He(K^-,K^+n)H$ are calculated, using empirical data on the reaction $K^-p \rightarrow K^+\Xi^-$ as input, as well as an oscillator model for the quark-fusion process $\Xi^-p \rightarrow H$. The spectrum for the quasielastic process $^3He(K^-,K^+)n\Xi^-p$ is also calculated. For coincidence experiments involving both K^+ and neutron detection at forward angles, the cross section for H production ranges from 10-30 nb/sr^2 for K^- beam momenta between 1.4 and 2.2 GeV/c. If the H lies below the $\Lambda\Lambda$ threshold, it can be nicely separated from the K^+ quasielastic background, although π^+'s misidentified as K^+'s can be a problem for certain H masses. If only the K^+ is detected, the separation of the H signal ($\approx$0.5 μb/sr) from the quasielastic background can be achieved through a careful measurement of the K^+ momentum spectrum. They assess the effects on their results of the rapid momentum dependence in the $K^-p \rightarrow K^+\Xi^-$ reaction, as well as short-range correlations in the ^{3}He wave function. (35 refs.)

Relation between coherent π^0 photoproduction and π-nucleus elastic scattering .... See Entry 105841

Target nucleus excitation dependence of correlation in the multiple production on nuclei at 400 GeV and the additive quark model .... See Entry 105847

25.85 FISSION REACTIONS

105939 Delayed neutron yield and decay constants for thermal neutron-induced fission of ^{235}U. S.Synetos (Imperial Coll. of Sci. & Technol., London, England), J.G.Williams.
Nucl. Energy (GB), vol.22, no.4, p.267-74 (Aug. 1983).
Delayed neutron yield and decay constants were measured using foils of ^{235}U irradiated in a thermal column of the University of London Reactor. After each irradiation the delayed neutron emission rate was measured in a detector consisting of a water bath containing BF_3 counters. The number of fissions in the foils was measured using a gamma spectrometer to determine their ^{140}La activity, relative to that of calibration foils irradiated in an absolute fission chamber. The measured delayed neutron decay curve was fitted to the sum of five exponential groups by the least squares method. The total yield of the five groups was 0.0151±0.0007 delayed neutrons per fission. When the six group parameters of Keepin and Wimett (1965) were used together with the total counts observed in this experiment the total yield found for the six groups was 0.0156±0.0010, where the difference from the previous value is attributable to the presence of the sixth group. The period-reactivity relationship was calculated for positive periods between 0.2 and 900 s using both the five-group data and the six-group data. (16 refs.)

105940 Energy dependence of fission fragment angular distributions for ^{19}F, ^{24}Mg and ^{28}Si induced reactions on ^{208}Pb. M.B.Tsang, H.Utsunomiya, C.K.Gelbke, W.G.Lynch (Nat. Superconducting Cyclotron Lab., Michigan State Univ., East Lansing, MI, USA), B.B.Back, S.Saini, P.A.Baisden, M.A.McMahan.
Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.18-22 (15 Sept. 1983).
The energy dependence of fission fragment angular distributions was measured for reactions induced by ^{19}F, ^{24}Mg, and ^{28}Si on ^{208}Pb over the range of incident energies of E/A=5.6-10 MeV. For all three systems the angular distributions are inconsistent with the saddle point deformations of the rotating liquid drop model. (14 refs.)

Time dependent Hartree-Fock and beyond .... See Entry 105774

The excitation and decay of isoscalar giant resonances .... See Entry 105822

Fission following capture reactions of ^{32}S+^{208}Pb .... See Entry 105916

Neutron-proton asymmetry and fast fission: two extreme time evolutions in dissipative heavy ion reactions .... See Entry 105930

Evaluation of computational models for fission and spallation reactions used in accelerator breeding and transmutation analysis code .... See Entry 106073

Neutronic evaluations of activations in graphite-thorium assemblies, 14 MeV neutron sources: Comparisons with measurements .... See Entry 106171

25.88 FUSION REACTIONS

105941 Emission of high-energy charged particles in incomplete-fusion reactions. C.V.Christov, I.I.Delchev, I.J.Petkov (Inst. of Nuclear Res. & Energy, Bulgarian Acad. of Sci., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.5, p.603-6 (1983).
The authors consider the emission of high-energy α-particles within the framework of a model based on a simple quantum mechanical approach to the transfer process in which, however, the fusion process is included as an essential stage. They analyse reactions of the type $A+B \rightarrow \alpha+(x+B)$ where an α-particle is emitted from the projectile A and the fragment $_x$ fuses into the target B. The physical picture they accept supposes the formation of a $x-B$ nuclear quasimolecule in accordance with a complete-fusion model. (8 refs.)

105942 Rate of nuclear fusion reaction in a magnetoplasma. O.Aono (Dept. of Phys., Jichi Medical School, Yakushiji, Tochigi, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2610 (July 1983).
A recent paper by S. Imazu (see ibid., vol.51, p.2999, 1982) shows that the rate of nuclear fusion reaction in a magnetoplasma decreases as the field increases. However, a more careful treatment reveals the reaction rate to be independent of the magnetic field. (1 ref.)

105943 Reply to the comment 'Rate of nuclear fusion reaction in a magnetoplasma'. S.Imazu (Dept. of Electrical Engng., Technol. Univ. of Nagaoka, Niigata, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2611 (July 1983).
For comment see ibid., vol.52, p.2610 (1983). The author states that when the direction of the relative velocity of particles changes with the time t, the effect of the magnetic field on the number of collisions appears for $\omega t > 1$. (no refs.)

105944 Fusion near and below the barrier for the systems ^{32,34}S+^{24,25,26}Mg and ^{32}S+^{27}Al. G.M.Berkowitz, P.Braun-Munzinger, J.S.Karp, R.H.Friefelder, T.R.Renner, H.W.Wilschut (Dept. of Phys., State Univ. of New York, Stony Brook, NY, USA).
Phys. Rev. C (USA), vol.28, no.2, p.667-78 (Aug. 1983).
Excitation functions are reported for total fusion near and below the Coulomb barrier of the systems ^{32,34}S+^{24,25,26}Mg and ^{27}Al. The data cannot be reproduced by one-dimensional barrier penetration calculations. The enhancement of the cross sections at low energies is compared to predictions of models taking into account the static deformation or zero point vibration of the reaction partners. Calculations including zero point motion do not reproduce the observed variations of the measured cross sections with respect to the neutron number of target and projectile. Reasonable agreement is obtained when calculating fusion between statically deformed nuclei. Finally, the fusion process is described in a quantum mechanical coupled channels model, indicating the importance of dynamical effect on sub-barrier fusion. (21 refs.)

New directions in studies of nuclei far from stability with heavy ions .... See Entry 105727

Multiple discontinuities of the moment of inertia at high spin .... See Entry 105728

Nuclear level density at high excitation energies .... See Entry 105748

Time dependent Hartree-Fock and beyond .... See Entry 105774

Direct and direct-fusion reaction approach to continuum spectra of nuclear reactions .... See Entry 105826

Breakup process for the 100 MeV ^{3}He interacting with the ^{165}Ho and ^{166,167}Er nuclei .... See Entry 105888

Symmetrical fusion of heavy ions around the Coulomb barrier energy .... See Entry 105894

Channel-coupling effects in heavy-ion fusion reactions .... See Entry 105897

Charged particle production in peripheral reactions induced by 118 MeV ^{12}C ions on ^{118}Sn .... See Entry 105906

Different regimes of dissipative collisions .... See Entry 105928

Fusion and compound nuclei decay for light and intermediate-mass systems: ^{24}Mg, ^{28}Si+^{12}C; ^{24}Mg+^{24,26}Mg; ^{28}Si+^{24}Mg, ^{28,29,30}Si .... See Entry 105931

25.90 OTHER TOPICS IN NUCLEAR REACTIONS AND SCATTERING: SPECIFIC REACTIONS

Interaction with a large multiplicity registered in photoemulsion .... See Entry 110833

27.00 PROPERTIES OF SPECIFIC NUCLEI LISTED BY MASS RANGES

27.10 A ≤ 5

Structures revealed in the neutron-proton mass spectrum in the deuteron break-up reaction .... See Entry 105662

Properties of the three-nucleon bound states with virtual Δ-isobar excitation .... See Entry 105735

Exchange-current contributions to the ^{3}He magnetic properties .... See Entry 105741

The four-nucleon problem with local realistic NN interactions .... See Entry 105745

The deuteron asymptotic D-state as a probe of the nucleon-nucleon force .... See Entry 105749

Reduced nuclear amplitudes in quantum chromodynamics ...... See Entry 105804

Second-order terms in the ^{3}He-nucleus folding model .... See Entry 105808

High-momentum-transfer processes with polarized deuterons .... See Entry 105835

The rate of the $^3He(p,e^+\nu)^4He$ reaction .... See Entry 105839

Excitation of the quasi-bound state in ^{4}He by electron scattering at medium momentum transfer .... See Entry 105842

Differential muon-capture rate and the deuterium form factors in the timelike region .... See Entry 105845

Optical model analysis of intermediate energy p-^{4}He scattering .... See Entry 105850

Effects of the ^{3}He D state in the reaction $^2H(p,\gamma)^3He$ .... See Entry 105854

Absolute cross section for the reaction $^3H(p,\gamma_0)^4He$ and a review of $^4He(\gamma,p_0)^3H$ measurements .... See Entry 105857

Mesonic exchange currents and radiative thermal neutron capture by the deuteron .... See Entry 105859

Sensitivity of N-d polarization observables on the off-shell behaviour of the N-N interaction .... See Entry 105860

Breakup reaction of ^{3}He with protons at 65 MeV .... See Entry 105872

Strong E1 transitions in ^{9}Be, ^{11}Be, and ^{13}C .... See Entry 105878

On the production of the six-quark H dibaryon in the (K^-,K^+) reaction .... See Entry 105938

27.20 6 ≤ A ≤ 19

A semimicroscopic model of nuclear vibrations with separable forces and the giant dipole resonance of ^{12}C .... See Entry 105711

Molecular orbital model study of the $_{\Lambda}^{9}$Be, $_{\Lambda\Lambda}^{10}$Be, $_{3\Lambda}^{11}$Be and $_{4\Lambda}^{12}$Be hypernuclei .... See Entry 105783

Structure of the $_{\Lambda\Lambda}^{10}$Be hypernucleus .... See Entry 105784

On a combined model of direct and compound-resonant nuclear reactions .... See Entry 105805

Polarization phenomena in heavy ion transfer reactions .... See Entry 105837

Relation between coherent π^0 photoproduction and π-nucleus elastic scattering .... See Entry 105841

Inelastic electron scattering from ^{9}Be .... See Entry 105843

Electron scattering at 180° from the 'single-hole' states in ^{15}N .... See Entry 105844

Large-angle proton emission in the ^{9}Be(p,2p) reaction at 300 MeV .... See Entry 105851

An interference effect in the channel radiative neutron capture process .... See Entry 105853

Study of the 18.30 and 19.40 MeV states in ^{12}C in intermediate energy proton scattering .... See Entry 105856

Double differential inclusive hydrogen and helium spectra from neutron-induced reactions on carbon at 27.4, 39.7, and 60.7 MeV .... See Entry 105858

Measurement of the electron capture branching ratio of ^{7}Be .... See Entry 105865

Analysing power-polarization inequality in the inelastic scattering of protons on ^{12}C for incident energies from 22.0 to 29.0 MeV. In beam proton-gamma ray coincidence studies using polarized beam .... See Entry 105867

Strong $E1$ transitions in ^{9}Be, ^{11}Be, and ^{13}C .... See Entry 105878

Nuclear moments of ^{9}Li .... See Entry 105881

Coupled-channel effects in elastic ^{12}C-^{12}C scattering at 1016 MeV .... See Entry 105892

Origin of the molecular-resonance-like structures in the ^{12}C(^{16}O,α) reaction studied by an alpha-HI correlation measurement .... See Entry 105893

Spectroscopy of $A=16$ from ^{13}C(^{6}Li,t)^{16}O .... See Entry 105896

Contribution of two-step processes to the elastic scattering of ^{9}Be on ^{12}C .... See Entry 105900

Nature of molecular resonances and background in the ^{16}O+^{12}C system .... See Entry 105902

Refractive effects in ^{9}Be scattering and nuclear rainbow ghosts .... See Entry 105903

Excitation of ^{17}O and ^{18}O scattered by ^{208}Pb in the Coulomb-nuclear interference region .... See Entry 105904

Reaction cross sections for ^{14}N+^{10}B .... See Entry 105909

Energy dependence of ^{9}Be+^{12}C cross sections: nonstatistical component of the mean cross section .... See Entry 105910

Elastic scattering of ^{16}O by ^{28}Si .... See Entry 105913

Intermediate-structure resonances in the ^{16}O+^{16}O total reaction cross section .... See Entry 105914

Breakup effects of ^{7}Li on the elastic and inelastic scatterings .... See Entry 105919

^{12}C$\rightarrow 3\alpha$ breakup effect on ^{12}C+^{12}C scattering at $E_{LAB}=140\sim300$ MeV studied by microscopic coupled channels methods .... See Entry 105920

Potential model description of heavy ion scattering using spline techniques .... See Entry 105926

Fusion and compound nuclei decay for light and intermediate-mass systems: ^{24}Mg, ^{28}Si+^{12}C; ^{24}Mg+^{24,26}Mg; ^{28}Si+^{24}Mg, ^{28,29,30}Si .... See Entry 105931

Systematics of pion double-charge-exchange reactions on $T=0$ nuclei .... See Entry 105934

Isovector $M2$ state observed in the ^{14}C(π^{-},γ) reaction .... See Entry 105935

K^{+} and K^{-} elastic scattering within the framework of multiple scattering theory .... See Entry 105936

27.30 $20 \leq A \leq 38$

Excitation modes of the γ-band in ^{24}Mg through the ^{24}Mg($\vec{p}$,p′) reaction .... See Entry 105721

Analysis of the ^{28}Si(p, γ)^{29}P reaction data in the region of the subbarrier single particle resonances .... See Entry 105810

Proton strength functions in the mass region of 30 to 70 .... See Entry 105821

^{24}Mg($\vec{p}$,d) reaction at 65 and 80 MeV .... See Entry 105836

A semimicroscopic calculation of the photodisintegration of the ^{32}S nucleus .... See Entry 105840

Relation between coherent π^{0} photoproduction and π-nucleus elastic scattering .... See Entry 105841

Coupled channel effects in ^{26}Mg(p,p′) at 40 MeV .... See Entry 105861

The doorway to the continuum: quasifree nucleon-nucleon interactions .... See Entry 105873

Ground state transitions in (d,^{6}Li) reactions on sd-shell nuclei .... See Entry 105883

High energy (^{3}He,d) proton stripping by ^{27}Al and ^{28}Si nuclei: Transitions to excited states .... See Entry 105885

Single particle strengths in A=28 nuclei via (α,t) and (α,^{3}He) reactions .... See Entry 105887

Analysis of the statistical S matrix generated in fitting ^{16}O+^{28}Si elastic scattering .... See Entry 105891

Large-angle ^{6}Li+^{28}Si elastic and inelastic scattering at 27 and 34 MeV .... See Entry 105899

Total inclusive neutron cross sections and multiplicities in nucleus-nucleus collisions at intermediate energies .... See Entry 105911

Potential model description of heavy ion scattering using spline techniques .... See Entry 105926

Fusion and compound nuclei decay for light and intermediate-mass systems: ^{24}Mg, ^{28}Si+^{12}C; ^{24}Mg+^{24,26}Mg; ^{28}Si+^{24}Mg, ^{28,29,30}Si .... See Entry 105931

Systematics of pion double-charge-exchange reactions on $T=0$ nuclei .... See Entry 105934

Fusion near and below the barrier for the systems ^{32,34}S+^{24,25,26}Mg and ^{32}S+^{27}Al .... See Entry 105944

Neutronic evaluations of activations in graphite-thorium assemblies, 14 MeV neutron sources: Comparisons with measurements .... See Entry 106171

27.40 $39 \leq A \leq 58$

Study of the lepton-violating (μ^{-},e^{+}) reaction in modern gauge theories .... See Entry 105455

Light nuclei far from stability .... See Entry 105787

The distribution of the low-energy octupole strength in ^{48}Ca, ^{90}Zr and ^{208}Pb .... See Entry 105817

Proton strength functions in the mass region of 30 to 70 .... See Entry 105821

Knock-out effects in (p,p′) reactions .... See Entry 105825

Relation between coherent π^{0} photoproduction and π-nucleus elastic scattering .... See Entry 105841

Response functions for deep inelastic scattering from ^{40}Ca .... See Entry 105846

Resonance averaged channel radiative neutron capture cross sections .... See Entry 105852

Parity violation in nucleon-nucleus elastic scattering within a phenomenological single particle model .... See Entry 105864

The doorway to the continuum: quasifree nucleon-nucleon interactions .... See Entry 105873

Ground state transitions in (d,^{6}Li) reactions on sd-shell nuclei .... See Entry 105883

Study of ^{46,48}Ca(α,p) reactions .... See Entry 105884

A model for alpha particle induced reactions .... See Entry 105890

The (^{14}C,^{14}O)reaction considered as simultaneous pair-exchange or double-charge-exchange processes .... See Entry 105895

The absolute normalization of three-nucleon transfer reactions .... See Entry 105905

^{12}C on ^{48}Ca transfer reactions: a test of the effective Q-value model .... See Entry 105912

Tensor interactions and projectile excitations in the scattering of ^{7}Li by ^{58}Ni .... See Entry 105917

Sequential projectile-breakup process in ^{20}Ne induced reactions at 92, 149 and 213 MeV .... See Entry 105921

Potential model description of heavy ion scattering using spline techniques .... See Entry 105926

Systematics of pion double-charge-exchange reactions on $T=0$ nuclei .... See Entry 105934

27.50 $59 \leq A \leq 89$

$(f_{7/2})_{7,0}{}^{-2}$ configuration high-spin states in ^{60}Co strongly excited in the ^{62}Ni(d,α) reaction .... See Entry 105713

Proton inelastic scattering by the even-Ge isotopes at $E_p=22$ MeV .... See Entry 105722

Sum-rule strengths of low-lying 4^{+} levels in $^{74-82}$Se nuclei .... See Entry 105723

Multiple discontinuities of the moment of inertia at high spin .... See Entry 105728

Recent results on nuclei far from stability in the mass region $A\simeq70$ .... See Entry 105729

Strong effect of the sign of the hexadecapole moment on the polarized-proton inelastic scattering to the 4_1^{+} states in the even $^{74-82}$Se .... See Entry 105742

Overlapping β decay and resonance neutron spectroscopy of levels in ^{87}Kr .... See Entry 105747

Effective coupling constants for spin-flip and non spin-flip E1 transitions in $A\sim90$ nuclei .... See Entry 105811

Proton strength functions in the mass region of 30 to 70 .... See Entry 105821

$1f_{7/2}$ neutron hole strength in ^{59}Ni with the ^{60}Ni($\vec{p}$,d)^{59}Ni reaction at 94 MeV .... See Entry 105863

Non-direct transitions in transfer reactions and spectroscopy .... See Entry 105870

^{79}As via proton pickup .... See Entry 105880

A model for alpha particle induced reactions .... See Entry 105890

Onset of damping in energetic heavy-ion interactions .... See Entry 105901

Neutronic evaluations of activations in graphite-thorium assemblies, 14 MeV neutron sources: Comparisons with measurements .... See Entry 106171

27.60 $90 \leq A \leq 149$

Rotational structure and Nilsson orbitals for highly deformed odd-A nuclei in the $A\sim100$ region .... See Entry 105716

The moment of inertia of ^{130}Ce above spin 30ħ .... See Entry 105718

Excitations of the states of ^{107,109}Cd from the (p,nγ) reaction on silver isotopes .... See Entry 105743

Energy levels in ^{93}Mo populated by the ^{93}Nb(p,nγ) reaction .... See Entry 105744

Neutrinoless double electron capture as a tool to measure the electron neutrino mass .... See Entry 105789

K-capture probabilities in the decay of ^{133}Ba .... See Entry 105790

Nuclear matrix elements governing the 809 keV first-forbidden beta transition in the decay of ^{147} Nd .... See Entry 105794

Direct proton decay of ^{147}Tm .... See Entry 105799

Proton spin-orbit splittings in the continuum .... See Entry 105812

The distribution of the low-energy octupole strength in ^{48}Ca, ^{90}Zr and ^{208}Pb .... See Entry 105817

Low energy octupole resonance in deformed nuclei .... See Entry 105818

Study of the (^{3}He,t) reaction on heavy nuclei .... See Entry 105820

Deuteron D-state effects on the vector polarization observables in (d,p) reactions at 55.4 MeV .... See Entry 105824

High-resolution investigation of the ^{116}Sn(p,p′) reaction .... See Entry 105849

Resonance averaged channel radiative neutron capture cross sections .... See Entry 105852

Evidence of energy dependence in proton-neutron effective interaction for ^{90}Zr(p,d)^{89}Zr reactions at energies from 20 MeV to 120 MeV .... See Entry 105855

Angle-energy correlated model of preequilibrium angular distributions .... See Entry 105862

Proton scattering in the interacting boson model .... See Entry 105868

The doorway to the continuum: quasifree nucleon-nucleon interactions .... See Entry 105873

Vector analyzing powers for valence and inner shell pickup in the ^{116}Sn($\vec{d}$,t)^{115}Sn and ^{116}Sn($\vec{d}$,^{3}He)^{115}In reactions .... See Entry 105876

Proton hole states in ^{95}Y and ^{95,97,99}Nb .... See Entry 105879

Resonant and nonresonant particle decay following α-bombardment on medium heavy nuclei .... See Entry 105889

A model for alpha particle induced reactions ....See Entry 105890

Charged particle production in peripheral reactions induced by 118 MeV ^{12}C ions on ^{118}Sn ....See Entry 105906

Light particle emission in the reaction of ^{93}Nb+^{14}N at 132, 159 and 208 MeV ....See Entry 105925

Migration of cesium-137 through sandy soil layer; effect of fine silt on migration ....See Entry 105962

Neutronic evaluations of activations in graphite-thorium assemblies, 14 MeV neutron sources: Comparisons with measurements ....See Entry 106171

27.70 150 ≤ A ≤ 189

Retarded dissipation of the Z=64 shell gap in $_{66}{}^{160}$Dy$_{94}$ ....See Entry 105709

Neutron and proton alignment at high spin in ^{168}W ....See Entry 105712

Anharmonicities of gamma vibration in ^{168}Er ....See Entry 105720

Multiple discontinuities of the moment of inertia at high spin ....See Entry 105728

The decay of ^{153}Tb oriented in a gadolinium host ....See Entry 105788

Decay of mass-separated ^{187}Au (8.4 min) to ^{187}Pt ....See Entry 105792

Ultralow-energy *K*-capture decay of ^{158}Tb: a new neutrino 'balance' ....See Entry 105793

Low energy octupole resonance in deformed nuclei ....See Entry 105818

Study of the low-energy neutron inelastic scattering in deformed transitional nuclei: ^{186}W ....See Entry 105848

Breakup process for the 100 MeV ^{3}He interacting with the ^{165}Ho and ^{166,167}Er nuclei ....See Entry 105888

Resonant and nonresonant particle decay following α-bombardment on medium heavy nuclei ....See Entry 105889

Neutronic evaluations of activations in graphite-thorium assemblies, 14 MeV neutron sources: Comparisons with measurements ....See Entry 106171

Slow neutron capture origin for ^{180}Ta^m ....See Entry 110898

27.80 190 ≤ A ≤ 219

Microscopic calculation of dynamical effects: the energy dependence of nucleon self-energies in ^{208}Pb ....See Entry 105714

Molecular alpha-particle clustering in ^{218}Ra; dipole collectivity in the vicinity of nuclear shell closures ....See Entry 105715

Transition charge and current densities of collective isoscalar quadrupole states in ^{208}Pb ....See Entry 105717

The nuclear magnetic moment of ^{190}Ir and the directional distribution of gamma rays in ^{190}Os ....See Entry 105740

The spectroscopic study of ^{206,204}Pb with the (α,^{6}He) reaction ....See Entry 105786

Proton spin-orbit splittings in the continuum ....See Entry 105812

The distribution of the low-energy octupole strength in ^{48}Ca, ^{90}Zr and ^{208}Pb ....See Entry 105817

Hexadecapole component in giant quadrupole resonance region of ^{208}Pb ....See Entry 105819

Study of the (^{3}He,t) reaction on heavy nuclei ....See Entry 105820

Extended study of (p-d-t) process in the (p,t) reactions including the unbound state channels ....See Entry 105871

The doorway to the continuum: quasifree nucleon-nucleon interactions ....See Entry 105873

Precise determination of two-step contributions in (d,α) reaction by using vector and tensor analyzing powers for the ^{208}Pb(d,α)^{206}Tl(g.s;0$^-$) reaction ....See Entry 105882

Neutron-multiplicity distributions for (α,xnγ) reactions with E_α=50-120 MeV and the pre-equilibrium neutron deexcitation processes ....See Entry 105886

The (^{14}C,^{14}O)reaction considered as simultaneous pair-exchange or double-charge-exchange processes ....See Entry 105895

Mechanism of neon-induced reactions studied between 7.5 and 20 MeV/nucleon: inclusive cross sections ....See Entry 105898

Fission following capture reactions of ^{32}S+^{208}Pb ....See Entry 105916

Two-step contributions and non-orthogonality effects in deuteron and ^{17}O reactions on lead ....See Entry 105918

Sequential projectile-breakup process in ^{20}Ne induced reactions at 92, 149 and 213 MeV ....See Entry 105921

Energy dependence of fission fragment angular distributions for ^{19}F, ^{24}Mg and ^{28}Si induced reactions on ^{208}Pb ....See Entry 105940

Evaluation of computational models for fission and spallation reactions used in accelerator breeding and transmutation analysis code ....See Entry 106073

27.90 220 ≤ A

Ground state properties of actinide nuclei ....See Entry 105731

Equilibrium deformations for the Ra-Th region of nuclei ....See Entry 105734

A new excited level in Th-229 at 582.1±1 keV ....See Entry 105785

The excitation and decay of isoscalar giant resonances ....See Entry 105822

Spectroscopy of superheavy quasimolecules and quasiatoms ....See Entry 105933

Delayed neutron yield and decay constants for thermal neutron-induced fission of ^{235}U ....See Entry 105939

Numerical model of radionuclide migration in geologic media ....See Entry 105961

Theoretical analysis of ternary UF$_6$ gas isotope separation by centrifuge ....See Entry 106072

Evaluation of computational models for fission and spallation reactions used in accelerator breeding and transmutation analysis code ....See Entry 106073

Neutronic evaluations of activations in graphite-thorium assemblies, 14 MeV neutron sources: Comparisons with measurements ....See Entry 106171

28.00 NUCLEAR ENGINEERING AND NUCLEAR POWER STUDIES

(see also 86.10 Energy resources and their utilisation)

105945 Finding the flaws in nuclear power plants. E.Herbert.
IEEE Spectrum (USA), vol.19, no.9, p.56-61 (Sept. 1982).
Research and development sponsored by the Electric Power Research Institute in Palo Alto, California, has led to new nondestructive evaluation techniques. These include: a high-energy, portable X-ray system for ensuring the integrity of thick metal reactor vessels and coolant pumps, ultrasonic methods to enable reliable detection and characterization of corrosion-induced cracks in pipes, advanced eddy-current inspection equipment for steam generator tubing and automated inspection and evaluation systems capable of reducing plant downtime. (no refs.)

28.20 NEUTRON PHYSICS

(see also 25.40 Nucleon-induced reactions and scattering)

105946 Cross-sections of materials used as neutron monochromators and filters. A.K.Freund (Inst. Max von Laue-Paul Langevin, Grenoble, France).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.2-3, p.495-501 (1 Aug. 1983).
Transmission properties of several materials important for neutron scattering instrumentation are presented. A semi-empirical formula is given which permits to calculate the thermal diffuse scattering cross-section as a function of materials constants temperature and neutron energy, E, in the range $10^{-5}<E<10$ eV. (22 refs.)

Optimal flux distribution in slab reactors with a uniform external source ....See Entry 105947

MORSE-E1, source and analysis routines to be used with the MORSE code ....See Entry 105952

Effect of Fe-56 anisotropic scattering on neutron penetration ....See Entry 106175

28.41 FISSION REACTOR THEORY AND DESIGN

105947 Optimal flux distribution in slab reactors with a uniform external source. J.Vitela E., A.Z.Akcasu (Dept. of Nuclear Engng., Univ. of Michigan, Ann Arbor, MI, USA).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.5, p.359-65 (May 1983).
The problem of optimal flux distribution for maximum power in bare slab reactors with a uniform external source and maximum flux constraint, is solved using an optimal control formalism for the case of the one group neutron diffusion approximation. A set of optimal solutions, which depend on the magnitude of the external source, the upper and lower limit of the control variable and the maximum flux allowable in the reactor, is obtained. The results corresponding to a critical reactor are included here, as a particular case. A numerical example is used to illustrate the parametric dependence of the solutions. (4 refs.)

105948 Extension of fission product model for use in lattice calculation of thorium fueled BWR. T.Yamamoto, T.Takeda (Dept. of Nuclear Engng., Osaka Univ., Suita, Japan), T.Yoshida, S.Iijima.
J. Nucl. Sci. & Technol. (Japan), vol.20, no.6, p.523-5 (June 1983).
The authors apply the fission product model for BWR lattice calculations to a Th fueled BWR, and discuss its applicability. (5 refs.)

105949 A fuel-ringed external irradiation cavity for the annular core research reactor. J.A.Reuscher, T.F.Luera (Sandia Nat. Lab., Albuquerque, NM, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.12-14 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
The annular core research reactor (ACRR) consists of a water-moderated core of 236 uniquely designed BeO-UO$_2$ fuel elements arranged in a hexagonal grid around a 22.8-cm-diam, dry, irradiation cavity. The reactor is utilized for a wide variety of radiation effects and advanced reactor safety research programs. The flexible reactor control system can be programmed to provide a variety of operating modes, including single pulses, multiple pulses, square wave, ramp, steady state, or a combination of these modes. Experiments with a diameter >22.8 cm have required the installation of a 38-cm-diam. external cavity adjacent to the core to achieve the proper fluence-volume capability. An initial external cavity without surrounding fuel was installed and used for experiments; however, the fluence distribution across this cavity had neither sufficient magnitude nor uniformity, so another cavity with a surrounding neutron multiplier was designed and fabricated. This paper describes the design and performance characteristics of the ACRR fuel-ringed external cavity (FREC). (1 ref.)

105950 Calculational procedures used to extend MITR-II fuel burnup. J.Bernard, K.Kwok, D.Lanning, L.Clark (MIT, Cambridge, MA, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.14-15 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
This paper describes calculational and experimental methods developed to extend fuel burnup at the Massachusetts Institute of Technology's 5-MW(th) research reactor, MITR-II. This report complements an earlier one which discussed element rotation and inversion as a means of increasing fuel depletion. (4 refs.)

105951 CORE-MASTER—the ASEA-ATOM boiling water reactor core analysis system. S.-O.Lindahl (AB ASEA-ATOM, Vasteras, Sweden).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.87-8 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
To provide power utilities with independent capability to perform extensive on-line and off-line core calculations in support of reactor operation and for in-core fuel management (ICFM), an integral program package has been designed. It is based on codes that have long been applied in core design and tracking. The program system, termed CORE-MASTER, is implementable on a variety of powerful minicomputers. The on-line core surveillance mode is directed toward the reactor operator for enabling flexible and safe operation, while the off-line use is intended for the nuclear engineering personnel for day-to-day operations analysis and optimization of fuel usage. (4 refs.)

105952 MORSE-E1, source and analysis routines to be used with the MORSE code. C.Ponti, R.Van Heusden.
Report EUR 8420 EN, Comm. European Communities, Luxembourg (1983), 9 pp.
Describes the content and the use of a set of source and analysis routines to be used with the MORSE code. Uniformly distributed sources within simple geometrical shapes are implemented in the package. It calculates the flux of particles as the sum of the path travelled within a given volume; the corresponding relative errors are also provided. Particle currents through surfaces may also be computed. The MORSE-E1 package enables the user to solve many problems without further programming work. (4 refs.)

105953 EURDYN: Computer programs for the nonlinear transient analysis of structures submitted to dynamic loading. EURDYN (Release 3): Users' manual. J.P.Halleux.
Report EUR 8357 EN, Comm. European Communities, Luxembourg (1983), 152 pp.
A user manual for the EURDYN-3 computer code for nonlinear analysing of structures under dynamic loading is presented.

105954 TPLOT: An interactive time plot system for transient structural problems. J.P.Halleux.
Report EUR 8391 EN, Comm. European Communities, Luxembourg (1983), 42 pp.
Efficient use of modern computer programs (finite element or finite difference) for structural analysis requires availability of powerful pre- and post-processing capabilities. Plotting facilities are needed as well in the input phase for verifying the mesh f.i., as in the output phase for analysing the results (deformed shapes, isocurves, strain and stress profiles). In dynamic problems there is a further interest in obtaining time plots, i.e. visual representation of the variation of a local quantity in time. The present report describes the use of a time plot system TPLOT available for interactive post-processing of EURDYN 01, 02, 03, EURDYN-1M, SEURBNUK-2, ASTARTE and experimental results of the COVA tests (PLURIMAT-S and HP-1000). (8 refs.)

105955 MUP, CEC-DES, STRADE. Codes for uncertainty propagation, experimental design and stratified random sampling techniques. A.Amendola, M.Astolfi, B.Lisanti.
Report EUR 8244 EN, Comm. European Communities, Luxembourg (1983), 115 pp.
The report describes how to use the codes: MUP (Monte Carlo Uncertainty Propagation) for uncertainty analysis by Monte Carlo simulation, including correlation analysis, extreme value identification and study of selected ranges of the variable space; CEC-DES (Central Composite Design) for building experimental matrices according to the requirements of Central Composite and Factorial Experimental Designs; and STRADE (Stratified Random Design) for experimental designs based on the Latin Hypercube Sampling Techniques. Application fields of the codes are probabilistic risk assessment, experimental design, sensitivity analysis and system identification problems. (13 refs.)

105956 Modeling of natural circulation phenomena in nuclear reactor cooling loops. Y.Zvirin, Y.Rabinoviz.
Report EPRI-NP-2951, Electr. Power Res. Inst., Palo Alto, CA, USA (March 1983), 148 pp.
Available from Res. Rep. Center (RRC), Box 50490, Palo Alto, CA 94303, USA.
This report discusses the development of a steady-state and transient computer code to analyze single-phase natural circulation in multiple-loop PWRs with either U-tube or once-through steam generators. The code is compared with experimental data. In addition, the results of applying the code to sensitivity studies of the major parameters involved are presented.

Design, installation, and use of experimental facilities at the Texas A&M University Nuclear Science Center .... See Entry 106087

Evaluation of primary feed-and-bleed cooling capability of pressurized water reactor systems .... See Entry 106102

Use of a heat transfer coefficient for describing the radiative exchange between water vapour and the bounding walls .... See Entry 106106

Evaluation of statistical reliability measures for a program for the limitation of power density in a reactor vessel .... See Entry 106112

Quantification of the contribution of light water reactor core melt frequency of loss of offsite power .... See Entry 106113

Melting and cladding motion in a cylindrical vertical channel with a gaseous counterflow .... See Entry 106116

Prediction of critical heat flux in flow boiling at low qualities .... See Entry 106117

Starting on a new phase at Loft .... See Entry 106125

Criteria for determining the duration of containment integrated leakage rate tests .... See Entry 106127

SEP operating history review of the Millstone Unit 1 nuclear power plant .... See Entry 106135

Characterization of the pressure wave originating in the explosion of an extended heavy gas cloud: Critical analysis of the treatment of its propagation in air and interaction with obstacles .... See Entry 106146

Scale model tests of turbine missile containment by reinforced concrete .... See Entry 106152

28.42 FISSION REACTOR MATERIALS

105957 Experience with the construction of a reactor safety containment using 15 MnNi 63. W.Backfisch, W.Clauss, E.Dittemer, E.Klaiber (Technischer Uberwachungs-Verein EV, Mannheim, Germany).
VGB Kraftwerkstech. (German Ed.) (Germany), vol.63, no.6, p.532-7 (June 1983). In German.
As an introduction the design criteria and the licensing and technical regulatory constraints are considered. Because of the principal requirement—high material toughness in all conditions of stress or operation—the low alloy stee, 15 MnNi 63 with a minimum yield strength of 370 N/mm^2 has been used as a material for a reactor safety containment. No suspect circumstances arose during the manufacture of the containment. Subsequent pressure and leak-proof testing proceeded without problems. The expansion measurements carried out during this also produced no unacceptable local plastifications even at points of high stress. (5 refs.)

105958 Modelling the effect of diffusion into the rock matrix on radionuclide migration. D.A.Lever, M.H.Bradbury, S.J.Hemingway (Theoretical Phys. & Chem. Technol. Div., AERE, Harwell, England).
Prog. Nucl. Energy (GB), vol.12, no.1, p.85-117 (1983).
Diffusion into the rock matrix is potentially an important retardation mechanism for nuclides leached from an underground radioactive waste repository in a fractured hard rock. Models of this diffusion process are discussed and incorporated into three-dimensional radionuclide migration models. Simple solutions to these models are derived for two regions: the region near to the repository where the nuclide is diffusing into effectively infinite rock, and that much further downstream where the concentrations in the rock and fractures are almost in equilibrium. These solutions are used to evaluate the possible impact on migration. It is shown that retardation factors in excess of 100 and reductions in the peak concentration at a given point on the flow path by three or four orders of magnitude are possible for non-sorbed ions, which would otherwise be carried by the flow and not retarded at all. (46 refs.)

105959 Application of ion implantation and backscattering techniques to the analysis of nuclear waste glass corrosion. B.C.Sales, C.W.White, L.A.Boatner (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Mater. Lett. (Netherlands), vol.2, no.1, p.1-5 (July 1983).
Ion implantation and Rutherford backscattering depth profile analysis have been used to study changes in the near-surface composition of nuclear waste glasses that were corroded in aqueous media. The dissolution rate of the glass network during early stages of corrosion and effects of solution chemistry on the glass surface-layer composition were investigated. Properties of the altered layer were found to vary significantly as a function of the *pH* of the corroding solution. (10 refs.)

105960 Oxidation-reduction properties of mixed oxides in lanthanum-uranium-oxygen system. H.Tagawa (Inst. of Environmental Sci. & Technol., Yokohama Nat. Univ., Yokohama, Japan), T.Fujino, K.Ouchi, K.Watanabe, K.Saita, T.Morimoto.
J. Nucl. Sci. & Technol. (Japan), vol.20, no.6, p.467-74 (June 1983).
The oxidation-reduction properties and the phase relations of mixed oxides in the system La-U-O were examined by means of thermogravimetry and X-ray diffraction method. The O/M ratios of the mixed oxides $La_yU_{1-y}O_{2\pm x}$, prepared at 1650°C in vacuo by the reaction of La_2O_3 and UO_2, were expressed as 2-0.5 y except $0.2 \leq y \leq 0.4$. The oxides were the single fluorite phase at $y \leq 0.7$. These oxides of $0.2 \leq y \leq 0.6$ were oxidation-susceptible in air even at room temperature. For the oxides heated or prepared in air at 1000°C, the O/M ratio vs. y relationship was composed of three line with the turning points, 2.26 at $y=0.27$ and 1.92 at $y=0.70$. The fluorite phase was observed in the regions of $0.3<y<0.45$ and $0.7 \leq y<0.9$, and the rhombohedral phase was in $\sim 0.55<y<\sim 0.7$. The O/M ratios of the oxides reduced with hydrogen were nearly 2 at $y \leq 0.2$ and decreased with increasing y at $y>0.2$. The oxide of $y=0.5$ had a minimum in the O/M ratio when the oxide reduced with hydrogen was oxidized in air. (19 refs.)

105961 Numerical model of radionuclide migration in geologic media. H.Kimura, S.Muraoka (Div. of Environmental Safety Res., Tokai Res. Establ., JAERI, Ibaraki, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.6, p.503-10 (June 1983).
A three-dimensional radionuclide migration model has been developed by using the direct-simulation method. The phenomena taken into account are radioactive decay, convection and dispersion in the ground water and sorption and desorption in the geologic media. The decay chain is represented by the particle's character change using decay probability. A smoothing method is proposed to make an even distribution of particles and to obtain the exact radioactive inventory. Numerical calculations of the ^{245}Cm and ^{234}U decay chain in the single layered geologic media have been carried out, and reasonable results have been obtained in comparison with the INTRACON study. Nuclide migration of the ^{237}Np decay chain in three-layered geologic media were examined and shown graphically. (8 refs.)

105962 Migration of cesium-137 through sandy soil layer; effect of fine silt on migration. T.Ohnuki, Y.Wadachi (Atomic Energy Society of Japan, Tokyo, Japan).
J. At. Energy Soc. Jpn. (Japan), vol.25, no.6, p.486-93 (June 1983). In Japanese.
The migration of ^{137}Cs through sandy soil layer was studied by considering the migration of fine silt by the column method. It was found that a portion of fine silt migrated through the soil layer accompanying with ^{137}Cs. The mathematical migration model of ^{137}Cs involving the migration of fine silt through such a soil layer is presented. This model is in good accordance with the calculated concentration distribution curve in a sandy soil layer and the effluent curve. (12 refs.)

105963 Successful on-load refuelling at Hinkley Point AGR. R.W.Hall, C.A.Chaffey.
Nucl. Eng. Int. (GB), vol.28, no.343, p.23-6 (July 1983).
Since September 1982 on-load refuelling, at reduced power, has been routinely carried out at Britain's Hinkley Point B and Hunterston B AGRs. This is the result of an extensive development programme aimed at overcoming earlier apparent difficulties, which led to the cessation of on-load fuel handling in 1978, pending reassessment of safety arguments. Progress to date and future prospects are described. (no refs.)

105964 Looking at waste management worldwide. M.H.Raudenbush (S.M. Stoller Corp., Boulder, CO, USA).
Nucl. Eng. Int. (GB), vol.28, no.345, p.30-3 (Aug. 1983).
The recent IAEA waste management conference in Seattle showed that, though there is a considerable degree of international agreement on engineering issues, there remain wide policy differences between countries. These differences are most pronounced in national timetables for the final disposal of high-level waste and the assessment of long-term risk. These issues are discussed. (no refs.)

105965 Disposing of intermediate and low level waste in Britain. A.Cruickshank.
Nucl. Eng. Int. (GB), vol.28, no.345, p.33-7 (Aug. 1983).
A new organisation, Nirex, has been set up by Britain's nuclear industry to manage the disposal of its low and intermediate level waste. This co-operative venture, has a sizeable task before it. (no refs.)

105966 Contribution of photoelasticity measurements to the evaluation of operating safety of nuclear facilities (photoelasticimetric determination of stress intensity coefficient). J.Visner, S.Stepanek.
Skoda Rev. (Czechoslovakia), no.1, p.32-6 (1983).
Describes how the photoelectricity laboratory of Skoda contributes to the maintenance of operating safety standards for nuclear power stations. (no refs.)

105967 Evaluation of liquid radwaste processing at Turkey Point power station. D.J.Feingold, J.M.Donis, A.Byrnes (Florida Power & Light Co., Juno Beach, FL, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.20-3 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
This paper establishes baseline data on the disposable demineralizer system used at Turkey Point to process dirty liquid radwaste. This system is utilized at the Turkey Point Nuclear Station which consists of two 760-MW(e) Westinghouse units. The cost to process the liquid waste, including operation, maintenance, materials, waste transport and burial, and contract services, averages \$57/m^3 (21 cent/gal). The dose incurred from operation and maintenance of the system averages 1.3 E-3 man-rem/m^3 (4.6 E-6 man-rem/gal) of liquid processed. The carbon filter utilized in the disposable system does not add significantly to the process decontamination factor (DF). On the average, 103 m^3 of liquid is processed per cubic meter of liquid process system waste buried. (no refs.)

105968 Etched disk filter insert for the Millstone Unit 1 radwaste system. R.C.Keith (TTI Engng., Norwood, MA, USA), D.F.Snedeker.
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.23-4 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
An etched disk filter insert system was installed in the Millstone Unit 1 radwaste floor drain filter vessel in August 1982. The filter insert system is an approach that has been developed to retrofit existing precoat filters to etched disk filters without changing the filter vessel and the associated piping and valves. The insert, which provides the mounting plate for the etched disk elements and contains the air accumulator for backflushing, directly replaces the flanged head and elements of the existing precoat filter vessel. The filter outlet flange is located such that it bolts directly to the existing outlet piping. The filter inlet and backflush outlet connections remain unchanged on the existing filter vessel. (no refs.)

105969 Performance testing of Marble Hill radwaste solidification system. J.B.Mason (UNC Nuclear Industries Inc., Richland, WA, USA), P.L.Hiland.
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.24-5 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
This paper describes the predelivery inspections and performance tests that were performed on the radwaste solidification system for the Marble Hill Nuclear Power Station Units 1 and 2. Public Service of Indiana (PSI), owner of the Marble Hill Station, contracted with UNC Nuclear Industries Inc. (UNC) for the design, fabrication and testing of a complete Portland cement-sodium silicate radwaste processing, solidification, and handling system (RPSS) for the Marble Hill Station. (no refs.)

105970 Recent developments and operating experiences with cement immobilization of low-level radioactive waste. J.P.Staehr (Chem-Nuclear Systems Inc., Columbia, SC, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.25-6 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
Cement has long been a favorite medium for the solidification of aqueous low-level radioactive waste. However, with the pending implementation of 10CFR61 and rising costs associated with radwaste disposal, questions continue to be raised about its suitability. Chem-Nuclear Systems Inc. is engaged in a research and development program aimed squarely at economical control of product quality while continuing to conform to regulatory requirements. The results of this program thus far have clearly shown that cement remains a very viable waste binder. (3 refs.)

105971 A computerized program for waste inventory tracking and shipping optimization. R.H.Klinetob, C.Calia (EDS Nuclear, San Francisco, CA, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.26-30 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
Over the past several years radioactive waste generation and disposal have undergone significant change. All but two low-level waste (LLW) burial sites have been closed permanently. New US Nuclear Regulatory Commission (NRC) regulations, 10CFR61, effective at the end of 1983, require increased isotope analysis and tracking. These changes make the job of handling wastes more difficult and time consuming. The time currently required for some utilities to do the calculations and paperwork needed to ship a truckload of dry active waste can amount to several days. Several hours are required for processing the papers for shipping a single 100 to 200 ft^3 container of process waste. A radioactive waste tracking and shipping optimization program called WASTETRAK has been developed for Pennsylvania Power and Light to address these problems. It is currently up and running at the Susquehanna Units. The program provides a means of assembling and manipulating the large amount of data required for radioactive waste tracking and shipping. (no refs.)

105972 Determination of the maximum justifiable capital expenditure for volume reduction systems. M.H.Jacobs, C.C.Miller, L.G.Young (Sargent & Lundy Engrs., Chicago, IL, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.28-30 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
The costs associated with the disposal of low-level radioactive waste have increased dramatically over the last ten years. The cost of transportation has increased an average of 7%/yr over the last eight years and the burial costs have increased over 40% annually in the same time period. With these rapidly increasing costs, many utilities are considering the installation of new volume reduction (VR) equipment in an attempt to reduce the volume of radioactive waste that must be disposed of each year, thereby reducing the disposal cost. As with any equipment purchase for retrofit, the key issues are the performance and the operational cost savings of the system. In volume reduction systems, the cost savings arise from packaging, transportation, and burial cost reductions. The purpose of this paper is to demonstrate that the equivalent capital investment (ECI) method of economic evaluations is a convenient method for determining the justifiable capital investment for a VR system backfit. (no refs.)

105973 Evaluation of boron-10 depletion during pressurized water reactor operation. N.Asai (Kansai Electric Power Co. Ltd., Osaka, Japan), N.Yamazaki, H.Tochihara, A.Takahashi, T.Ohno.
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.70-1 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
Boric acid is used as a chemical shim in a pressurized water reactor (PWR) to adjust the long-term reactivity change. Critical boron concentration in the hot full power, all control rods out, equilibrium xenon condition varies from about 1000 ppm at beginning of cycle (BOC) to about 10 ppm at end of cycle (EOC), in which boron means natural boron. Natural boron contains 19.8 at.% ^{10}B which is a strong neutron absorber. The percentage of ^{10}B in the boron concentration reduces during operation because of ^{10}B depletion in the core. The calculational model which simulates ^{10}B depletion in a PWR, assuming realistic boration and dilution operation, shows that ^{10}B depletion during normal operation is not negligible and should be considered in the resultant boron concentration. (no refs.)

105974 Rationale for the choice of radwaste volume reduction by hyperfiltration at a Tennessee Valley Authority nuclear plant. T.Hillmer, D.Shoemaker (Tennessee Valley Authority, Chattanooga, TN, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.92-3 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
The installed liquid radwaste processing system at Sequoyah Nuclear Plant (SQN) consists of a 7.5/15 gal/min rated auxiliary waste evaporator and a 2 gal/min rated waste evaporator. Large volumes of liquid waste (up to 25.8 gal/min average over a month) are being generated at SQN. Since the evaporators cannot process the volume of liquid waste being generated, a new system is needed. Based on the testing, it appeared that a reverse osmosis (RO) unit used in conjunction with demineralization for polishing was potentially the most viable system to install at SQN. To verify this, a twofold approach was developed: (a) to perform comprehensive testing of an RO unit with a dynamically formed membrane on actual plant waste streams, and (b) to perform a cost-benefit analysis for a variety of radwaste systems to determine the most economically attractive alternative. (no refs.)

105975 Salem Unit I nuclear plant radwaste liquid volume reduction system operation and performance. J.W.Walcott (HPD Inc., Naperville, IL, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.93-5 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
The Salem Unit I nuclear plant began full use of the HPD evaporator/crystallizer liquid volume reduction system during 1982. During initial operation, ~400000 gal of feed was processed with a resultant concentrated waste volume of 1500 gal. During continuous operation, a concentration factor of 267 to 1 was realized. Information concerning chemical waste components particularly pH and chloride levels, and chemical pretreatment is presented to allow determination of system limitation. The interface with the cement solidification system for solidifying the liquid waste is also discussed. Operation of the system is analyzed with particular comments concerning operation time between mandatory shutdown and maintenance requirements. An economical evaluation of capital costs and operating costs is presented for the evaporator/crystallizer system. (no refs.)

105976 Impact of polyvinyl chloride content on incineration of dry active wastes: problems and solutions. E.M.Vander Wall, R.E.Jones (Aerojet Energy Conversion Co., Sacramento, CA, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.96-7 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
Low-level radioactive wastes generated at commercial nuclear power stations consist of evaporator concentrates, spent ion-exchange resins and sludges, and dry active wastes (DAW). At most plants, the DAW represents a significant portion of the total wastes that must be processed, packaged, and shipped to a commercial burial site for final disposal. The DAW consists of paper, cardboard, wood, cloth, plastic sheet, rubber, and other similar materials which contain very little radioactivity. In most plants, the DAW is compacted in a 55-gal drum and shipped for disposal. Compaction provides a volume reduction (VR) factor of about 3. An alternative option to compaction of the DAW is to incinerate the material, which provides a much greater VR factor, on the order of 100. The paper examines the impact of the PVC content on the incineration of the DAW and the achievable VR factor. (no refs.)

105977 Incineration of spent ion-exchange resins at commercial nuclear stations. R.Garcia, E.M.Vander Wall (Aerojet Energy Conversion Co., Sacramento, CA, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.97-8 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
During the past ten years the Aerojet Energy Conversion Company (AECC) has developed and demonstrated a fluidized-bed volume reduction (VR) system for processing low-level radioactive wastes generated at commercial nuclear power stations. The AECC VR System utilizes two fluidized-bed vessels, a dryer, and an incinerator, to process liquid evaporator concentrates, dry active wastes, contaminated oil, and spent ion-exchange resins. A common off-gas cleanup system services both fluidized-bed vessels and removes particulate, iodine, hydrogen chloride, and sulfur dioxide from the gas stream prior to discharge. During the past three years the development and demonstration effort was associated with the incineration of spent ion-exchange resins. A description of this program, results obtained, benefits associated with spent resins incineration, and licensing of the system are discussed. (no refs.)

105978 The impact of polyvinyl chloride on waste incineration systems. B.Waters (Combustion Engng. Inc., Windsor, CT, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.98-9 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
The paper addresses the impact of processing polyvinyl chloride (PVC) on material selection and volume reduction (VR) factors in an incineration system. Consideration is given to PVC sources, pretreatment, combustion processes, material selection, and VR factors. The impact on volume reduction is addressed for two cases: (a) the effect on the incineration process, and (b) the effect on the overall VR process including solidification of the incinerator product. A summary conclusion addresses the practical limitations for incinerating PVCs. (no refs.)

105979 Certification of a uranium metal reference material for chemical analyses.
Report EUR 8349 EN, Comm. European Communities, Luxembourg (1983), 27 pp.
The procedure followed for the certification of the EC uranium metal reference material no. 101 is described. The certificate appended to the report gives the uranium mass fraction, the overall uncertainty attached to that value and recommendations for use of the material. (1 ref.)

105980 BENCHMARK. Reference data on post irradiation analysis of light water reactor fuel samples. S.Guardini, G.Guzzi.
Report EUR 7879 EN, Comm. European Communities, Luxembourg (1983), 162 pp.
The aim is to review the results obtained within the framework of the Benchmark activity, to indicate the field of application for these results, and to provide information that will make them simple and straightforward to use. The Benchmark activity was a destructive assay carried out in cooperation

with various European nuclear power plant utilities on irradiated LWR fuel elements. The irradiated assemblies were dismantled, some fuel pins were selected and pellets, representative of both unperturbed and perturbed reactor core regions were cut from them after γ-scanning. The pellets were then dissolved and submitted to α, γ and mass spectrometry in order to determine fission-product and heavy-element buildup, isotopic ratios and burnup. The aim of this activity was to prepare a set of clean reference data from which many users would profit. (62 refs.)

105981 Testing and evaluation of solidified high-level waste forms. R.De Batist.
Report EUR 8424 EN, Comm. European Communities, Luxembourg (1983), 123 pp. Contract 121-80-53 WASUK/122-80-53 WASD/123-80-55 WASF/124-80-55 WASB/125-80-55 WASN/232-81-53 WASD/268-81-55 WASF.
Describes the work carried out during the period 1980-81 on the characterisation and evaluation of several solidified high level waste forms suggested as examples by member countries of the European Community. In addition to borosilicate glasses and a glass ceramic investigated during the preceding programme of the European Atomic Energy Community and which are being further studied, two new borosilicate glass compositions have been introduced. The chemical stability of these waste forms, in particular with respect to geological disposal conditions, is examined as well as effects of alpha-radiation and of devitrification. Leaching studies are also discussed. (23 refs.)

105982 Diffusive transport of strontium-85 in sand-bentonite mixtures. R.W.Gillham, M.J.L.Robin, D.J.Dytynyshyn.
Report AECL-6838, Atomic Energy Canada Ltd., Chalk River, Ont. (June 1983), 34 pp.
Diffusion experiments have been used to determine the transport of ^{85}Sr in sand-bentonite mixtures. The diffusion experiments were performed on one natural soil (Chalk River sand) and on seven mixtures of bentonite and silica sand, containing from 0% to 100% bentonite. Two nonreactive solutes (^{36}Cl and ^{3}H) and one reactive solute (^{85}Sr) were used in the study. The experiments with nonreactive solutes yielded estimates of tortuosity factors. Retardation factors were obtained from experimental porosities, experimental bulk densities, and from batch distribution coefficients (K_d). These K_d values are a simple way of describing the solute/medium reaction, and are based on the assumption that the cation-exchange reaction may be described by a linear adsorption isotherm passing through the origin. The results demonstrate that, for practical purposes and for these experimental conditions, the use of the distribution coefficient provides a convenient means of calculating the effective diffusion coefficient for ^{85}Sr. The porosity and bulk density were also found to have a considerable influence on the effective diffusion coefficient, through the retardation factor. (11 refs.)

105983 Radwaste incineration, is it ready for use?. B.W.Coplan (BVC Consultants Inc., Sun City Center, FL, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.121-32
The original incineration installations experienced operating problems and demonstrated various design deficiencies. However, substantial operating time has been accumulated particularly in Canada, Japan and Europe. As a result of the information gained by the operating installations it is believed that the second generation, state-of-the-art, radwaste incineration systems now commercially available are sufficiently advanced to be operationally reliable and merit installation. (no refs.)

105984 Design and performance of a fluidized bed incinerator for TRU combustible wastes. L.J.Meile, F.G.Meyer (Rockwell Internat., Golden, CO, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.133-8
Problems encountered in the incineration of glovebox generated waste at Rocky Flats Plant (RFP) led to the development of a fluidized bed incineration system for transuranic (TRU) combustible wastes. Laboratory and pilot-scale testing of the process preceded the installation of an 82 kg/hr production demonstration incinerator at RFP. The FBI process is discussed, and the design of the demonstration incinerator is described. Operating experience and process performance for both the pilot and demonstration units are presented. (4 refs.)

105985 Acid digestion of combustible radioactive wastes. C.R.Allen, R.E.Lerch, M.D.Crippen, R.G.Cowan (Westinghouse Hanford Co., Richland, WA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.139-47
Engineering demonstration of the acid digestion process has been performed at Westinghouse Hanford Company in the Radioactive Acid Digestion Test Unit (RADTU). RADTU construction was completed in June 1977. Following shakedown testing, RADTU began processing potentially contaminated non-glovebox wastes from a plutonium facility (234-5 Building) in November 1978. RADTU was modified for capacity increase which included a change in digester design from a slab tray geometry to an agitated annular digester in December 1979. Major quantities of plutonium were introduced into the system in December 1980 when over 500 kg of waste containing multigram quantities of plutonium were processed during a two week run. Data were collected on plutonium behavior in the system and overall process decontamination factors were calculated. A series of special tests were conducted to assess the system's ability to process unique waste forms including ion exchange resin, decon rags, wooden structural materials, reactive scrap and a plastic shipping bottle. Because funding for waste management operations is currently limited, RADTU has been placed in ready standby status. (1 ref.)

105986 Experimentation with a prototype incinerator for beta-gamma waste. M.G.Farber, K.E.Lewandowski, G.W.Becker (Savannah River Lab., E.I. du Pont de Nemours & Co., Aiken, SC, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.148-52
A test facility for the incinerator of suspect and low-level beta-gamma waste has been built and operated at the Savannah River Laboratory. The processing steps include waste feeding, incineration, ash residue packaging, and off-gas cleanup. Demonstration of the full-scale (180 kg/hr) facility with nonradioactive, simulated waste is currently in progress. At the present time, over nine metric tons of material including rubber, polyethylene, and cellulose have been incinerated during three burning campaigns. A comprehensive test program of solid and liquid waste incineration is being implemented. The data from the research program is providing the technical basis for a phase of testing with low-level beta-gamma waste generated at the Savannah River Plant. (no refs.)

105987 Volume reduction of radioactive resins through controlled incineration. E.J.Brown, J.M.Wu (Dept. of Nuclear Engng., Rensselaer Polytech. Inst., Troy, NY, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.153-6
Volume reduction experiments were carried out in a laboratory scale prototype furnace under controlled incineration conditions. Nuclear grade cation-exchange resins from three manufacturers carrying simulated radioactive contamination were used in all experiments. Volume reductions were found to be approximately the same for each of the different resins. Reduction was found to be heavily dependent on the temperature of primary incineration and the presence or lack of oxygen. Volume reduction potentials of about 95% or better are achievable during oxidation incineration and 85% in pyrolysis carried out at 750°C. Entrainment levels of radioactive cesium in the offgas were measured for pyrolysis and oxidation incinerations carried out at 750°C and were found to be 0.54% and 1.7% respectively of the total cesium activity in the spent resin. (3 refs.)

105988 Development and testing of prototype alpha waste incinerator off-gas systems. E.J.Freed, G.W.Becker (Savannah River Lab., E.I. du Pont de Nemours & Co., Aiken, SC, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.157-60
A test program is in progress at Savannah River Laboratory (SRL) to confirm and develop incinerator design technology for an SRP production Alpha Waste Incinerator (AWI) to be built in the mid-1980s. The Incinerator Components Test Facility is a full scale (5 kg/hr), electrically heated, controlled-air prototype incinerator built to burn nonradioactive solid waste. The incinerator has been operating successfully at SRL since March 1979 and has met or exceeded all design criteria. During the first 1-1/2 years of operation, liquid scrubbers were used to remove particulates and hydrochloric acid from the incinerator exhaust gases. A dry off-gas system is currently being tested to provide data to Savannah River Plant's proposed AWI. (no refs.)

105989 Controlled air pyrolysis incinerator. K.H.Dufrane (Atcor Engineered Systems Inc., Farmington, CT, USA), M.Wilke.
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.161-7
An advanced controlled air pyrolysis incinerator has been researched, developed and placed into commercial operation for both radioactive and other combustible waste. Engineering efforts concentrated on providing an incinerator which emitted a clean, easily treatable off-gas and which produced a minimum amount of secondary waste. Feed material is continuously fed by gravity into the system's pyrolysis chamber without sorting, shredding, or other such pretreatment. Metal objects, liquids such as oil and gasoline, or solid products such as resins, blocks of plastic, tire, animal carcasses, or compacted trash may be included along with normal processed waste. The temperature of the waste is very gradually increased in a reduced oxygen atmosphere. Volatile pyrolysis gases are produced, tar-like substances are 'cracked' and the resulting product, a relatively uniform, easily burnable material, is introduced into the combustion chamber. (no refs.)

105990 Waste vitrification: a historical perspective. J.L.McElroy, W.J.Bjorklund, W.F.Bonner (Pacific Northwest Lab., Richland, WA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.171-7
The possibility of converting high-level wastes (HLW) to glass was first pursued in Canada and England at a time when other countries were evaluating many other alternatives. By 1966, the British had completed radioactive demonstrations of the FINGAL pot process, converting HLW to borosilicate glass. By this time other countries, including France and the United States, had begun using the glass waste form. Beginning in 1966, several processes, including phosphate and borosilicate glass, were demonstrated by the US in the Waste Solidification Engineering Prototypes (WSEP) program at the Pacific Northwest Laboratory (PNL). Most of the current vitrification processes are adaptations of the FINGAL pot process or the continuous metallic melter used in the WSEP program. One notable exception is the joule-heated ceramic melter which was adapted from commercial glass technology for HLW by PNL in the mid-1970s. Both batch and continuous processes have been developed to an advanced stage of readiness. These processes are described and compared. (24 refs.)

105991 Waste glasses—requirements and characteristics. J.E.Mendel (Pacific Northwest Lab., Richland, WA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.178-83
The regulatory requirements relating to waste glass that have been presented recently in draft form by the US Environmental Protection Agency (EPA) and Nuclear Regulatory Commission (NRC) are reviewed. These requirements assume that waste glass will be considered as a subcomponent of a waste package. Current waste package concepts are described and the important characteristics of waste glass are summarized, with emphasis on the present status of standardizing methods for measuring the characteristics of waste glass. (15 refs.)

105992 High-level waste vitrification technique in a full-scale pilot plant. S.Weisenburger (Inst. fur Nukleare Entsorgungstech., Karlsruhe Nuclear Res. Centre, Karlsruhe, Germany).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.184-90
The liquid-fed ceramic melter process is reviewed and evaluated. Process application in a full-scale cold pilot plant, currently under construction in the Institut fur Nukleare Entsorgungstechnik, is described. It is concluded that the process has high potential for use in future industrial vitrification plants. (1 ref.)

105993 Savannah River Laboratory's operating experience with glass melters. F.H.Brown, C.T.Randall, M.B.Cosper, J.P.Moseley (Savannah River Lab., E.I. du Pont de Nemours & Co., Aiken, SC, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.191-6
The Department of Energy, with recommendations from the Du Pont Company, is proposing that a Defense Waste Processing Facility be constructed at the Savannah River Plant to immobilize radioactive waste. The immobilization process is designed around the solidification of waste sludge in borosilicate glass. The Savannah River Laboratory, who is responsible for the solidification process development program, has completed an experimental program with one large-scale glass melter and just started up another melter.

Experimental data indicate that process requirements can easily be met with the current design. (2 refs.)

105994 Operating characteristics of a direct liquid-fed vitrification process. W.J.Bjorklund, R.A.Brouns (Pacific Northwest Lab., Richland, WA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.197-202
For several years, The Pacific Northwest Laboratory has studied the process of immobilizing stimulated high-level radioactive waste by directly feeding it to an electric melter as a slurry containing glass-forming chemicals. Over 65000 L of simulated waste have been processed in more than 1000 h of operation in various-sized melters. A feed system using an air-operated positive-displacement diaphragm pump has been shown to be reliable. Melting rates ranging from 40 to 60 $kg/h\text{-}m^2$ (kilograms of total oxides per hour per square meter of melter surface area) have been demonstrated. Large-scale tests have shown the process to be stable, safe and capable of capacities meeting the needs of both commercial and defense waste immobilization programs now under study in the United States. (4 refs.)

105995 Corrosion experience with a slurry-fed ceramic melter. S.M.Barnes, G.J.Sevigny, R.W.Goles (Pacific Northwest Lab., Richland, WA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.203-7
Presents the findings of an investigation into the long-term performance of construction materials for joule-heated, ceramic-lined melters. The materials investigated include: the glass contact refractories, the melter electrodes and the process off-gas containment materials. The corrosion rates and mechanisms for these materials are presented. The report also includes the initial corrosion data from testing of improved effluent containment materials. Results indicate that melter service lives in excess of three years are attainable. (5 refs.)

105996 Utilization of a drum drier for the conditioning of radioactive wastes. St.Halaszovich, S.Dix, E.Merz (Inst. for Chem. Technol., Kernforschungsanlage Julich GmbH, Julich, Germany).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.208-11
Arguments are presented for the preference of a separate drying step in the solidification process of liquid wastes. In particular, the possibilities and advantages of the utilization of a drum drier for the conditioning of high- and medium-level wastes are described, referring to the experience gained in its conventional utilization underlined by practical use and experiments. Main aspects discussed are handling and safety, variety of possible products, throughput and economy. Finally, the future work is outlined. (5 refs.)

105997 Microstructures and crystallization in simulated waste glasses. A.Skokan, V.Schaurer (Kernforschungszentrum Karlsruhe, Karlsruhe, Germany).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.212-17
A borosilicate glass has been developed as a solidification matrix for high level radioactive waste solution at the Karlsruhe Nuclear Research Centre. As a part of product characterization, the microstructures and the crystallization behavior of the glass products were investigated in the range from 350 to 750°C with annealing times up to 10000 hours. In addition to ruthenium oxide and palladium alloys that are insoluble in the melt, two major silicate phases were observed after thermal treatment. The maximum degree of crystallinity measured by X-ray diffraction analysis was between 20 and 30% at 650°C. Heat treatment below the transition temperature of the glass led to no appreciable crystallization. (6 refs.)

105998 The IAEA's role in radioactive waste management, particularly for low- and intermediate-level wastes. E.R.Irish (Div. of Nuclear Fuel Cycle, IAEA, Vienna, Austria).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.221-7
The management of low- and intermediate-level wastes is an area of increasing interest to practically all Member States having activities in the nuclear field, in particular to those which are producing electricity and heat by use of nuclear energy. This fact is reflected in the Agency's activities and in this presentation. (no refs.)

105999 Low- and intermediate-level waste management practices in Belgium. J.C.Claes, N.Van de Voorde, P.Dejonghe (Study Centre for Nuclear Energy-CEN/SCK, Mol, Belgium).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.228-36
The main ongoing nuclear activities and the organization of LLW and ILW management in Belgium are described. Data are presented on the waste arisings and characteristics. The treatment and conditioning techniques, currently applied at the waste processing plants, are reported. Attention is also drawn to the new processes and managerial improvements, which are being implemented and will become operational in 1982-1983. The importance of sea dumping as a LLW disposal strategy for Belgium, among other West-European countries, is underlined. Information is given on the packaging procedures and sea dumping operations. (7 refs.)

106000 Low level and intermediate level wastes management practice in France. A.Faussat.
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.237-42
The long-term industrial management of radioactive waste which is or will be produced mainly by the electronuclear industry is handled in France by a national agence, l'Agency Nationale pour las Gestion des Dechets Radioactifs (ANDRA), which was formed in 1979 within the CEA by an interministerial order. (no refs.)

106001 LLW and ILW waste management practices in Italy. A.Donato (CNEN CSN-Casaccia, Roma, Italy).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.243-7
LLW and ILW radwastes are produced in Italy by power plants pilot reprocessing plants and nuclear research centers. Liquid radwastes produced at old power plants are treated by ion exchange, chemical precipitation or evaporation, while in the new Caorso BWR plant, Powdex resins and filtration are used, followed by urea-formaldehyde solidification. No solidification processes are used at the two pilot reprocessing plants (Eurex and Itrec), while cementation and bituminization are employed at the research centers (Casaccia, Camen and Ispra). Solid wastes are generally compacted where possible and stored. The management of radwastes in Italy is highly influenced by the uncertainties concerning the type of disposal to be adopted. (11 refs.)

106002 Low- and intermediate-level waste management practices in Canada. D.H.Charlesworth (AECL Res. Co., Chalk River, Ontario, Canada).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.248-51
Low- and intermediate-level wastes arise in Canada from the operation of nuclear power stations, nuclear research establishments, nuclear fuel and radioisotope production facilities, as well as from many medical, research and industrial organizations. Essentially all of the solid radioactive wastes are stored in a retrievable fashion at five waste management areas from which a portion is expected to be transferred to future disposal facilities. Waste processing for volume reduction and stabilization is becoming an increasingly important part of low-level waste management because of the advantages it provides for both interim storage currently, and permanent disposal in the future. (19 refs.)

106003 Low- and intermediate-level waste management practices in Japan. M.Tsuchiya (Radioactive Waste Management Center, Tokyo, Japan).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.252-5
At present, disposal of low-level radioactive wastes is yet to be carried out in Japan. Liquid wastes, except for the diluted discharge of very low-level waste into the environment, are mostly solidified with cement or bitumen to be packed in 200 litre drums and put in storage. Solid wastes, on the other hand, are mostly put into 200 litre drums, some of them being incinerated beforehand. Efforts are being made to develop technology for reducing the production of wastes. Regarding sea disposal a test dumping program has been forestalled by the opposition of South Pacific islanders, but the Japanese are endeavoring to promote their understandings on this matter. Regarding land disposal, first they are going to start centralized storage, then to shift to underground disposal. (no refs.)

106004 Low and intermediate level waste management practices in the United Kingdom. F.H.Passant (CEGB, Gloucester, England).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.256-60
Current UK policy and practices for the management of low and intermediate activity wastes are summarised. Methods of treatment, packaging and transport and described for those wastes which are disposed of by shallow trench burial and by sea dumping. These disposal practices are described as are the methods of storage for those wastes awaiting disposal. Current and possible future developments are briefly outlined which included improved methods of handling and the establishment of disposal routes for all intermediate activity wastes. (5 refs.)

106005 US Department of Energy program for commercial low-level waste management—a progress report. J.M.Brown (EG&G Idaho Inc., Idaho Falls, ID, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.261-2
The Low-Level Waste Management Program was established in September 1978 by the US Department of Energy. EG&G Idaho Inc. in Idaho Falls, Idaho is the lead contractor for the National Program and has been coordinating program activities since 1979. The goal of the program is to ensure that low-level wastes are disposed of in a manner that will protect public health and safety over the long term. To accomplish this goal, the primary objective of the program is to provide an acceptable low-level waste management system by 1986. (no refs.)

106006 Incinerator development program for processing transuranic waste at the Idaho National Engineering Laboratory. T.G.Hedahl (EG&G Idaho Inc., Idaho Falls, ID, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.265-9
In the fall of 1981, two short-term tests were conducted on a controlled air and a rotary kiln incinerator to assess their potential for processing transuranic (TRU) contaminated waste at the Idaho National Engineering Laboratory (INEL). The primary purpose of the test program was a 'proof-of-principle' verification that the incinerators could achieve near-complete combustion of the combustible portion of the waste while mixed with high percentages of noncombustible and metal waste materials. Other important test objectives were to obtain system design information including off-gas and end-product characteristics and incinerator operating parameters. Approximately 7200 kg of simulated (non-TRU) waste from the INEL were processed during the two tests. (no refs.)

106007 Coreless induction melting of simulated transuranic wastes. J.L.McCall, R.D.Tenaglia (Battelle Columbus Labs., Columbus, OH, USA), G.W.Gibson, R.L.Benedetti.
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.270-5
The major objective of the Transuranic Waste Treatment Facility (TWTF) is to develop a facility to process low-level transuranic waste stored at the Idaho National Engineering Laboratory (INEL). One concept for processing the waste involves a first stage incineration process to reduce the level of combustibles and a second stage melting process to further consolidate the end product. Coreless induction melting was selected for evaluation as a melting process. Uncontaminated waste representative of the types of INEL wastes was charged directly onto the surface of a cast iron bath to form slag and metal products. Metal, slag, off-gas and particulate products were collected and characterized. Coreless induction melting was found to be a feasible method to process INEL waste provided that problems of low slag fluidity and short refractory life can be overcome. (4 refs.)

106008 Investigations of the treatment of alpha-contaminated wastes at the Karlsruhe Nuclear Research Center. H.Krause (Kernforschungszentrum Karlsruhe GmbH, Inst. fur Nukleare Entsorgungstechnik, Karlsruhe, Germany).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.276-80
R&D-activities are being carried out with the aim of separating actinides and F.P. from MLLW to such an extent that it virtually becomes a non-TRU

waste and requires only a small shielding. Several types of TRU-waste concentrates have been encapsulated in a ceramic matrix successfully. This matrix is characterized by a low sensitivity to the chemical composition of the waste, a high leach resistance and radiation stability. Cladding hulls could be embedded in lead by pressing a mixture with lead chips at room temperature. The acid digestion process could be improved and developed to such an extent that active demonstration in a pilot plant can start in the near future. (9 refs.)

106009 Future trends in transuranic waste generation. R.T.Jensen (Rockwell Internat., Energy Systems Group, Rocky Flats Plant, Golden, CO, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.281-5
This paper presents data from the major Department of Energy (DOE) sites that will generate 92% of all Transuranic (TRU) waste during the next five years. Forecasts are given for three kinds of activities. They include production, decontamination and decommissioning (D&D), and research and development. The major production activities and locations are described, and forecasts are given for each one. This report further describes the type and amount of waste forms that will be generated. The expected trends for the categories are presented, and possible areas for reducing waste generation are given. (9 refs.)

106010 Advances in measurement of alpha-contaminated wastes. D.A.Close, T.W.Crane, J.T.Caldwell, W.E.Kunz, E.R.Shunk, J.C.Pratt (Los Alamos Nat. Lab., Los Alamos, NM, USA), L.A.Franks, S.M.Kocimski.
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.286-90
A comprehensive program is in progress at the Los Alamos National Laboratory for the development of sensitive, practical, nondestructive assay techniques for the quantification of low-level transuranics in bulk solid wastes. The program encompasses a broad range of techniques, including sophisticated active and passive gamma-ray spectroscopy, passive neutron detection systems, pulsed portable neutron generator interrogation systems, and electron accelerator-based techniques. The techniques can be used with either low-level or high-level beta-gamma wastes in either low-density or high-density matrices. (14 refs.)

106011 Current status of the multi-isotopic transuranic waste assay system. W.E.Kunz, J.T.Caldwell, J.D.Atencio, W.Bernard, S.W.France, G.C.Herrera, H.H.Hsu, T.H.Kuckertz, J.C.Pratt (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.291-5
The authors have designed, constructed, tested, and are scheduled to field a 208-l barrel-sized working version of our multi-isotopic transuranic assay system. This system uses both passive neutron multiplicity and pulsed active measurements to identify and quantify spontaneous neutron emitters and fissile TRUE isotopes. Using the system they can separately quantify up to seven individual transuranic isotopes under favorable conditions with the intrinsic sensitivity to screen or assay barrels at or below the 10 nCi/g transuranic level. The measured 3σ sensitivity for ^{239}Pu is about 0.5 mg. A large range of waste matrix materials can be accommodated by the system, as well as extremes in both gamma-ray and neutron backgrounds. (6 refs.)

106012 Experimental evaluation of the differential die-away pulsed-neutron technique for the fissile assay of hot irradiated fuel waste. J.T.Caldwell, W.E.Kunz, H.F.Atwater, J.D.Atencio, G.C.Herrera, R.E.Morgado, J.C.Pratt (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.296-9
Hot irradiated fuel waste packages containing self neutron sources up to 10^7 n/s may be assayed successfully with a 25-mg ^{239}/Pu detection sensitivity using a differential die-away fissile assay system based on a Sandia-designed 14-MeV neutron generator. With a minor design change, our system can accommodate contact gamma dose rates up to 10^4 R/h with no loss of fissile assay sensitivity. (7 refs.)

106013 Alpha content and long-term safety in nuclear waste management. B.A.Hunt, H.Dworschak, F.Mousty (Commission of the European Communities, Joint Res. Centre-Ispra Establ., Ispra, Italy).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.300-4
Radioactive waste management practices and concepts have been examined. The concentration/confinement concept always applicable to the HAW fraction has gradually and progressively been applied to the ever increasing MAW arisings containing significant long-lived components. Due to the long-term hazard posed by such components, mainly the transuranic actinides, particular efforts have been directed over the past few years to improvements in alpha waste reduction, conditioning and disposal. An alternative strategy however is proposed, backed by experimental results, which offers the possibility to combine all the alpha sources into a unique chemically homogeneous stream, thus allowing more stable matrices to be selected for their immobilization. (8 refs.)

106014 Department of Energy's selection of high level waste forms. R.D.Walton,Jr. (Office of Defense Waste & Byproducts Management, US DOE, Washington, DC, USA), W.B.Wilson, D.E.Gordon.
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.307-11
Several candidate waste forms have been investigated under US Department of Energy (DOE) programs as potential media for the immobilization and geologic disposal of high-level radioactive waste (HLW) resulting from chemical processing nuclear reactor fuels and targets. Two of these HLW forms were selected at the end of fiscal year (FY) 1981 for further development. Borosilicate glass was continued as the reference waste form and a crystalline ceramic material, Synroc, was selected as the alternative form. The selection of one of these two forms for production in the Defense Waste Processing Facility (DWPF) at the Savannah River Plant site will be made before the end of FY 1983. This paper focuses on the selection of these two waste forms, including discussions on the historical perspectives of HLW treatment and disposal, the Materials Characterization Organization, and the evaluation method used in the selection process. (10 refs.)

106015 Demonstration of SYNROC fabrication scaleup on a non-radioactive basis. E.J.Ramm, K.D.Reeve (AAEC Res. Establ., Lucas Heights Res. Labs., Sutherland, NSW, Australia).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.312-17
SYNROC fabrication development at Lucas Heights is based on hot uniaxial pressing, and a method known as in-can hot pressing was devised for the first scaleup demonstration. The present in-can hot press consists of a 1 m long induction furnace into which a 115 mm diameter stainless steel tube can be fitted and provided with lateral support, together with associated hydraulics. Five 30 kg canisters of dense SYNROC-B have been produced and the method is considered suitable for further development. Current plans for continuing SYNROC process development at Lucas Heights are outlined. (9 refs.)

106016 Immobilization of high-level defense wastes in SYNROC-D: recent research and development results on process scale-up. J.H.Campbell, R.B.Rozsa, C.L.Hoenig (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.318-24
SYNROC is a titanate-based ceramic waste form being developed to immobilize high-level nuclear reactor wastes. SYNROC-D is a unique variation of SYNROC designed to contain high-level defense wastes, particularly those in storage at the Savannah River Plant (SRP). The authors review recent research and development on SYNROC-D processing options and report on work in progress on various unit operations. (14 refs.)

106017 An improved polyphase ceramic for high-level defense waste. A.B.Harker, P.E.D.Morgan, J.Flintoff, D.R.Clarke (Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.325-30
Modifications of the chemical formulation and processing of the SYNROC-D polyphase ceramic for defense waste have been studied to provide greater flexibility with respect to compositional variations in the waste and to improve leach resistance. It has been demonstrated that by applying only that amount of reduction to the waste required to produce uranium in the 4+ state and by using lower consolidation temperatures, an improved ceramic can be formed. The resulting ceramic consolidated at 1040°C and 10000 p.s.i. maintains the SYNROC-D zirconolite, perovskite and nepheline phases; however, the two SYNROC-D spinel phases are replaced with a single magnetite-type spinel and two additional radiophases, magnetoplumbite, and a cubic murataite-type phase. This modified phase assemblage provides crystalline host sites for all radionuclides and trace elements in SRP waste, minimizes amorphous intergranular material, and shows superior leach resistance. (14 refs.)

106018 High level waste forms: glass marbles and thermal spray coatings. R.L.Treat, K.H.Oma, S.C.Slate (Pacific Northwest Lab., Richland, WA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.331-5
A process that converts high-level waste to glass marbles and then coats the marbles has been developed at Pacific Northwest Laboratory (PNL) under sponsorship of the US Department of Energy. The process consists of a joule-heated glass melter, a marble-making device based on a patent issued to Corning Glass Works, and a coating system that includes a plasma spray coater and a marble tumbler. The process was developed under the Alternative Waste Forms Program which strived to improve upon monolithic glass for immobilizing high-level wastes. Coated glass marbles were found to be more leach-resistant, and the marbles, before coating were found to be very homogeneous, highly impact resistant, and conducive to encapsulation in a metal matric for improved heat transfer and containment. Marbles are also ideally suited for quality assurance and recycling. However, the marble process is more complex, and marbles require a larger number of canisters for waste containment and have a higher surface area than do glass monoliths. (5 refs.)

106019 Evaluation of coated particle waste forms. T.D.Gulden, O.D.Erlandson, J.L.Kaae, W.J.Kovacs (General Atomic Co., San Diego, CA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.336-40
An in-depth evaluation of the technical merits and engineering practicality of coated particles, based on sol gel processes, as a candidate waste form has been performed. The results of the study showed that coated particle waste forms, because of the exceptional chemical inertness of the carbon and silicon carbide coatings, have the potential for nearly absolute containment of radionuclides for geologic time periods. The processes, although somewhat complex, are amenable to remote operation, and have considerable potential for further development and simplification. Coated particle fuels have inherent advantages for quality control sampling and are readily recycled for rework. (8 refs.)

106020 Factors to be taken into account in the selection and application of a processing system for TRU waste. H.Krause (Kernforschungszentrum Karlsruhe GmbH, Inst. fur Nukleare Entsorgungstech., Karlsruhe, Germany).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.343-6
The greatest portion of presently arising TRU waste is either treated like other radwastes or stored intermediately. A large fast-breeder fuel cycle will call for a particular, self-contained TRU-waste treatment system. Its main characteristics should be minimization of waste arisings, volume reduction, separation of plutonium and other actinides where reasonably achievable, recycling of plutonium, and incorporation of the TRU-waste concentrates into adequate matrix materials. Most of the processes and waste forms required are already available or under development. (17 refs.)

106021 State-of-the-art review on the management of low-level radioactive and transuranic wastes. H.W.Godbee, A.H.Kibbey (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.347-51
To place the management of low-level and transuranic wastes in perspective, the amounts of each waste type buried in 1980 and accumulated (with locations) through 1980 are presented. A review of the basic unit operations used to remove radioactivity from process and liquid waste streams shows that filtration, evaporation, and ion exchange remain the dominant ones. Centri-

fugation is frequently used to dewater filter sludges and spent resins. In the United States at present, dry wastes are, for the most part, compressed (compactor or baler) for burial. However, the present trend in waste management is toward greater volume reduction, improved waste form stability, and longer onsite storage (viz., at commercial sites). Thus, use of and interest in calcination, incineration, incorporation of wastes into stable matrices, and engineered onsite storage is growing. (13 refs.)

106022 Treatment of TRU wastes: recent results of developments underway in Germany. V.W.Schneider, F.W.Ledebrink (ALKEM GmbH, Hanau, Germany).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.352-6

Objectives and projects of the German program on TRU waste treatment are briefly reviewed. Three tasks (Studies of TRU Waste Management, Development of Washing Processes, and An Improved Process for Solidification by Cement) are outlined in more detail. Recent results are communicated and the properties of the solidified products provided. Finally, a Scheme for Treatment of TRU waste from a MOX Fuel Fabrication Plant is presented. (7 refs.)

106023 Long term management of USDOE transuranic waste. W.S.Bennett, K.V.Gilbert (Rockwell Internat., Rocky Flats Plant, Golden, CO, USA), R.Y.Lowrey.

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.357-60

Operations of the USDOE and its predecessor agencies have generated large quantities of waste materials contaminated with transuranic (TRU) elements. These wastes were originally managed by shallow land burial. In 1970 a change in policy occurred which required that wastes contaminated with TRU elements above 10 nCi/gm be placed in retrievable storage pending development of a permanent isolation method. The policy change occurred because of concern that the high radiotoxicity of many TRU isotopes, combined with their long halflives, might pose a threat to the health and safety of future generations. (5 refs.)

106024 Transuranic Waste Treatment Facility design alternates. A.L.Ayers,Sr. (EG&G Idaho Inc., Idaho Falls, ID, USA).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.361-4

The Transuranic Waste Treatment Facility (TWTF) will process transuranic (TRU) waste in retrievable storage at the Idaho National Engineering Laboratory (INEL). The costs for a TWTF concept using a slagging pyrolysis incinerator were excessive. Alternate concepts using a slow speed shredder, a rotary kiln incinerator, and concrete immobilization should result in significant cost reductions. These will be included in future TWTF considerations. (no refs.)

106025 Volume reduction and solidification of low radioactive and plutonium waste—technology and operation experience. K.-G.Hackstein (NUKEM GmbH, Hanau, Germany).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.365-8

The author deals mainly with the volume reduction and solidification of radioactive waste generated from nuclear power plants, but also includes the work which has been done to reduce the volume of plutonium bearing waste generated by fuel-fabrication plants. (no refs.)

106026 Recent advances in power plant radwaste volume reduction systems and end product characteristics. J.A.Blewett (Atcor Engineered Systems Inc., Farmington, CT, USA), M.Van Dorpe.

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.371-6

The preconditioning of nuclear power plant liquid wastes is of vital importance if the volumes, decontamination factors (DF) leachability and ability to solidify the wastes is to be optimized during the Volume Reduction Process. Extensive testing conducted by Belgonucleaire (BN) and ATCOR in the development of the ATCOR/BN Volume Reduction System has proven the benefits of the chemical pretreatment as a major part of the Volume Reduction Process. (no refs.)

106027 Development of chemical methods of radioactive waste management for UK power reactor sites. D.Bradbury (Berkeley Nuclear Labs., CEGB, Berkeley, England).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.377-80

Chemical processing can be beneficial in the management of medium level radioactive waste. The purpose of such processing is to reduce the volume of the waste, to separate active components from inactive components, or to change the waste's chemical form to make it more amenable to safe disposal. This paper describes two chemical techniques which are currently being developed to assist in the management of radioactive waste from the UK's Magnox Power Reactor sites. The first case concerns regeneration and reuse of cesium-selective ion exchange materials and in the second case a process is described for selectively dissolving Magnox alloy waste in carbon dioxide saturated water as a means of separating it from active components. (5 refs.)

106028 Removal of radioactive materials from waste solutions via magnetic ferrites. T.E.Boyd, R.L.Kochen, M.Y.Price (Rockwell Internat., Rocky Flats Plant, Golden, CO, USA).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.381-4

Ferrite waste treatment was found to be effective in removing actinides from simulated Rocky Flats process waste solutions. With a one-stage ferrite treatment, plutonium concentrations were consistently reduced from 10^{-4} g/l to less than 10^{-8} g/l and americium concentrations were lowered from 10^{-7} g/l to below 10^{-10} g/l. In addition, significantly less solid was produced as compared with the flocculant precipitation technique now employed at Rocky Flats. Aging of ferrite solids and evaluated beryllium and phosphate concentrations were identified as interferences in the ferrite treatment of process waste, but neither appeared serious enough to prevent implementation in plant operations. (8 refs.)

106029 Removal of cesium from a salty, aqueous waste with sodium tetraphenyl boron. W.H.Bond, M.K.Williams, C.M.Colvin, G.L.Silver (MRC-Mound; Miamisburg, OH, USA).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.385-9

A process for the coprecipitation of cesium-137 with potassium, using sodium tetraphenyl boron, from a salty, aqueous, low-level radwaste was developed and successfully conducted. Potential treatments for cesium removal from the waste were first evaluated. As a result of this evaluation (which compared a number of factors including cost, safety, equipment availability, and decontamination) physical separation techniques and adsorbents were eliminated. Two chemical treatments involving sodium tetraphenyl boron and copper ferrocyanide were further tested. Treatment with sodium tetraphenyl boron was chosen and successfully reduced the cesium-137 concentration in the supernatant of the waste from 570 to 4 counts/min/ml. (5 refs.)

106030 Improved radwaste economics and operating performance by use of the etched disc backflushable filter. B.V.Coplan (BVC Consultants Inc., Sun City Center, FL, USA).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.390-4

Filtration of liquid radwaste streams is a basic unit operation for liquid radwaste management systems at nuclear power plants and other nuclear facilities. Traditionally, PWRs, for most of their filtration applications, have used disposable cartridge filters, while BWRs have generally used pressure precoat filters. A filter, etched disc backflushable filter, has been developed which eliminates, or greatly reduces, the problems and operating expenses encountered with cartridge and precoat filters. It has shown, in over five years of continuous online service, that it is both efficient and reliable and should be considered for any new or retrofit filtration application in radioactive liquid processing. The author presents summaries of some economic analyses made by utilities, or in some cases by their architect/engineers, for specific new and retrofit installations. The studies were made to determine if replacing a cartridge filter with an etched disc backflushable filter would be economically attractive. (4 refs.)

106031 The new aqueous waste treatment facility at Rocky Flats. K.G.Peter (Rockwell Internat., Rocky Flats Plant, Golden, CO, USA).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.395-7

The new waste treatment facility at Rocky Flats, Building 374, is designed to remove radioactive and chemical contaminants from aqueous process effluents collected from operations throughout the plant. By utilizing evaporation as well as precipitation, flocculation, and clarification, plant wastes are converted into reusable distilled water, disposable and retrievable solids, and exhaust gases. Total average capacity of the facility is 14900 l/hr as evaporator feed, producing an average of 80 kg/hr of dried sludge and 320 kg/hr of evaporator salts. (1 ref.)

106032 Remote aspects of treating and handling radioactive wastes. K.Wegner (NUKEM GmbH, Hanau, Germany).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.413-17

Carrying out detailed handling analysis on process components is the only way to get a fundamental basis for the choice of handling concepts. It is necessary to set up methods for the procedure of handling analysis in a systematic, uniform and checkable way. Large hot cell concepts promise a lot of advantages, but these concepts live and die with the availability of suitable handling equipment. High emphasis has to be put into the development of this special equipment. (no refs.)

106033 The defense waste processing facility a remote process for solidification of Savannah River Plant high level waste. R.Maher, L.F.Shafranek, J.A.Kelley, R.W.Zeyfang, A.J.Lethco (E.I. du Pont de Nemours & Co., Savannah River Plant, Aiken, SC, USA).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.421-30

The Department of Energy (DOE) is proposing that a defense waste processing facility (DWPF) be built at the Savannah River Plant (SRP) to remotely process and immobilize high level radioactive waste produced at the site. Research, development and design of the facility is being provided by a multidisciplined task force of personnel from the Du Pont Company which designed, built and has operated SRP since 1950. This remotely operated facility will immobilize 28 million gallons of high level waste now stored in tanks, plus the waste to be generated from continued reprocessing operations. Borosilicate glass has been selected as the reference waste form for the immobilization process. (no refs.)

106034 SRP radioactive glass studies: small-scale process development and product performance. M.J.Plodinec, P.D.Soper, N.E.Bibler, J.L.Kessler (E.I. du Pont de Nemours & Co., Savannah River Lab., Aiken, SC, USA).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.431-4

The Savannah River Plant has been producing defense nuclear materials for over 25 years. Radioactive wastes from chemical separation processes have accumulated during this time and now amount to approximately 25 million gallons, all of which is stored in underground tanks on the plant site. The Savannah River Laboratory (SRL) has been actively investigating methods of immobilization of these wastes. Recent results are reviewed. These results show that the slurry-fed melting process can immobilize a wide range of waste compositions with minimal effluents at acceptable production rates. A small-scale joule-heated ceramic melter contained in the Shielded Cells Facility has demonstrated the vitrification process for actual Savannah River Plant radioactive waste. Losses of radionuclides due to volatility are low and easily treated, and the glass produced is of comparable quality to laboratory-prepared simulated glass. Future work will include studies with wastes from other tanks, using new frit compositions. Leaching tests will continue, with emphasis being placed on long-term tests under anticipated repository conditions. (6 refs.)

106035 Spray calcination of SRP waste compositions for ceramic waste forms. L.F.Grantham, J.F.Flintoff (Energy Systems Group, Rockwell Internat. Corp., Canoga Park, CA, USA).

Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.435-8

A heated-gas calciner produces a reactive powder suitable for ceramic immobilization of nuclear waste. This spray calciner has the added advantages of simultaneously destroying nitrates and organics in the waste. In addition, chemical tailoring as well as valence control were also accomplished during the calcination step. Though spray calcination remains the reference calcination method, Rockwell and LLNL are investigating alternate calcination methods for ceramic immobilization of nuclear waste. (8 refs.)

106036 High level waste management at the Idaho Chemical Processing Plant. J.R.Berreth, B.R.Dickey (Exxon Nuclear Idaho Co., Idaho Falls, ID, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.439-44
The paper summarizes past and current high-level waste management practices at the Idaho Chemical Processing Plant (ICPP); options for long-term waste management of existing and future waste calcine are also emphasized. (17 refs.)

106037 High level waste management and characterization at the Hanford plant site. J.L.Deichman (Rockwell Hanford Operations, Richland, WA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.449-52
Of the total 540-million curie fission product inventory at Hanford in 1981, 99% was generated as high-level waste. Methods of storing this inventory and methods for reducing the volume of this inventory are discussed. (2 refs.)

106038 10 CFR 61 waste form requirements. T.C.Johnson, P.H.Lohaus, R.D.Smith (US Nuclear Regulatory Commission, Washington, DC, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.455-6
The Nuclear Regulatory Commission (NRC) staff is preparing a regulation on low-level radioactive waste management, 10 CFR 61. The performance objectives of this regulation stress: 1) the long-term stability of the disposal site to minimize water infiltration into trenches and to minimize remedial maintenance operations, and 2) the protection of individuals as well as populations. Based on these objectives, a waste classification system has been developed which is used for determining the waste form requirements for specific wastes. (no refs.)

106039 Radioactive waste: commercial disposal practices. J.J.Scoville (US Ecology Inc., Louisville, KY, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.457-9
Commercial low-level radioactive waste is disposed at three commercial disposal facilities. These facilities differ from each other climatically as well as in hydrological and geological characteristics. Therefore, the individual sites must tailor the conduct of operations and the method of waste burial to provide for the proper long-term burial of low-level radioactive waste. This paper briefly examines the current disposal practices utilized at US Ecology's Beatty, Nevada and Richland, Washington disposal facilities. (1 ref.)

106040 Barnwell low-level waste disposal operations. D.G.Ebenhack (Chem-Nuclear Systems Inc., Bellevue, WA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.460-1
The CNSI burial facility is one of three operating commercial shallow-land burial disposal sites available to generators of low-level radioactive waste. The Barnwell facility was originally licensed in early 1971 and has been in operation since then. It is located in South Carolina's coastal plain adjacent to the eastern boundary of DOE's Savannah River Project and Allied General's reprocessing facility. The facility encompasses an area of approximately 300 acres, of which 47 acres have been utilized for disposal to date with a remaining acreage available for burial of approximately 160 acres. The remaining acreage not designated for future burial activities is utilized for administrative and operation areas and as a buffer zone surrounding the site. The author discusses some of the past, present and future trends in Barnwell waste disposal operations. (no refs.)

106041 Alternatives for future land disposal of radioactive waste. C.W.Mallory (Hittman Nuclear & Dev. Corp., Columbia, MD, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.462-5
The first commercial radioactive waste disposal site was opened in Beatty, Nevada in 1962. Since that time five other sites have been opened and three of the six are now closed. All of the commercial radioactive waste sites have been shallow land burial sites. Of these six shallow land burial sites that have been opened two are located in arid regions having permeable soils, two are located in humid areas with permeable soils, and two are located in humid areas with the trenches over impervious strata. The latter two sites located at Morehead, Kentucky and West Valley, New York have been closed. In addition the site at Sheffield, Illinois was closed when a license to open additional trenches was not granted and the costs of conducting additional hydrogeologic investigations became prohibitive. The paper discusses the conditions leading to the closures of these sites and the actions that will be necessary to decommission shallow land burial sites. It also considers alternative methods for the disposal of low-level radioactive waste in the future. (no refs.)

106042 Novel experiments for understanding the shallow-land burial of low-level radioactive wastes. G.L.DePoorter, W.V.Abeele, T.E.Hakonson, B.W.Burton, B.A.Perkins (Environmental Sci. Group, Los Alamos Nat. Lab., Los Alamos, NM, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.466-70
Three field experiments that will provide data on water movement in SLB facilities are described. The experiments are designed to measure water movement, to quantify techniques to control water movement, and to determine the effects of surface moisture content fluctuations on liquid and vapor movement back to the surface. (5 refs.)

106043 Evaluation of geologic materials to limit biological intrusion of low-level waste site covers. T.E.Hakonson, G.C.White, E.M.Karlen (Environmental Sci. Group, Los Alamos Nat. Lab., Los Alamos, NM, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.471-6
Reports the preliminary results of a screening study to determine the effectiveness of four biobarrier materials to stop plant root and animal penetration into simulated low-level wastes. Experiments employed 288 lysimeters consisting of 25-cm-diameter PVC pipe, with four factors tested: plant species (alfalfa, barley, and sweet clover); top soil thickness; biobarrier material (crushed tuff, bentonite clay, cobble, and cobble-gravel; and biobarrier thickness (clay—15, 30, and 45 cm, others 30, 60, and 90 cm). The crushed tuff, a sandy backfill material, offers little resistance to root and animal intrusion through the cover profile, while bentonite clay, cobble, and cobble-gravel combinations do reduce plant root and animal intrusion through cover profiles. However, desiccation of the clay barrier by invading plant roots may limit the usefulness of this material as a moisture and/or biological barrier. The cobble-gravel combination appears to be the best candidate for further testing on a larger scale because the gravel helps impede the migration of soil into the cobble layer—the probable cause of failure of cobble-only biobarriers. (15 refs.)

106044 In-situ stabilization of a low-level radioactive site—a case history. A.A.Metry, D.R.Phoenix (Roy F. Weston Inc., Designers-Consultants, West Chester, PA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.477-84
The US DOE is considering several methods for carrying out remedial actions in Canonsburg, Pennsylvania, at the site of an inactive uranium-processing mill. The main objective of this study is to determine the feasibility of in-situ stabilization as the remedial action. In-situ stabilization is an alternative to site decontamination and offsite disposal. The problems associated with offsite hauling of large quantities of contaminated material and with the location and development of a new disposal site could be avoided by the implementation of an in-situ stabilization concept. In addition, the in-situ approach would be more cost-effective than offsite disposal. This study will establish that a technically feasible and implementable in-situ stabilization concept can be developed that meets regulatory requirements and is cost-effective. (6 refs.)

106045 Mound pelletized waste form demonstration program. E.L.Lewis, R.F.Herbert,Jr., J.W.Doty,Jr. (MRC-Mound, Miamisburg, OH, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.487-92
During the past 4 years, an immobilized waste matrix has been under development at Mound. The matrix is a cold pressed, high density, low porosity pellet which is composed of Portland 1A cement, the waste material, water, and in some cases, special additives. The waste materials immobilized include incinerator ash and associated sludge produced in the incinerator off-gas system. Initially, nonradioactive pellets were produced in laboratory-scale experiments. Pilot-scale experiments were next performed using 'Pu-238 oxide' contaminated ash and sludge. Sample pellets were tested for compressive strength, leachability, and gas generation. Finally, a production system was designed and built, and it is now producing plutonium-contaminated waste/cement pellets on a routine basis. (12 refs.)

106046 Immobilization of Rocky Flats wastes using the inert carrier process. P.M.Arnold, J.A.Ledford (Rockwell Internat., Rocky Flats Plant, Golden, CO, USA), M.Kasahara, S.A.Hobart.
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.493-6
A demonstration plant to solidify transuranic waste has been designed for Rockwell International's Rocky Flats Plant. This solidification system was designed by Quadrex Corporation with support from United Technologies Corporation and was based on the inert carrier process technology developed by United Technologies Corporation (UTC). These three companies have worked together towards the development of a unique transuranic waste immobilization system. The demonstration plant has been designed and sized to be used as an experimental test unit with the option of converting the system to a continuous production plant. The demonstration plant will test the use of freon TF as an inert carrier and cement as a binding agent. Freon was suggested as the carrier since it is nonflammable and is currently used at the Rocky Flats site as a solvent; cement was considered as the most desirable binder since it is readily available and relatively inexpensive. (no refs.)

106047 Solidification of ion exchange resin wastes in hydraulic cement. R.Neilson,Jr., P.Kalb, M.Fuhrmann, P.Colombo (Dept. of Nuclear Energy, Brookhaven Nat. Lab., Upton, NY, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.497-503
Work has been conducted to investigate the solidification of ion exchange resin wastes with Portland cements. These efforts have been directed toward the development of acceptable formulations for the solidification of ion exchange resin wastes and the characterization of the resultant waste forms. The paper describes formulation development work and defines acceptable formulations in terms of ternary phase compositional diagrams. The effects of cement type, resin type, resin loading, waste/cement ratio and water/cement ratio are described. The leachability of unsolidified and solidified resin waste forms and its relationship to full-scale waste form behavior is discussed. Gamma irradiation was found to improve waste form integrity, apparently as a result of increased resin crosslinking. Modifications to improve waste form integrity are described. (7 refs.)

106048 The feasibility of incinerating and vitrifying organic resins in a single step. J.L.Buelt (Pacific Northwest Lab., Richland, WA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.504-9
Pacific Northwest Laboratory has completed a feasibility testing program for a process designed to incinerate and vitrify the inorganic and radionuclide components of EPICOR II resins in a single step. The process tests utilized pilot-scale, high-level waste vitrification equipment with a special feeding technique that forces contact of the combustible resins with molten glass. This technique demonstrated high retention of nonradioactive forms of cesium and strontium in the glass product. Other performance evaluations of the process were also favorable. (7 refs.)

106049 The applications of iron-enriched basalt to TMI radioactive waste disposal. D.E.Owen, J.M.Welch, P.V.Kelsey, J.E.Flinn (EG&G Idaho Inc., Idaho Falls, ID, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.515-22
Iron-enriched basalt (IEB), a man-made analogue to natural basalt, has been investigated as a dissolution and immobilization medium for Three Mile Island (TMI) radioactive wastes. The research has focused on the ability of IEB, a glass-ceramic whose principal constituents are SiO_2, Fe_2O_3+FeO, and Al_2O_3, to contain TMI zeolites, resins and core debris, and on the practical aspects of producing IEB on a large scale using a joule-heated melter. The retention of cesium and strontium during high-temperature processing of IEB and the leach rate of these species from IEB in 363K deionized water have been investigated. Simulated TMI core debris (UO_2, Zircaloy, and stainless steel) have been successfully dissolved in IEB by using an air bubbler to

accelerate the dissolution process. Large-scale IEB castings (10 kg and 75 kg) incorporating simulated TMI wastes have been prepared using a 250 kg capacity joule-heated research melter. Subjecting the castings to a controlled cooling produced fine grained monoliths with almost no microcracks. (7 refs.)

106050 Economics of transuranic waste immobilization and disposal. C.L.Timmerman (Pacific Northwest Lab., Richland, WA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.523-7
Seven proposed transuranic (TRU) waste immobilization systems are assessed and evaluated on the basis of costs. Specific cost components that are estimated include processing costs, transportation costs, and repository or disposal costs. Economics are examined to determine the effects that each component has on the system costs. The evaluation led to two recommended systems based on these cost component evaluations. A cast-cement system is recommended for immobilized TRU wastes disposed in a defense-related waste repository because of lower processing costs and a reduced incentive for waste volume reduction. The joule-heated glass system is recommended for the immobilized TRU wastes placed in a commercial waste repository since the increased disposal cost places a greater emphasis and value upon an immobilization system which provides a large volume reduction. (6 refs.)

106051 West Valley demonstration project—strategy for an achievable but challenging project. J.P.Hamric (Dept. of Energy, Idaho Operations Office, Idaho Falls, ID, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.531-3
The West Valley facility, a shutdown reprocessing plant, was taken over by West Valley Nuclear Services Co. Inc. in February 1982. The reopening of the facility for a waste management demonstration project has now reached the stage of identifying all links in the chain for solidification, storage and shipment of high level waste. (no refs.)

106052 Present status of the West Valley demonstration project. J.L.Knabenschuh.
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.534-6
The West Valley project is to demonstrate cost-effective and safe commercial high-level waste immobilisation. The author discusses the waste forms, process development and safety documentation for this project. (no refs.)

106053 Evaluation of process alternatives for solidification of the West Valley high-level liquid wastes. L.K.Holton, D.E.Larson (Pacific Northwest Lab., Richland, WA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.537-41
The Department of Energy established the West Valley Solidification Project in 1980. The project purpose is to demonstrate removal and solidification of the high-level liquid wastes presently stored in tanks at the Western New York Nuclear Service Center (WNYNSC). As part of this effort, the Pacific Northwest Laboratory conducted a study to evaluate process alternatives for solidification of the WNYNSC wastes. Two process approaches for waste handling before solidification, together with solidification processes for four terminal and four interim waste forms, were considered. The first waste-handling approach, designated the salt/sludge separation process, involves separating the bulk of the nonradioactive nuclear waste constituents from the radioactive waste constituents, and the second waste-handling approach, designated the combined-waste process, involves no waste segregation prior to solidification. The processes were evaluated on the bases of their readiness for plant startup by 1987, relative technical merits, and process cost. The study has shown that, based on these criteria, the salt/sludge separation process with a borosilicate glass waste form is preferred when producing a terminal waste form. It was also concluded that if an interim waste form is to be used, the preferred approach would be the combined waste process with a fused-salt waste form. (7 refs.)

106054 An evaluation of the AVM process and its applicability to West Valley. W.A.Cameron, S.Merlin.
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.542-6
The author introduces the French program for the vitrification of high level nuclear wastes. The reasons for the advanced state of the program are briefly discussed and some indication of the relation between the French program and the situation at West Valley is provided. (no refs.)

106055 High-level waste solidification system for the Western New York Nuclear Service Center. J.R.Carrell, L.K.Holton, D.H.Siemens (Pacific Northwest Lab., Richland, WA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.547-52
A preconceptual design for a waste conditioning and solidification system for the immobilization of the high-level liquid wastes (HLLW) stored at the Western New York Nuclear Service Center (WNYNSC) was completed in 1981. The preconceptual design was conducted as part of the Department of Energy's West Valley Demonstration Project, which requires a waste management demonstration at the WNYNSC. The authors summarize the bases, assumptions, results and conclusions of a preconceptual design study of a solidification system designed for installation in existing facilities. (1 ref.)

106056 Low level waste management—a brief overview of the Western European countries. L.Mergan, M.Vandorpe (Belgonucleaire, Brussels, Belgium).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.555-8
A review of the low level waste management in the Western European countries is presented. It is found that 97 nuclear power plants are already operating, only 34 are provided with onsite radwaste encapsulation, and 85% of them use cement as solidification matrix. Governments of the most active countries have created specific governmental organizations who will be responsible for storage and final disposal of the conditioned wastes. (no refs.)

106057 Separation of nonradioactive wastes from wastes of low specific radioactivity. A.N.Sinclair (Nuclear Generation Div., Ontario Hydro, Toronto, Ontario, Canada).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.559-63
A sorting program is proposed to separate mildly-contaminated waste into radioactive and nonactive components. Benefits would include a considerable reduction in space required for indefinite storage of radioactive waste, and a corresponding reduction in costs. Potential engineering problems in various parts of the program, and methods for dealing with them, are discussed. These areas of concern include waste collection, monitoring standards and equipment, the mechanics of the actual sorting process, and performance verification. (no refs.)

106058 Current status of low-level waste segregation technology. D.E.Clark, P.Colombo, V.L.Sailor (Dept. of Nuclear Energy, Brookhaven Nat. Lab., Upton, NY, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.564-70
The state-of-the-art of LLW segregation technology and current practices in the USA have been surveyed at representative facilities. Favourable experience has been reported at various sites following the application of segregation controls. Efficient segregation of nonradioactive waste from radioactive wastes at the point of generation can drastically reduce the volume and cost of waste requiring treatment and disposal. Segregation of wastes can also lead to more efficient waste processing by which, for example, personnel exposures can be reduced and solidification can be directed towards certain 'problem' wastes. The authors report on the state-of-the-art survey and address current and projected LLW segregation practices and their relationship to other waste management activities. (21 refs.)

106059 Figure-of-merit analysis and cost-effectiveness of low-level radioactive waste treatment systems. N.D.Cox, K.L.Falconer, M.D.McCormack (EG&G Idaho, Idaho Falls, ID, USA), H.D.Hootman, T.K.Thompson.
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.571-7
Two studies were performed to assess low-level waste treatment systems that are available commercially for volume reduction and/or solidification. In the first, a figure-of-merit decision analysis technique was used to evaluate fourteen low-level radioactive waste processing systems on their ability to treat power reactor wastes. The system judged superior to all the others was compaction of dry wastes with liquid wastes and sludges being directly incorporated into concrete; this was also the lowest cost system. In the second study, the cost economy of volume reduction measured in land disposal dollars was investigated. The greatest cost savings with volume reduction were realized with a BWR using a deep bed condensate polishing system; the least was with a PWR with condensate polishing. (7 refs.)

106060 Design of the CRNL radwaste solidification plant. W.H.Pettipas (Chalk River Nuclear Labs., AECL Res. Co., Chalk River, Ontario, Canada).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.578-81
Solid and liquid effluents from Canadian reactor systems and laboratories can contain widely varying quantities and species of radioactive solids and chemicals. Presently solid wastes are stored, while liquid wastes are diluted and dispersed, if possible. Those wastes which cannot be dispersed are stored in tanks for a suitable decay period. The Chalk River Nuclear Laboratories have been developing and refining volume reduction and activity immobilization techniques in support of the Canadian nuclear power program. A Waste Treatment Centre (WTC) has been constructed at CRNL to house volume reduction and immobilization systems which will treat liquid and solid wastes originating at, and transported to, CRNL. The Radwaste Solidification Plant (RSP) is housed in the WTC and handles liquid and combusted solid wastes. Liquids are accepted into the plant for concentration and mixing with bitumen in a wiped-film evaporator, Solid wastes in the form of incinerator ash are mixed with bitumen in a ribbon blender. The products of these two processes are placed in galvanized steel 210 L drums and then sealed. These product drums, once sealed, are transferred to the interim storage building where they are held pending shipment to a repository. (2 refs.)

106061 Implications of pathway analysis of deminimus concentrations of radioactive waste. J.R.Mernagh, P.J.Dinner, L.R.Olden, R.G.Tulk.
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.582-6
The authors present the results of pathway analysis performed to assess the possible exposures resulting from the disposal of waste which may contain small quantities of artificially produced or enhanced radioactivity into sanitary landfill sites. The four pathways considered are external exposure, dust inhalation, food, and water ingestion. The proposed level of 100 pCi/g as the limit below which waste would be considered nonradioactive was found to produce a dose rate to members of the critical group of less than the suggested minimus level of 10 mrem/a^1 under conservative exposure conditions, and less than 1 mrem/a^1 with more realistic assumptions. (15 refs.)

106062 Transportation system (TRUPACT) for contact-handled transuranic wastes. L.E.Romesberg, R.B.Pope (Transportation Technol. Center, Sandia Nat. Labs., Albuquerque, NM, USA), R.M.Burgoyne.
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.589-94
Contact-handled transuranic defense waste is being, and will continue to be, moved between a number of locations in the United States. The DOE is sponsoring development of safe, efficient, licensable, and cost-effective transportation systems to handle this waste. The systems being developed have been named TRUPACT which stands for TransUranic PACkage Transporter. The system will be compatible with Type A packagings used by waste generators, interim storage facilities, and repositories. TRUPACT is required to be a Type B packaging since larger than Type A quantities of some radionuclides (particularly plutonium) may be involved in the collection of Type A packagings. TRUPACT must provide structural and thermal protection to the waste in hypothetical accident environments specified in DOT regulations 49CFR173 and NRC regulations 10CFR71. Preliminary design of the systems has been completed and final design for a truck system is underway. The status of the development program is reviewed and the reference design is described. Tests that have been conducted are discussed and long-term program objectives are reviewed. (5 refs.)

106063 Transportation packaging for processed transuranic waste. W.B.Andrews (Pacific Northwest Lab., Richland, WA, USA), R.H.Jones.
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.595-600
This project was to develop design criteria and packaging design concepts for transportation of processed TRU (PTRU) waste products with surface dose rates 2 mSv/hr (200 mR/hr). Two transportation categories are potentially feasible for waste forms considered in this project under proposed revisions to US transportation packaging regulations. These include low level solids and

type B packagings. Much uncertainty remains on final design criteria due to current trends in material performance requirements and packaging construction economics. However, preliminary estimates indicate large economic benefits to designing a combination transportation/disposal packaging. (7 refs.)

106064 Defense TRU waste transportation and receiving simulation. R.L.Engel, P.M.Daling (Pacific Northwest Lab., Richland, WA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.601-5
Pacific Northwest Laboratory has recently conducted a simulation analysis to predict the transportation and waste handling equipment requirements for transporting government owned transuranic waste to the Waste Isolation Pilot Plant (WIPP). Two interrelated models were developed. One estimates the time required to receive and unload shipping containers at the WIPP. The other model uses this estimate to predict the number of shipping containers and transporters that will be required. (5 refs.)

106065 Process and transportation safety evaluation of a synthetic basaltic waste form. R.P.Sandoval, W.B.Leisher (Transportation Technol. Center, Sandia Nat. Labs., Albuquerque, NM, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.606-10
Tests were performed to address two areas of concern: the response of a slagging-pyrolysis incineration (SPI) processed transuranic waste form to realistic process handling and transportation accident scenarios, and the quantity of particulate production of the SPI processed waste form subjected to Type A packaging test conditions. Several tests were performed to provide preliminary data to assess the qualifications of SPI transuranic waste forms as a DOT proposed low-level solid. Test results indicate that the SPI waste form and canister are capable of satisfying the Type A test conditions specified for the new proposed low-level solids (LLS) category. (5 refs.)

106066 Overview of waste-handling requirements for a nuclear waste repository in basalt. R.J.Gimera, J.M.Davis (Rockwell Hanford Operations, Basalt Waste Isolation Project, Richland, WA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.611-22
The Basalt Waste Isolation Project (BWIP) has the responsibility for assessing the feasibility of using the deep basalts beneath the Hanford Site as a medium for nuclear waste disposal, as part of the National Waste Terminal Storage program. The authors discuss the waste handling system for spent fuel canisters; the waste-handling building, the receiving facilities, the hot cell, the transfer cask, the transfer-cask transporter, and radwaste management are considered. (no refs.)

106067 Operational features of the waste isolation pilot plant (WIPP). R.K.Brown, V.F.Likar (Westinghouse Electric Corp., Tech. Support Contractor, Pittsburgh, PA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.623-7
The Department of Energy plans to construct the Waste Isolation Pilot Plant (WIPP) in southeast New Mexico. The facility will retrievably store transuranic waste from defense activities of the United States and conduct experiments with defense high level waste which would be retrieved at the end of the experiments. The authors describe the handling of the transuranic waste, both by contact and by remote handling methods. It also describes the arrangement of the shaft and the underground ventilation system, and the protection provided during surface handling of the waste. Finally, the present status of construction at the WIPP site is discussed. (no refs.)

106068 Requirements for certifying TRU waste for the WIPP. R.J.Merlini, D.W.Rutherford (Rockwell Internat., Rocky Flats, Golden, CO, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.628-31
The authors identify and describe the requirements associated with the certification of TRU waste for acceptance at the Waste Isolation Pilot Plant (WIPP). These requirements specify what a transuranic waste generating site must accomplish to establish a waste certification program and produce certified TRU waste. Certification basically requires that the waste generation sites establish a certification program that controls and demonstrates that all the waste characteristics identified by the WIPP Waste Acceptance Criteria (WAC) are met for site waste. (4 refs.)

Fuel cycles: A bibliography of AECL publications .... See Entry 105056

Extension of fission product model for use in lattice calculation of thorium fueled BWR .... See Entry 105948

CORE-MASTER—the ASEA-ATOM boiling water reactor core analysis system .... See Entry 105951

Developments in breeder reprocessing technology and design concepts—the remote operation and maintenance aspects .... See Entry 106076

Operational experience in remote handling during the reprocessing of PFR fuel elements .... See Entry 106077

EBR-II reactor transient qualification tests .... See Entry 106090

Study of dilute reagent decontamination for application in boiling water reactors .... See Entry 106107

Thermal shock in nuclear reactors .... See Entry 106115

Simulation test on interactions of Zircaloy claddings deforming in fuel assembly under LOCA conditions .... See Entry 106123

Possible research program on a large scale nuclear pressure vessel .... See Entry 106145

Conversion of smectite to illite in hydrothermal systems: A literature review .... See Entry 106147

Benefiting from standardization in Russia and Western Europe .... See Entry 106153

Waste management and environmental controls in the Australian uranium mining industry .... See Entry 106173

A risk assessment for the transportation of radioactive zeolite liners .... See Entry 106180

Purification of zirconium by electrotransport .... See Entry 109121

Possible mechanism for embrittlement of Zircaloy by molybdenum and tungsten .... See Entry 109510

Joint exercise to compare fatigue crack growth data obtained on type 304/316 stainless steel .... See Entry 109512

Low temperature stress corrosion cracking of Inconel 600 under two different conditions of sensitization .... See Entry 109568

An apparatus for determining the deformability of a material in a complex strain state with neutron irradiation from the Neitron 9 unit .... See Entry 109669

The point of zero charge and adsorption properties of natural magnetite .... See Entry 109781

The availability of uranium, thorium and heavy water in the world in the light of the results of the INFCE study .... See Entry 109863

Deep-ocean radioactive waste disposal: an evaluation of the seaweed critical pathway .... See Entry 110192

28.42H Fuel preparation and reprocessing
(inc. isotope separation and enrichment)

106069 Preparation of thorium metal sponge from thorium oxalate. P.L.Vijay, J.C.Sehra, C.V.Sundaram, K.R.Gurumurthy, R.V.Raghavan (Bhabha Atomic Res. Centre, Bombay, India).
Trans. Indian Inst. Met., vol.35, no.2, p.143-7 (April 1982). [received: Aug. 1983]
Deals with the laboratory scale preparation of high purity thorium metal by magnesium reduction of thorium tetrachloride. In the preparation of thorium tetrachloride from thorium oxalate, studies have been made to optimise chlorination conditions with various chlorinating agents such as CO-Cl_2, CO_2-CCl_4 and Cl_2-CCl_4. The quality of the sponge obtained from single and double distilled chloride has been assessed. The overall process efficiency under the optimum conditions was 81%. Thorium metal button, prepared by arc melting the sponge, gave a hardness of 90 VPN, and was analysed as 0-847, N-20, C-719, Mg-100, Fe-49, and Ni-50 (expressed in parts per million parts of thorium). The button has been further purified by electron beam melting to improve its ductility (button hardness—60 VPN). (19 refs.)

106070 Preparation of (UPu)C, (UPu)N and (UPu) (CN) powders. C.Ganguly, P.R.Roy (Radio Metall. Div., Bhabha Atomic Res. Centre, Bombay, India), A.K.Seal.
Trans. Indian Inst. Met., vol.35, no.2, p.148-61 (April 1982). [received: Aug. 1983]
The principal methods developed so far for the preparation of (UPu)C, (UPu)N and (UPu) (CN) powders on a laboratory scale are: (a) direct synthesis from elements, (b) carburisation and nitridation of fine uranium-plutonium alloy powder and (c) carbothermic reduction of uranium-plutonium oxides. The carbothermic reduction process has the greatest potential for commercial utilisation because of economic incentive and inherent safety. The development work carried out in different laboratories has been confined to uranium rich compositions ($Pu/U=0.18$ to 0.43) only. Results of the laboratory scale preparation of plutonium rich ($Pu/U=2.33$) (UPu)C, (UPu)N and (UPu)(CN) by the carbothermic reduction of the oxide are reported. (29 refs.)

106071 Pyrohydrolysis reactions of UF_4 and UO_2F_2. Effect of oxygen on reactions. M.Iwasaki, N.Ishikawa (Tokai Res. Establ., JAERI, Tokai, Ibaraki, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.5, p.400-4 (May 1983).
This study was made for clarification of the pyrohydrolysis behaviours of UF_4 and UO_2F_2. The progress of the reaction was measured by titrating the amount of produced hydrogen fluoride. When nitrogen was used as carrier gas of water, the pyrohydrolysis of UF_4 proceeded at the temperatures of 350~400°C, and UO_{2+x} ($x \lesssim 0.3$) was formed; the value of x decreased with the decrease of oxygen dissolved in the water. In the case of oxygen carrier gas, the pyrohydrolysis of UF_4 formed U_3O_8-UO_2F_2 mixture as the reaction product in the above temperature region and the reaction was markedly retarded in the course because of lower rate in the pyrohydrolysis of UO_2F_2. The pyrohydrolysis of UO_2F_2 proceeded at a little higher temperature of 450~500°C in both cases of nitrogen and oxygen carrier gas and α-UO_3 was formed. (14 refs.)

106072 Theoretical analysis of ternary UF_6 gas isotope separation by centrifuge. T.Kai (Tokai Works, Power Reactor & Nuclear Fuel Dev. Corp., Ibaraki, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.6, p.491-502 (June 1983).
The author presents a theoretical analysis of the isotope separation in a centrifuge for the ternary gas mixture which includes ^{236}U besides ^{235}U and ^{238}U. The expressions for the diffusion velocities are used to derive diffusion equations in terms of the mole concentration and of the mass average velocity. The concentration distributions of the ternary UF_6 gas isotopes are calculated by numerically integrating the above diffusion equations with the aid of a flow field for an appropriate model centrifuge. A value function for two of any species in a multicomponent mixture is defined as a natural extension of the value function for a binary mixture. Furthermore, a total value function for the whole multicomponent mixture is defined as a linear combination of the obtained value function. The results of numerical calculations show that the total separative power for the ternary gas isotopes mixture derived from the total value function is an effective expression for the evaluation of centrifuge separation performance. (17 refs.)

106073 Evaluation of computational models for fission and spallation reactions used in accelerator breeding and transmutation analysis code. Y.Nakahara (JAERI, Tokai, Ibaraki, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.6, p.511-17 (June 1983).
Computational models for spallation and fission reactions used in an accelerator breeding and transmutation code have been evaluated by performing calculations for thin targets of Bi, Pb, Th and U in the energy range of 50~1000 MeV. Proton and neutron non-elastic and fission cross sections have been derived from the counts of real collisions and fission events in the targets. Several fission models in combination with a spallation model are compared with the experimental data due to Steiner et al. (1956) and Schimmerling et al. (1973). A good agreement has been obtained for a model with the level density parameters $a_n=A/10$ and a_f/a_n fitted to the data due to Il'inov et al. (1980). The mass dependence of the non-elastic cross sections has been calculated also with the use of the best fit model. A good agreement with the experimental data was obtained over a wide range of nuclear masses. (20 refs.)

106074 Separation of some radionuclides from fission product elements by adsorption on diethylene glycol succinate. M.B.Hafez, Abo El-Khair B.M. (Chem. Dept., United Arab Emirates Univ., Al Ain, Egypt).
J. Radioanal. Chem. (Switzerland), vol.78, no.1, p.25-8 (1983).
Separation of adsorbed radionuclides on diethylene glycol succinate (DGS) by diethylene-triaminepentaacetic acid (DTPA) was quantiatively performed. Adsorption between the radionuclides studied and DGS was attained at pH 5±0.5. Individual separations of ^{60}cobalt (II), ^{90}strontium (II), ^{144}cerium

(III), ^{233}uranium (VI) and ^{239}plutonium (IV) were done by 25 ml of 10^{-4} M of DTPA, as eluting agent, at different pH values. (5 refs.)

106075 Integrated testing of equipment for FBR fuel reprocessing. W.D.Burch (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Nucl. Eng. Int. (GB), vol.28, no.345, p.37-9 (Aug. 1983).
To support the development in the United States of equipment and systems for a proposed demonstration reprocessing plant for fast reactor fuel, the Integrated Equipment Test facility has been built at Oak Ridge National Laboratory for trials of prototype hardware systems. (no refs.)

106076 Developments in breeder reprocessing technology and design concepts—the remote operation and maintenance aspects. M.J.Feldman (Fuel Recycle Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.401-2
The conceptual design of a facility for breeder reactor reprocessing recently done at Oak Ridge National Laboratory included capabilities to process high-level waste, transuranium waste, low-level waste, and gaseous effluents. The solutions in remote control engineering that will satisfy a highly efficient, high-level waste processing facility, which does not rely on personnel exposure to resolve its maintenance and operational problems, will be similar to solutions that satisfy the same problems in reactor maintenance, fuel refabrication and reprocessing, fusion plant maintenance, decontamination and decommissioning, and an ever-present category called unplanned events. (5 refs.)

106077 Operational experience in remote handling during the reprocessing of PFR fuel elements. G.Bailey (Waste Management Section, Dounreay Nuclear Power Dev. Establ., Dounreay, Scotland).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.403-11
The reprocessing of PFR elements at DNE was achieved using new techniques of remote handling as well as standard manipulative procedures. This engineering balance was justified in the successful completion of two PFR reprocessing campaigns, where the personnel involved received low radiation doses. Development work is progressing along the lines of minimizing in-cell equipment, improved remote viewing, and the modular assembly and construction of equipment and cells. (3 refs.)

Fuel cycles: A bibliography of AECL publications .... See Entry 105056

Oxidation-reduction properties of mixed oxides in lanthanum-uranium-oxygen system .... See Entry 105960

BENCHMARK. Reference data on post irradiation analysis of light water reactor fuel samples .... See Entry 105980

Waste management and environmental controls in the Australian uranium mining industry .... See Entry 106173

The new waste calcining facility at ICPP .... See Entry 106182

Characteristics of a thermal neutron source based on an intermediate energy proton accelerator .... See Entry 106200

Polarographic waves of tri-n-butyl phosphate and polarographic determination of uranium in the presence of tri-n-butyl phosphate .... See Entry 109829

The availability of uranium, thorium and heavy water in the world in the light of the results of the INFCE study .... See Entry 109863

28.43 FISSION REACTOR OPERATION

106078 Automation with microcomputers.
Elektro-Anz. (Germany), vol.36, no.15-16, p.13-15 (Aug. 1983). In German.
The article looks at the way in which the microcomputers now available can be used to rationalize factory operations, optimize processes and enable manufacturing operations to be carried out at greater speed and with greater accuracy. Some of the examples briefly described include the rationalization of measuring processes, calibration systems and two systems for the monitoring and control of the power generation and feedwater supply of two nuclear reactors in Sweden. (no refs.) *R.S.*

106079 Simple method for evaluating mesh size effects in control rod worth analysis. K.Azekura, K.Kawashima, K.Inoue (Energy Res. Lab., Hitachi Ltd., Ibaraki, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.6, p.518-21 (June 1983).
A new method for evaluating mesh size effect on control rod worths using the first-order perturbation theory is presented. The method allows other effects such as diffusion coefficients to be evaluated at the same time, and hence computing and labour costs can be saved significantly. The authors apply the method to the typical fast reactor critical experiment ZPPR-9. (7 refs.)

106080 Mirage effect of non-linear transfer element (symmetric limiter) upon power spectral density function of statistical fluctuation. H.Fujita, H.Konno, K.Saito (Inst. of Materials Sci., Univ. of Tsukuba, Ibaraki, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.6, p.521-2 (June 1983).
Nuclear reactor noise intrinsically features nonlinear properties, which are occasionally revealed in power spectral density profiles. In order to clarify the characteristics of the noise profiles, the authors take the symmetric limiter as an example of the nonlinear element and present a numerical investigation of the distortion effects. (4 refs.)

106081 Heat transfer in the supercritical region at low pressure and mass velocity. G.V.Tsiklauru, T.S.Dzhishkariani, M.E.Kipshidze (Inst. of High Temperatures, Acad. of Sci., Moscow, USSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1187-92 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.709-15 (Nov. 1982). [received: Sept. 1983]
Results are presented from experiments on heat transfer in the supercritical region for pressures $p=0.05$-0.3 MPa and low mass velocities $\rho w=16.9$-168.9 kg/m^2.sec, i.e. for conditions characteristic of emergency and post-emergency regimes of operation of steam-generating equipment in nuclear power plants. (13 refs.)

106082 Post-accident monitoring at Arkansas One. M.Huff, J.Shea (Generation Engng. Dept., Arkansas Power & Light Co., Little Rock, AR, USA).
Nucl. Eng. Int. (GB), vol.28, no.343, p.29-32 (July 1983).
Arkansas Power and Light was one of the first utilities in the United States to install and operate the type of on-line post accident sampling system described here. A large investment has been made to ensure adequate post accident sampling, as well as improving normal sampling and reducing exposure to sampling system operators. The utility feels that the lessons learned are worth sharing with those contemplating similar modifications in the future. (no refs.)

106083 Large test rigs verify Clinch River control rod reliability. H.D.Michael, G.G.Smith (Westinghouse Electric Corp., Advanced Energy Systems Div., Madison, PA, USA).
Nucl. Eng. Int. (GB), vol.28, no.343, p.38-40 (July 1983).
Reliability testing programmes for the Clinch River FBR control rod systems have been carried out on two major facilities at Westinghouse's Waltz Mill site. One of the rigs contains three sodium loops and has been used for a complex matrix of shutdown tests. The other is principally for seismic testing. (no refs.)

106084 A theoretical analysis of the DC electromagnetic flow coupler. W.F.Hughes, C.C.Alexion (Westinghouse R&D Center, Pittsburgh, PA, USA).
Nucl. Eng. & Des. (Netherlands), vol.74, no.3, p.367-76 (1982).
A descriptive model and design procedure for the DC electromagnetic flow coupler is developed based on a quasione-dimensional analysis previously developed for the DC electromagnetic pump. It is shown that for a particular flow coupler geometry, the total efficiency and the pressure gradients through the pump and generator depend on two parameters—the Hartmann number and the ratio of the pump flow rate to generator flow rate. Thus, for a fixed Hartmann number the efficiency depends only on the flow ratio. However, for a fixed pressure rise through the pump it is shown that the efficiency depends only on the Hartmann number. Nomographs showing the operating characteristics and critical design points are presented. Example calculations for a full-size unit, suitable for use in a liquid-metal cooled fast breeder reactor are also discussed using the design nomographs. (11 refs.)

106085 Repairs to the coolant circuit of the Universities Research Reactor. H.Bridge, E.Humphreys (Univ. Res. Reactor, Risley, England).
Nucl. Energy (GB), vol.22, no.4, p.261-6 (Aug. 1983).
The Universities Research Reactor of the Universities of Liverpool and Manchester is one of the three low-power reactors financed in 1963 by the Science Research Council to provide research and training facilities in the nuclear sciences and related disciplines. During low-power operation on 29 March 1977, a leak detector on the drain pipe to the sump below the core gave a positive indication. The reactor was shut down and an inspection revealed water seeping from beneath the removable shielding in the south face. The authors describe the steps taken to locate the source of this seepage and details subsequent repairs to the primary coolant circuit. Apart from a few specialized tasks, the entire operation was carried out by members of site staff. The success of the health physics precautions enforced during the six-month period required to complete the repairs may be judged from the total beta/gamma dose of 7.33 man-rems received by the 21 workers involved. (2 refs.)

106086 Boiling heat transfer and nuclear power. K.Nishikawa.
Rep. Res. Inst. Ind. Sci. Kyushu Univ. (Japan), no.74, p.227-47 (1983). In Japanese.
The importance of boiling heat transfer in nuclear power production is stated and the relation among the information requirements of the nuclear reactor, thermodynamic data and boiling is clarified. In order to understand the boiling heat transfer in the field of nuclear power engineering by grasping the essence of boiling phenomena, the characteristics of three basic types of boiling (nucleate, film and transition) are illustrated. (38 refs.)

106087 Design, installation, and use of experimental facilities at the Texas A&M University Nuclear Science Center. G.Schlapper, D.E.Feltz, J.Head, J.Holland (Texas A&M Univ., College Station, TX, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.8-9 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
The Nuclear Science Center (NSC) at Texas A&M University (TAMU) is currently pursuing an upgrade aimed at improving existing facilities and developing new and unique facilities for experimental use. The objective of this program is to increase reactor utilization at reasonable costs. The purpose of this paper is to outline this effort. Two existing facilities for neutron radiography and production of tailored energy gamma beams are described in detail and planning for another experimental effort in the area of analysis of nuclear pumped plasmas is discussed. (no refs.)

106088 Reinitiation of pulsing operations at the Texas A&M Nuclear Science Center. D.E.Feltz, R.D.Rogers (Texas A&M Univ., College Station, TX, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.9-11 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
Pulsing operations of the Nuclear Science Center Reactor (NSCR) at Texas A&M University were terminated in September 1976 following the discovery of three damaged fuel elements during a routine inspection. A commitment was then made to the US Nuclear Regulatory Commission (NRC) to terminate pulsing of the NSCR until a thorough study of the damaged fuel had been completed. A report describing that study and discussing the possible mechanism of damage was issued in December 1981. Based on a recommendation in the report to establish a fuel temperature safety limit, the NRC issued a letter authorizing the reinitiation of pulsing the NSCR but limiting pulsing parameters 'to those in the current technical specifications or to a maximum calculated fuel temperature of 830°C'. (1 ref.)

106089 Thermal hydraulic studies for upgrading the Virginia Polytechnic Institute and State University Argonaut reactor from 100 to 500 kW. R.J.Florian, T.F.Parkinson, P.D.Holian, D.R.Krause, E.R.Ellis (Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.11-12 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
The Virginia Polytechnic Institute and State University (VPI&SU) nuclear reactor is an Argonaut UTR-10 reactor, which has been in operation since 1959. In 1966, it was upgraded from 10 to 100 kW(th). It is currently being upgraded to 500 kW(th). It will be the first Argonaut reactor in the USA to operate at a power level in excess of 100 kW(th). (2 refs.)

106090 EBR-II reactor transient qualification tests. F.S.Kirn (Argonne Nat. Lab., Idaho Falls, ID, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.15-17 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
During November 1982, EBR-II completed a series of transient tests to qualify the driver fuel and the reactor system for future transient test operation. Since 1965, EBR-II has served as a test bed for a large variety of LMFBR fuels and materials, operating under steady-state conditions, providing burnup levels in oxide and metal fuels up to 18 at.% and fluences on materials up to 20×10^{22} nvt. It is known that fuel performance is also related to rate of power change as well as the usual steady-state parameters of burnup, fuel density, cladding, etc. Therefore, the EBR-II Project began an investigation into extending the irradiation program into this area of transient testing, which would include not only the effect of rate of power changes to fuel

performance but also the capability of raising test elements to overpower conditions. A test matrix was established for the reactor, which would specifically qualify the reactor driver fuel as well as the mechanical components, secondary sodium system, and steam system for the extremes of the envisioned test program. This matrix would then be investigated under steady-state conditions and at two different power ramp rates of 0.7 and 4 MW/s over a power change from 40% power to full power. (no refs.)

106091 Signal validation for a boiling water reactor suppression pool. J.Fisher, A.Ray, R.Ornedo (Charles Stark Draper Lab., Cambridge, MA, USA), E.Kujawski, S.M.Divakaruni, P.Smith.
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.50-2 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
A real-time signal validation program has been developed for monitoring a boiling water reactor (BWR) suppression pool and related sensors. The major objectives are to (a) improve the reliability of information that is needed to implement emergency operating procedures, (b) provide a reliable, cost-effective means for suppression pool temperature monitoring, and (c) validate data for an SPDS. The methodology can also be used to determine the additional sensors necessary to meet the aforementioned goals. The program has been tested with Oyster Creek plant simulation data. A variety of sensor and plant component faults were successfully identified during simulated steady-state and transient operations. (9 refs.)

106092 Pressurized water reactor chemistry/radiochemistry sampling programs. J.D.Maddox (Public Service Co. of New Mexico, Albuquerque, NM, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.53-4 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
The establishment, monitoring, and maintenance of a pressurized water reactor (PWR) fluid chemistry sampling program is an important element of a successful PWR startup and operations plan. A viable program will contribute significantly to a smoother and contiguous plant startup. The dividends of a smoother and contiguous startup add up quickly at ~$1,000,000/day for a delayed startup schedule. This paper emphasizes the importance and difficulty of achieving and maintaining proper water purity and chemistry during plant startup through actual plant startup experiences. (no refs.)

106093 Pipe vibration testing. R.L.Humphreys (Sargent & Lundy Engrs., Chicago, IL, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.54-9 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
In 1980, when ANSI/ASME OM-3 (Requirements for Preoperational and Initial Startup Vibration Testing of Nuclear Power Plant Piping Systems) was being prepared, Sargent and Lundy (S&L) undertook a survey of programs that were being used in the industry. The purpose of this survey was to include the best features of these programs and the then proposed ANSI Standard in S&L's unique approach to qualifying piping for steady-state and transient flow-induced vibration. The analytical approach that was developed from this study was then tempered by the practical application of the program on power plant piping. (no refs.)

106094 Susquehanna one startup test program. R.G.Sheranko (Pennsylvania Power & Light Co., Berwick, PA, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.59-60 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
Susquehanna Unit One is the first domestic boiling water reactor (BWR) to complete a startup test program since the Three Mile Island accident. The Susquehanna startup test program was based on the General Electric startup test specifications augmented with other tests to comply with Regulatory Guides 1.68-Rev.2, 1.68.1-Rev.1, and 1.68.2-Rev.1. The majority of additional testing concerned the thermal growth and vibration testing of ASME Section III Nuclear Class 1, 2, 3 and ANSI B31.1 piping. (no refs.)

106095 Engineering support for startup and testing. J.E.Carter (Stone & Webster Engng. Corp., Cherry Hill, NJ, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.60-1 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
Engineering support is essential for a timely and efficient initial startup and test program. This support must be established well in advance of the actual testing dates and must continue, with increased intensity, for the duration of the test program. This paper reviews engineering support issues for power plant test programs during the design and procurement, construction, and test and startup phases of a project. The technical matters and administrative methods addressed highlight the critical role that engineering plays in the startup effort and reflect, to a large extent, the approach taken on several Stone and Webster Engineering Corporation projects. (no refs.)

106096 Microcomputer based data acquisition and analysis applications for nuclear power plant startup. J.C.Zimmerman (Impell Corp., Bannockburn, IL, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.62-3 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
The use of microcomputer-based data acquisition equipment during the conduct of preoperational and initial startup testing offers several benefits to the plant engineer. First, high-speed multiplexing techniques permit the acquisition of relatively large quantities of data in shorter time frames. Second, application-specific input cards permit data to be acquired from a variety of input sources. Third, 16-bit microprocessors programmed using high-level languages such as BASIC provide the formulation capability and numerical precision necessary to perform local engineering analysis. Last, formatted printing software and graphics packages provide flexible data representation as well as hard copy documentation of results. (1 ref.)

106097 Midland technical specifications equipment control system. F.Hubbard, E.Abbott, J.C.Lin (Pickard, Lowe & Garrick Inc., Washington, DC, USA), A.Puplis, S.Cherba.
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.63-4 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
The Midland technical specification equipment control system (MTSECS) consists of an integrated set of 'logic' models each for a given limiting condition of operation (LCO) in the Midland technical specifications. Each model contains a logical arrangement of components and sub-systems necessary to assure operability of the system associated with the LCO. The logical arrangement of the components within each model determines whether or not failure of or maintenance on that component will put the plant in the 'action statement' of the LCO. The action statement may require a plant shutdown within a fixed period of time or a verification of the operability of redundant systems. The logic model and component data base have been computerized for ease of LCO monitoring and to allow an operator to test the effect on LCOs of planned maintenance operations. (no refs.)

106098 Digital computer control of a nuclear reactor. J.Bernard, A.Ray, D.Lanning (MIT, Cambridge, MA, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.64-6 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
This paper describes a digital algorithm that changes power on the 5-MW(th) MIT research reactor. The Massachusetts Institute of Technology and the Charles Stark Draper Laboratory have undertaken a program to demonstrate signal validation techniques for real-time fault diagnosis, information display, and sensor calibration in nuclear plants. (2 refs.)

106099 Design of an automatic control rod drive system for transient power testing at EBR-II. L.J.Christensen (Argonne Nat. Lab., Idaho Falls, ID, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.66-9 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
A computer-controlled automatic control rod drive system (ACRDS) was designed and operated in EBR-II during reactor runs 121 and 122. The ACRDS was operated in a 'checkout' mode during run 121 using a low worth control rod. During run 122 a high worth control rod was used to perform overpower transient tests as part of the LMFBR oxide fuels transient testing program. The testing program required an increase in power of 4 MW/s, a hold time of 12 min and a power decrease of 4 MW/s. During run 122, 13 power transients were performed. (2 refs.)

106100 Computer applications for reactor control and diagnosis. L.R.Monson, R.C.Stratton, G.H.Chisholm, R.W.Lindsay (Argonne Nat. Lab., Idaho Falls, ID, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.69-70 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
As a result of the Three Mile Island (TMI-II) accident, the nuclear industry has emphasized development of methodologies and systems that will enhance the safety of the nuclear power industry. The operator is the focal point of the control of a nuclear power system and as such, requires the input of reliable and complete information to make proper decisions related to plant operation and safety. Extensive effort is being employed throughout the technical community in the area of man-machine interaction (MMI) to assist the operator with this task. (no refs.)

106101 Innovations and observations from boiling water reactor plant startup and operation. W.C.Elhoff (Combustion Engng. Inc., Windsor, CT, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.84-5 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
Discusses innovations and observations gleaned from a review of the General Electric Co. (GE) 22-year experience base in starting up over 40 boiling water reactor (BWR) plants and in subsequent operational support. (no refs.)

106102 Evaluation of primary feed-and-bleed cooling capability of pressurized water reactor systems. L.C.Pwu (GPU Nuclear Corp., Parsippany, NJ, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.85-6 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
A simple theoretical approach has been proposed to demonstrate the capability of a PWR system to undergo feed-and-bleed cooling. A sample run has shown that a typical PWR with high pressure injection (HPI) and a 0.02 ft^2 power-operated relief valve (PORV) can undergo stable feed-and-bleed cooling after loss of steam generators, provided the HPI is throttled as the pressurizer level exceeds 80%. It is applicable to other PWRs with different HPI and PORV design. Sensitivity studies, which vary the controlling bands for throttling the HPI and opening and closing the PORV, will determine the proper optimal guidance to achieve stable feed-and-bleed cooling. (3 refs.)

106103 A review of proposed instrumentation for measurement of inadequate core cooling in light water reactors. P.G.Bailey, M.Merilo (EPRI, Palo Alto, CA, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.88-91 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
The paper discusses many of the various concepts and systems that have been proposed for the determination of water level in PWRs. Three instrumentation systems offered by the PWR vendors are presented since they have already been or are about to be installed in commercial operating reactors. These systems are of particular interest to the nuclear utilities, as the NRC has required that each utility (on a plant-by-plant basis) commit to a choice of a system for installation in each PWR to satisfy the NUREG-0737 requirements by the first refueling outage in 1983. (8 refs.)

106104 Input to output—a closer look at plant process measurement systems. G.L.Pannell (Technol. for Energy Corp., Knoxville, TN, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.100-2 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
One of the fundamental areas of concern in the operation of nuclear plant systems is the frequent use of implied, rather than actual, systems status. The use of indirect process measurements as feedback for system control often leads to judgments based on implied system conditions. In the same vein, the calibration of measurement systems experiencing a wide variance in both process and environmental conditions in the design of instrumentation is an issue requiring further scrutiny. The author discusses the following subjects: indirect measurements; in-containment measurement problems; advanced sensor design, and advanced systems using computer-based data reduction and display. (no refs.)

106105 Integration of the safety parameter display system in control room design. L.R.Peterson (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.102-3 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
The need for a compact concise display of plant variables important to diagnosis of the safety status of a nuclear power plant was identified in early 1979 after the Three Mile Island, unit 2 accident. The US Nuclear Regulatory Commission (NRC) did not issue a requirement to install a safety parameter display system (SPDS) in the control room until December 1982 with the publication of Supplement 1 to NUREG-0737. The benefits to be derived from the SPDS will be determined by the management of each nuclear power plant. Management and designers have wide latitude to choose the form of the SPDS and the information to be displayed on it. The NRC

defined the function of the SPDS. The NRC did not determine prescriptive or proscriptive system design requirements. (no refs.)

106106 Use of a heat transfer coefficient for describing the radiative exchange between water vapour and the bounding walls. W.Eifler, I.M.Shepherd.
Report EUR 8344 EN, Comm. European Communities, Luxembourg (1983), 47 pp.
During the 'severe-fuel-damage' experiments of the SUPER SARA test program radiation heat transfer will play an important part. For the analysis of these experiments it should be modelled therefore in a particularly appropriate manner. Based on the same engineering type principles which are used in the radiation model of the TRAC code version for boiling water reactors, a new model has been developed. This model is less computer time consuming than the TRAC model and particularly appropriate for the use in the subchannel-type bundle computer code which is planned to be developed for the analysis of the 'severe-fuel-damage' experiments. (8 refs.)

106107 Study of dilute reagent decontamination for application in boiling water reactors. A.B.Johnson,Jr., B.Griggs, R.L.Dillon, F.Kustas, R.Peters.
Report EPRI-NP-2960, Electr. Power Res. Inst., Palo Alto, CA, USA (March 1983), 192 pp.
Available from Res. Rep. Center (RRC), Box 50490, Palo Alto, CA 94303, USA.
This report documents an experimental program to investigate the application of the dilute chemical decontamination (DCD) method to BWR coolant systems. Several decontamination parameters were investigated in the once-through test facility, including reagent composition, temperature, concentration, pH, and oxidation-reduction characteristics. The results of this study are related to results from other laboratories and to engineering considerations for a DCD of a BWR.

106108 Thermal mixing in a rectangular geometry model of a cold leg with high-pressure injection and a downcomer. A.Hashemi, J.Goodman.
Report EPRI-NP-2924, Electr. Power Res. Inst., Palo Alto, CA, USA (March 1983), 250 pp.
Available from Res. Rep. Center (RRC), Box 50490, Palo Alto, CA 94303, USA.
A series of tests to investigate fluid and thermal mixing in a transparent model of a PWR cold leg, with high-pressure injection and a downcomer, is described. Test conditions approximate the mixing phenomena in a prototypical reactor geometry, and the results include both transient temperature data and video movies of the cold leg mixing phenomena.

106109 Investigation of phosphate-sludge interactions. W.M.Connor, A.J.Panson.
Report EPRI-NP-2963, Electr. Power Res. Inst., Palo Alto, CA, USA (March 1983), 102 pp.
Available from Res. Rep. Center (RRC), Box 50490, Palo Alto, CA 94303, USA.
This report documents an investigation of the interactions of sodium phosphate with artificial steam generator sludge or sludge constituents. Tests were conducted at several temperatures in order to determine the effect of temperature on the initiation of these interactions, and the results are presented.

106110 Role of electrochemistry in causes and measurement of corrosion in PWR steam generators.
Report EPRI-NP-2962, Electr. Power Res. Inst., Palo Alto, CA, USA (March 1983), 88 pp.
Available from Res. Rep. Center, Box 50490, Palo Alto, CA 94303, USA.
The principles of electrochemistry are applied to the corrosion and stress corrosion of the engineering alloys used in PWR steam generators.

106111 Fatigue performance of Ni-Cr-Fe alloy 600 under typical PWR steam generator conditions. R.J.Jacko.
Report EPRI-NP-2957, Electr. Power Res. Inst., Palo Alto, CA, USA (March 1983), 402 pp.
Available from Res. Rep. Center, Box 50490, Palo Alto, CA 94303, USA.
The fatigue performance of Alloy 600 tubing in various high-temperature environments representative of reference and faulted PWR steam generator conditions is investigated. Details are given of the test matrix, which comprised strain-controlled low-cycle fatigue, load-controlled high-cycle fatigue, and resonant ultrasonic fatigue tests. The test environments and temperature range are described, the influence of a steady-state mean stress is analyzed, and the fatigue test results are presented.

106112 Evaluation of statistical reliability measures for a program for the limitation of power density in a reactor vessel. M.Kersken, B.Krzykacz (Gesellschaft fur Reaktorsicherheit mbH, Garching, Germany).
Software for Computer Control 1982. Proceedings of the Third IFAC/IFIP Symposium, Madrid, Spain, 5-8 Oct. 1982 (Oxford, England: Pergamon 1983), p.399-402
Errors within an assembler program for limiting the local power density in a reactor vessel are to be identified and corrected during two test phases. According to the special features for error detection of the testing facilities, the errors are classified, and an appropriate software reliability model is applied to each error class. These models allow predictions of certain reliability parameters from the observation of the test. Depending on the model employed these parameters can be e.g. the number of remaining errors, the probability for the occurrence of an error within a given time interval, the meantime between successive errors. (4 refs.)

11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s' ....See Entry 105022

Optimal flux distribution in slab reactors with a uniform external source ....See Entry 105947

A fuel-ringed external irradiation cavity for the annular core research reactor ....See Entry 105949

CORE-MASTER—the ASEA-ATOM boiling water reactor core analysis system ....See Entry 105951

MORSE-E1, source and analysis routines to be used with the MORSE code ....See Entry 105952

Modeling of natural circulation phenomena in nuclear reactor cooling loops ....See Entry 105956

Successful on-load refuelling at Hinkley Point AGR ....See Entry 105963

Evaluation of boron-10 depletion during pressurized water reactor operation ....See Entry 105973

Quantification of the contribution of light water reactor core melt frequency of loss of offsite power ....See Entry 106113

Prediction of critical heat flux in flow boiling at low qualities ....See Entry 106117

Instruments and safety: surveying cause and effect ....See Entry 106118

Nuclear qualification of instrumentation: benefits to the processing industries ....See Entry 106119

Effects of crud diameter on shutdown dose rate of recirculation pipes in boiling water reactors ....See Entry 106120

Water accumulation phenomena in upper plenum during reflood phase of PWR-LOCA by using CCTF data ....See Entry 106122

Starting on a new phase at Loft ....See Entry 106125

Criteria for determining the duration of containment integrated leakage rate tests ....See Entry 106127

SEP operating history review of the Millstone Unit 1 nuclear power plant ....See Entry 106135

Sensor response time measurement—seven years later ....See Entry 106136

Davis-Besse safety/power-operated relief valve test and modification program per NUREG-0737 ....See Entry 106137

Automated security functions ....See Entry 106138

Vermont Yankee gamma-TIP versus neutron-TIP experience ....See Entry 106139

The effects on operation of combustion engineering reactors caused by Three Mile Island ....See Entry 106144

Kinetics of iodine and cesium reactions in the CANDU reactor primary heat transport system under accident conditions ....See Entry 106148

Flow around turbulence promoters in parallel channels. II. Shedding vortex around cylinder ....See Entry 107165

28.44 FISSION REACTOR PROTECTION SYSTEMS, SAFETY AND ACCIDENTS

106113 Quantification of the contribution of light water reactor core melt frequency of loss of offsite power. M.G.K.Evans, G.W.Parry (NUS Corp., Gaithersburg, MD, USA).
Reliab. Eng. (GB), vol.6, no.1, p.43-5 (1983).
In any risk study of light water reactors the loss of offsite power and subsequent performance of the diesel generators in support of the emergency core cooling systems is an important part of the transient analysis. This paper shows how the event tree for loss of offsite power can be developed by partitioning the mechanical and electrical failures, in such a way as to simplify sequence quantification and allow the modelling of recovery of AC power. (61 refs.)

106114 Mechanics of aerosols in nuclear reactor safety: a review. S.K.Loyalka (Nuclear Engng. Program, Univ. of Missouri, Columbia, MO, USA).
Prog. Nucl. Energy (GB), vol.12, no.1, p.1-56 (1983).
Although the estimated public risks from the nuclear reactors are not high, a significant fraction of these arises from the accident sequences that lead to severe core damage. Calculation of release fractions of the core radioactive inventories for such accidents requires an understanding of the evolution of aerosols in primary coolant systems and reactor containment. There have been considerable advances in aerosol mechanics as applied to the safety of nuclear reactors. The state-of-the-art in the mechanics of a single aerosol particle is first reviewed and then available work on coagulation of two aerosol particles is discussed. Progress in kinetic theory descriptions and experimental works is described and directions of future work are noted. Next the general dynamic equation for the aerosol distribution is considered, and several forms of this for conditions of interest are noted. Methods of solution that are discussed include analytical techniques, similarity transforms, moments methods and numerical techniques. Computer programs that have been developed in the past few years are also discussed, and their capabilities and limitations are noted. (60 refs.)

106115 Thermal shock in nuclear reactors. A.M.Clayton (Structural Integrity Dept., UKAEA, Warrington, England).
Prog. Nucl. Energy (GB), vol.12, no.1, p.57-83 (1983).
Most types of liquid cooled reactors undergo rapid changes in coolant temperature during abnormal operating conditions, which cause components adjacent to the coolant to undergo rapid surface temperature changes. The differential expansion between surface and bulk material caused by repeated thermal shocks can induce fatigue or cyclic creep damage. In thick walled components individual thermal shocks may cause rapid fracture from pre-existing defects. The paper reviews the reported experimental and analytical work defining the temperature, stress and resultant damage in reactor structural components subject to thermal shock. (61 refs.)

106116 Melting and cladding motion in a cylindrical vertical channel with a gaseous counterflow. J.Galan, R.Brun, M.Fortunato, J.Papin (CEA-Dept. de Surete Nucleaire du Centre d'Etudes Nucleaires de Cadarache, St. Paul, Lez Durance, France).
Int. J. Heat & Mass Transfer (GB), vol.26, no.10, p.1453-61 (Oct. 1983). In French.
A physical model describing the melting, motion and relocation of the cladding after an accidental loss of sodium flow in a fast-reactor subassembly is presented. Fuel heating is also calculated. This model is based on a one-dimensional approximation of the Navier-Stokes equations governing sodium vapour and cladding flows. It takes into account transfer of mass, momentum and energy between phases. The hypotheses and the general equations of the model are indicated. The latter are solved by an explicit numerical method. A sequential analysis of results obtained in a concrete case along with a comparison with available experimental results are also considered. The comparison of calculated and experimental results leads to the conclusion that the major events are well described. (11 refs.)

106117 Prediction of critical heat flux in flow boiling at low qualities. J.Weisman, B.S.Pei (Dept. of Chem. & Nuclear Engng., Univ. of Cincinnati, Cincinnati, OH, USA).
Int. J. Heat & Mass Transfer (GB), vol.26, no.10, p.1463-77 (Oct. 1983).
A theoretically based prediction of CHF has been developed for the high velocity flow in tubes. Turbulent interchange between the bubbly layer and core regions is taken as the limiting mechanism. Good agreement was obtained between predictions and experimental data for water flowing in uniformly and nonuniformly heated tubes. The predictive procedure developed for water was found to yield results in agreement with experiment for each of the four other fluids examined. (65 refs.)

106118 Instruments and safety: surveying cause and effect. A.Krigman.
InTech (USA), vol.30, no.2, p.25-9 (Feb. 1983).
Instruments can cause as well as solve safety problems. As technology becomes more sophisticated, the challenges facing instrumentation specialists grow correspondingly more complex—to select, install, operate, and maintain equipment in a safe manner and to develop systems with higher levels of protection against injury or damage. Instrumentation specialists in nuclear

plants have met particularly stringent demands, and the approaches developed can serve as models for the monitoring and control system safety needs in other industries. (38 refs.)

106119 Nuclear qualification of instrumentation: benefits to the processing industries. R.D.Adams, C.C.Comins (Foxboro Co., Foxboro, MA, USA).
InTech (USA), vol.30, no.2, p.31-3 (Feb. 1983).
Instrumentation must be specially qualified for use in nuclear power generating stations. Efforts to meet the requirements of these critical applications have yielded improvements that benefit users in other industries as well. These include ability to operate under more severe conditions than ordinarily expected as well as increased confidence in reliability specifications. (no refs.)

106120 Effects of crud diameter on shutdown dose rate of recirculation pipes in boiling water reactors. S.Uchida, Y.Asakura, M.Kitamura (Energy Res. Lab., Hitachi Ltd., Hitachi, Japan), K.Ohsumi, K.Yonezawa, Y.Matsushima.
J. Nucl. Sci. & Technol. (Japan), vol.20, no.5, p.414-21 (May 1983).
The effects of crud diameter on radioactive corrosion product buildup in the primary cooling pipes of boiling water reactors were evaluated and the following conclusions were obtained: (1) the crud diameter affected the radioactivity buildup through two processes, i.e. deposition of crud on the fuel surfaces and adsorption of ionic cobalt on the fuel deposited crud. The contribution of the adsorption process to the radioactivity buildup for the plant where the average crud diameter was in the range of $1\sim10$ μm was as large as that of the deposition process. (2) As the result of numerical calculations by a radioactive corrosion product transport model, it was demonstrated that the shutdown dose rate was reduced by the suppression of crud concentration in the primary coolant when the crud diameter remained constant, and it was reduced by the increase of the average crud diameter when the crud concentration remained constant. (13 refs.)

106121 Measurement of leakage flow induced vibrations of cylinders. T.Nakao (Energy Res. Lab., Hitachi Ltd., Hitachi, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.5, p.433-5 (May 1983).
Some power plant components possess a slip-fit joint, which meets design requirement for allowing component removal and/or relative thermal expansion of structures. However, they complicate designing to avoid flow-induced vibrations since evaluation methods for the effect of leakage flow in an annular gap due to vibrations are difficult. Previous studies have been concerned with fluid forces and associated effective mass and damping provided by fluids in finite length annular gaps. The author presents basic data on the vibrational amplitudes of a cylinder in the presence of a leakage flow past the joint. (1 ref.)

106122 Water accumulation phenomena in upper plenum during reflood phase of PWR-LOCA by using CCTF data. T.Iguchi, Y.Murao (JAERI, Tokai, Ibaraki, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.6, p.453-66 (June 1983).
The water accumulation phenomena in the upper plenum of a PWR was investigated by using the data of the cylindrical core test facility (CCTF) test. When the liquid inventory in the upper plenum is small, the liquid carry over rate from the upper plenum was governed by the liquid inlet flow rate. After some amount of the water was accumulated in the upper plenum, the liquid carry over rate was governed by the steam up-flow rate and the liquid inventory in the upper plenum. The liquid carry over rate was higher with the higher steam up-flow rate and the larger liquid inventory. This trend on the liquid carry over rate was also observed in small scale model test. Based on the CCTF data, the empirical correlation on the liquid carry over rate was obtained. (8 refs.)

106123 Simulation test on interactions of Zircaloy claddings deforming in fuel assembly under LOCA conditions. M.Suzuki (Div. of Nuclear Safety Res., Tokai Establ., JAERI, Tokai, Ibaraki, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.6, p.475-90 (June 1983).
In a hypothetical LOCA of LWR, it is assumed that Zircaloy claddings of fuel assemblies undergo ballooning and cause thermal and mechanical interactions among themselves. To investigate the phenomena, burst tests were conducted with a single rod fuel simulator placed in the center of eight nonpressurized external heater pipes. It was found that the deformation and rupture behavior of ballooning cladding which made contact with the pipes depends on the following conditions: (1) temperature difference between cladding and heater pipes; higher temperature in the cladding than in the pipes produces an extended deformation and contact area, (2) internal pressure of cladding, and (3) temperature level at which ballooning takes place. It was observed and analyzed that cladding hoop tensile stress is largest at the inflection points generated in the contact surface of the expanding cladding. (19 refs.)

106124 Development of nuclear reactor accident diagnostic system based on knowledge engineering technique. J.Okada, M.Yokobayashi, F.Mizoguchi (Atomic Energy Society of Japan, Tokyo, Japan).
J. At. Energy Soc. Jpn. (Japan), vol.25, no.6, p.469-79 (June 1983). In Japanese.
For accident diagnosis in the nuclear reactor system from a global piont of view, the cause consequence tree (CCT) method has been mainly adopted as an effective technique. However this method is ineffective with insufficient or inconsistent accident information. To resolve this problem, the authors adopted the knowledge engineering method which had been recently developed in artificial intelligence research. They have developed a pilot system based on this method. This system is composed of two parts, the inference engine of EXPERT type and the diagnostic knowledge base which contains 211 production rules. This system allows stochastic diagnosis, display of diagnostic reasons, interactive consultation, and ease of frequent modifications and alternations of the diagnostic tree diagram. The authors have applied this system to various accident cases and examined the diagnosis, resolvability and usability. (23 refs.)

106125 Starting on a new phase at Loft. G.D.McPherson (US Dept. of Energy, Office of Nuclear Energy, Washington, DC, USA).
Nucl. Eng. Int. (GB), vol.28, no.343, p.32-6 (July 1983).
The objectives of the new OECD Nuclear Energy Agency programme at LOFT extend beyond NRC's previous focus on US safety issues. They include operating procedures and the design of commercial PWRs as well as their safety systems. It also expands on NRC's focus on principally thermal-hydraulic phenomena to include the release and transport of fission products. (no refs.)

106126 Analysing thermal hydraulics with the Bethsy loop. J.Brisbois (CEA, Inst. of Nuclear Protection & Safety, CEN, Fontenay aux Roses, France), M.Courtaud, J.C.Megnin, H.Sureau.
Nucl. Eng. Int. (GB), vol.28, no.343, p.36-8 (July 1983).
The Bethsy test loop will be commissioned at the nuclear research centre at Grenoble in France in 1986. Bethsy is specifically designed to create two-phase flow in the primary circuit, a situation where present knowledge is far from perfect. (no refs.)

106127 Criteria for determining the duration of containment integrated leakage rate tests. C.W.Rowley (Quadrex Corp., Campbell, CA, USA), T.M.Law, T.E.Renton.
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.31-3 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
An integrated leakage rate test (ILTR) is typically on the outage critical path for a nuclear power plant. The objective of limiting the duration of ILRTs is to improve plane economics by reducing the critical path outage time, while maintaining an acceptable and technically accurate approach. It was the purpose of this project to clearly define and validate a set of technical test duration acceptance criteria indicating when an ILRT may be terminated, and to support the use of such criteria by the nuclear power industry at large. (2 refs.)

106128 The issue of CILRT duration. J.R.Dougan (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.33-4 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
Containment integrated leakage rate tests (CILRTs) represent large investments of time and money on the part of the utilities operating nuclear power plants. These tests are conducted to ensure that an adequate degree of protection is being maintained by the containment against the release of radioactive products should an accident occur. Because these tests require the unit to be shut down they are normally conducted during refueling outages. Theoretically, a CILRT would not necessarily be a controlling event in returning the unit to power but, in practice, these tests often take quite a lot of time to complete. Thus the CILRT often is a controlling event in returning a unit to power and therefore should take no longer than necessary to establish the leakage rate of the containment. (7 refs.)

106129 Short duration PCILRT at Quad Cities using BN-TOP-1, rev.1. E.Mendenhall, J.Schnitzmeyer, F.Kaeppel (Commonwealth Edison Co., Chicago, IL, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.34-7 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
A test duration of <24 h has been allowed by the US Nuclear Regulatory Commission (NRC) provided the general test method used is that given in the Bechtel Corporation topical report BN-TOP-1, Rev.1, dated November 1, 1972. The statistical method used in BN-TOP-1 to analyze the collected data is different from the method previously used at Quad Cities; namely, the method presented in ANSI/ANS 56.8-1981. Therefore, simultaneous analysis was performed using both methods. If the measured leak rate phase of the test had been extended beyond 12 h, test procedures and the NRC test inspector would have permitted a full 24-h test using the ANSI/ANS method of statistical analysis. (no refs.)

106130 Containment failure experience-implications for testing. M.Weinstein (American Nuclear Insurers, Farmington, CT, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.37 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
Containment integrity failure experience has been examined to determine how such failures were identified, the primary cause of failure, and implications for testing. All significant failures (i.e. $>L_a$) through 1982 have been considered. The majority of failures have been caused by large valves leaking in series. These were identified during local leakage rate tests (LLRTs). Some failures have also been identified during integrated leak rate tests (ILRTs). These failures also predominantly involve penetration paths. Increased emphasis on local leak rate testing is warranted and the effect on overall reliability of reduced durations during containment testing would be minimal. (no refs.)

106131 Evaluation of short duration integrated leakage rate test criteria. R.E.Blum, L.R.Young (Bechtel Nat. Inc., San Francisco, CA, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.37 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
Two methods have recently been proposed to determine when a short duration integrated leakage rate test (ILRT), per ANSI/ANS 56.8, should be terminated. The first method presents an extrapolation formula to determine if the calculated leakage rate will remain within a ±25% maximum allowable leakage rate (L_a) window during the next four hours. The second method formulates a convergence criteria on the calculated leakage rate and 95% upper confidence limit (UCL). Both of the methods base the decision as to whether or not to end the test on the last few hours of data. (4 refs.)

106132 NRC program for emergency preparedness upgrade at research and test reactors. F.G.Pagano (US Nuclear Regulatory Comm., Washington, DC, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.41 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
In August 1980, the US Nuclear Regulatory Commission (NRC) upgraded its emergency planning regulations to assure that adequate protective measures can and will be taken in the event of a radiological emergency to protect public health and safety. To discharge its statutory responsibilities effectively, the Commission must know that proper means and procedures will be in place to assess the course of an accident and its potential severity. Among other things, the revised regulations at 10CFR50.54(q) require licensees authorized to possess and/or operate a research reactor or a fuel facility to follow and maintain in effect emergency plans that meet the requirements in Appendix E to 10CFR50. The Commission recognized that the potential radiological hazards to the public associated with the operation of research and test reactors involve considerations different than those associated with power reactors. Consequently, the degree of compliance with the requirements of Appendix E for research and test reactors will be determined on a case-by-case basis. (no refs.)

106133 The review and evaluation of emergency preparedness at research and test reactors. G.Bates (US Nuclear Regulatory Comm., Washington, DC, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.41-2 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
The upgraded emergency planning regulations require that licensees authorized to possess and/or operate a research or test reactor follow and maintain in effect emergency plans that meet the requirements of Appendix E to 10CFR50. Further, these licensees were required to submit upgraded emergency plans to the NRC for approval as a condition of the license. These plans are currently undergoing NRC staff review against the requirements of Appendix E. In addition, the staff review extends to ascertaining the degree of conformance with the guidance criteria set forth in Revision 1 to Regulat-

ory Guide 2.6, and ANSI/ANS-15.16-1982, 'Emergency Planning for Research and Test Reactors'. The purpose of extending the review and evaluation to include conformance with the guidance criteria is because licensees were requested by generic letter, dated June 16, 1982, to use these documents to meet the requirements of the amended emergency planning regulations and to institute a standard means of assuring that uniform evaluations and reviews are made of each plan. (no refs.)

106134 Establishing an effective relationship between the nonpower reactor licensee and regulator. J.D.Randall (Texas A&M Univ., College Station, TX, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.42-3 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
Recent disclosures at the US Environmental Protection Administration (EPA) clearly illustrate the importance of the proper relationship between regulator and licensee. The situation there showed how an improper balance could directly and significantly impact the health and welfare of the general public. The major difficulty in establishing a harmonious and productive working relationship between the US Nuclear Regulatory Commission (NRC) and managers of nonpower reactor facilities is the potential for creating the appearance of collusion between the parties. However, if a proper relationship is not achieved, the public will eventually pay the price. (no refs.)

106135 SEP operating history review of the Millstone Unit 1 nuclear power plant. G.T.Mays (Oak Ridge Nat. Lab., Oak Ridge, TN, USA), K.H.Harrington, M.D.Muhlheim.
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.44-5 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
The Systematic Evaluation Program Branch of the US Nuclear Regulatory Commission (NRC) is conducting the Systematic Evaluation Program (SEP) for the purpose of determining the safety margins of the design and operation of ten of the older operating commercial nuclear power plants in the United States. These ten plants are being reevaluated in terms of present NRC licensing requirements and regulations. The SEP evaluates specific safety topics based on an integrated review of the ability of a plant to respond to certain design basis events including normal operation, transients, and postulated accidents. (1 ref.)

106136 Sensor response time measurement—seven years later. J.D.Trotter (NUS Corp., Gaithersburg, MD, USA), F.R.Feiner.
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.45-6 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
In 1975, a parameter called 'reactor trip system response time' was defined in the technical specifications for D.C. Cook Unit 1. Furthermore, periodic measurement of this parameter became a requirement for the operators of D.C. Cook and subsequent plants licensed with 'standard' technical specifications. In the subsequent seven years a great deal of effort has gone into meeting this requirement. It is the purpose of this paper to question the basis of the requirement. In other words: 'Was there ever a problem?' First, a discussion of the history of this measurement and its attendent regulations will be given. Next, a summary of current test results and the authors' interpretation of those results will be shown. Finally, a proposal will be made to stop certain parts of time-response testing as currently practiced. (no refs.)

106137 Davis-Besse safety/power-operated relief valve test and modification program per NUREG-0737. G.O'Connor (Teledyne Engng. Services, Waltham, MA, USA), M.Foust.
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.46 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
In March 1979, Three Mile Island Unit 2 (TMI-2) Nuclear Station experienced a loss of feedwater transient that led to a series of events that created a partial loss-of-coolant-accident (LOCA) with core damage. As a result, NUREG-0737 was issued outlining actions to be taken by each utility. This presentation addresses the Toledo Edison/Teledyne Engineering Services approach for the Davis-Besse Nuclear Station to item II.D.1 of NUREG-0737, which is testing of safety- and power-operated relief valves and a determination on the effect of valve operation on the valves and discharge piping. (no refs.)

106138 Automated security functions. D.L.Davenport (Gulf States Utilities, St. Francisville, LA, USA), P.M.Buck.
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.46-7 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
River Bend Station is a 934-MW boiling water reactor (BWR6), being constructed by Gulf States Utilities near St. Francisville, Louisiana. The scheduled commercial operation date for this unit is in the fourth quarter of 1985. The Plant Security Group has been working with the Plant Technical Staff to define and implement automated security functions that will augment the capabilities of the Station Security System. This work has led to the implementation of computer programs that address the following functional requirements: (a) station key control, (b) station door lock control, (c) vehicle decal control, and (d) employee badge control. A brief overview of each of these functional capabilities is outlined. (no refs.)

106139 Vermont Yankee gamma-TIP versus neutron-TIP experience. R.A.Woehlke (Yankee Atomic Electric Co., Framingham, MA, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.47-50 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
During Cycle 8, Vermont Yankee installed Gamma-TIPs. Comparisons to the preceding Neutron-TIP data indicate that Gamma-TIPs have improved core-wide accuracy about 2% and margin to limits 6 to 8%. (6 refs.)

106140 Emergency plan development and training for the Ohio State University Research reactor. J.W.Talnagi,Jr., R.D.Myser (Ohio State Univ., Columbus, OH, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.77 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
An emergency plan has been developed for the Ohio State University research reactor (OSURR), a pool-type research reactor utilizing fully enriched, flat-plate MTR-type fuel, licensed to operate at a maximum steady-state thermal power of 10 kW. The emergency plan was prepared with guidance from ANSI/ANS-15.16, and was submitted to the US Nuclear Regulatory Commission (NRC) in November 1982. Approximately two person-months of total effort was applied to plan development, at a total cost of ~\$4000. Plan highlights include discussion of site security in the event of an emergency, emergency organization, emergency classification, and emergency plan training. The OSURR credible emergency classes include: (a) nonnuclear, nonreactor safety event, and (b) notification of unusual event. (no refs.)

106141 Summary of Fast Flux Test Facility emergency planning. W.C.Moffitt, D.J.Newland (Westinghouse Hanford Co., Richland, WA, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.77-8 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
The emergency planning structure and experience at the Fast Flux Test Facility (FFTF) are described. The FFTF is a 400-MW(th) sodium-cooled, three-loop, fast test reactor operated by Westinghouse Hanford Company (WHC) for the US Department of Energy (DOE) as part of the Hanford Engineering Development Laboratory (HEDL) facilities. (no refs.)

106142 Emergency plan exercises and appraisals—a nuclear regulatory commission perspective. W.L.Axelson (US Nuclear Regulatory Comm., Washington, DC, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.79-81 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
During the period from April 1981 to April 1982, the US Nuclear Regulatory Commission (NRC) conducted emergency preparedness implementation appraisals (EPIAs) at all operating power reactors and several near-term operating licences. Emergency preparedness exercises were also conducted during this period. The purpose of the paper is to summarize what the NRC has learned as a result of these appraisals and exercises, particularly in the NRC Region III area. Region III includes the power reactors located in Minnesota, Wisconsin, Iowa, Missouri, Illinois, Indiana, Michigan, and Ohio. (no refs.)

106143 The effects of Three Mile Island on nuclear plant operations. C.M.Wethy (Florida Power & Light Co., Juno Beach, FL, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.82 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
Out of the unfortunate TMI incident aftermath some good and some bad things have had a large effect on operating nuclear plants. The good has been the increased operator training and procedures. The experience gained at TMI has proved the nuclear plants can sustain a serious accident and still not injure the public or utility employees. Many technical improvements have been made and are still being made. On the other side of the ledger is the large amount of dollars and manpower that could have been put to better use if a slower more justified program for increased safety had been pursued. The most unfortunate change was the change of the NRC from a technically oriented organization to one that is more politically and legally sensitive. (no refs.)

106144 The effects on operation of combustion engineering reactors caused by Three Mile Island. W.E.Burchill (Combustion Engng. Inc., Windsor, CT, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.83-4 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
The accident at Three Mile Island (TMI) has significantly affected those aspects of reactor operation concerning prepared response to abnormal operation or emergencies and has produced little effect on normal mode 1 reactor power operation. Day-to-day influences on the plant operating staff are felt through changes that have occurred in control room staffing and plant technical specifications. Perhaps the most significant impact outside of mode 1 operation is the necessity to rely on natural circulation cooling or to reestablish forced circulation by the reactor coolant pumps (RCPs) due to the requirement to trip the RCPs during significant depressurization of the reactor coolant system. Finally, the TMI accident has produced major improvements in the planning for operation during abnormal and emergency situations. Many of these improvements have been based on the concept of preserving plant safety functions. (6 refs.)

106145 Possible research program on a large scale nuclear pressure vessel. Report EUR 8221 EN, Comm. European Communities, Luxembourg (1983), 404 pp. Contract 667/683/684/685-76-12 SISPI/N/E/F/.
The nuclear pressure vessel structural integrity is actually one of the main items in the nuclear plants safety field. Large research efforts have been devoted to the study of various aspects of this problem. Nevertheless till now the related experimental activities have been performed only by means of various types of specimens or reduced scale models of components as well as of the pressure vessel itself. This kind of research work was carried on in the last years, and it is ongoing nowadays too, in all the countries interested in the development and use of nuclear reactors, especially of the LWR type. In 1976, the cancellation of several nuclear plants made available in the builders' workshops some scale 1:1 pressure vessels at various levels of assembling. The availability of those vessels for the development of an engaging international research activity suggested the Forward Studies Directorate of the CEC Joint Research Centre, Ispra, to promote the constitution and to support the work of an international study group aimed at investigated the feasibility of a 'possible research program on a scale 1:1 LWR pressure vessel'. The main purpose of the work of the study group is to provide the technical background to enable a decision to be made regarding the usefulness of an integrity and safety related research activity on a scale 1:1 or, as was stated later, on a large scale pressure vessel. If the outcome of the study should be in favour of such a research activity, its implementation should be a matter of collaboration between the interested organizations.

106146 Characterization of the pressure wave originating in the explosion of an extended heavy gas cloud: Critical analysis of the treatment of its propagation in air and interaction with obstacles. J.A.Essers.
Report EUR 8482 EN, Comm. European Communities, Luxembourg (1983), 142 pp. Contract ECI-794-2651-81-B.
The protection of nuclear power plants against external explosions of heavy gas clouds is a relevant topic of nuclear safety studies. The ultimate goal of such studies is to provide realistic inputs for the prediction of structure loadings and transient response. To obtain those inputs, relatively complex computer codes have been constructed to describe the propagation in air of strong perturbations due to unconfined gas cloud explosions. A detailed critical analysis of those codes is presented. In particular, the relative errors on wave speed, induced flow velocity, as well as on reflected wave speed and overpressure, respectively due to the use of a simplified non-linear isentropic approximation and of linear acoustic models, are estimated as functions of the overpressure of the incident pulse. The ability of the various models to accurately predict the time and distance required for sharp pressure front formation is discussed. Simple computer codes using implicit finite-difference discretisations are proposed to compare the results obtained with the various models for spherical wave propagation. Those codes are also useful to study the reflection of the waves on an outer spherical flexible wall and to investigate the effect of the elasticity and damping coefficients of the wall on the characteristics of the reflected pressure pulse. (49 refs.)

106147 Conversion of smectite to illite in hydrothermal systems: A literature review. R.M.Johnston.
Report AECL-7792, Atomic Energy Canada Ltd., Chalk River, Ont. (June 1983), 27 pp.
In natural diagenetic shale systems, smectite converts to illite and mixed-layer illite-smectite in less than a million years at temperatures between 75°C and 200°C. This has raised questions as to the stability of smectite-based bentonite buffers under nuclear waste disposal vault conditions. Experimental and geological evidence indicate that the reaction is dependent on the availability of K^+, and that the rate of reaction in K^+-poor systems (such as the disposal vault) may be much lower than that observed in shale. The presence of Na^+, Ca^{2+} and Mg^{2+} in the system slows the reaction and may halt it altogether at lower temperatures. Two different reaction mechanisms have been proposed; the evidence for, and implications of, each are discussed. (58 refs.)

106148 Kinetics of iodine and cesium reactions in the CANDU reactor primary heat transport system under accident conditions. D.J.Wren.
Report AECL-7781, Atomic Energy Canada Ltd., Chalk River, Ont. (April 1983), 52 pp.
Gas-phase reaction kinetics have been modelled for the release of cesium and iodine into steam and steam/hydrogen atmospheres. The conditions are those anticipated in a CANDU reactor fuel channel following some postulated loss-of-coolant accidents. A total of seventeen chemical species were used in the model, including all important cesium and iodine species. Reaction rate constants were taken from the literature, or calculated where possible, or estimated. The composition evolution of the system was calculated, following a burst release of cesium and iodine, as a function of total iodine and cesium concentrations, cesium/iodine release ratio, iodine release form (atomic I or CsI), fuel channel atmosphere, and radiolysis effects. In general, the calculation demonstrates that CsI and CsOH rapidly ($<10^{-2}$ s) become the most important species in the system for virtually all conditions. Atomic I is found to be significant only for very low release concentrations, or for Cs:I ratios less than unity. (46 refs.)

106149 Understanding the statistics of small risks. E.Siddall.
Report AECL-7541, Atomic Energy Canada Ltd., Chalk River, Ont. (Oct. 1983), 8 pp.
Monte Carlo analyses are used to show what inferences can and cannot be drawn when either a very small number of accidents result from a considerable exposure or when a very small number of people, down to a single individual, are exposed to small added risks. The distinction between relative and absolute uncertainty is illustrated. No new statistical principles are involved.

106150 Influence of base isolation on the seismic response of light secondary equipment. J.M.Kelly.
Report EPRI-NP-2919, Electr. Power Res. Inst., Palo Alto, CA, USA (March 1983), 70 pp.
Available from Res. Rep. Center (RRC), Box 50490, Palo Alto, CA 94303, USA.
A demonstration of the effectiveness of using three different configurations of base isolation systems designed to reduce the amplification of seismic loads transmitted to light secondary systems and equipment is described. Details are provided on the three forms of base isolation systems, which were subjected to shake table testing, and of the test findings. Recommendations for further research on a system combining the more successful base isolation principles are given.

106151 Testing of a natural rubber base isolation system by an explosively simulated earthquake. J.M.Kelly.
Report EPRI-NP-2917, Electr. Power Res. Inst., Palo Alto, CA, USA (March 1983), 58 pp.
Available from Res. Rep. Center (RRC), Box 50490, Palo Alto, CA 94303, USA.
Results of the SIMQUAKE II tests conducted to demonstrate a base isolation system for a reactor containment structure and to evaluate the performance of this system in protecting the structure from strong ground vibrating motions are presented. Details are provided of the 1/24-scale containment structure model; of the model's base isolation system, which incorporates multilayer natural rubber bearings and a novel fail-safe support system; and of the SIMQUAKE II tests, which utilized two distinct ground motions.

106152 Scale model tests of turbine missile containment by reinforced concrete. C.M.Romander, A.L.Florence.
Report EPRI-NP-2747, Electr. Power Res. Inst., Palo Alto, CA, USA (March 1983), 212 pp.
Available from Res. Rep. Center (RRC), Box 50490, Palo Alto, CA 94303, USA.
This report discusses 25 impact tests performed on 1/11-scale models of reinforced concrete walls in order to experimentally determine the threshold velocity at which postulated turbine missiles perforate reinforced concrete walls. In addition, an assessment of how well current design formulas can predict the velocity at which turbine missiles perforate concrete structures is presented.

Modeling of natural circulation phenomena in nuclear reactor cooling loops .... See Entry 105956

Migration of cesium-137 through sandy soil layer; effect of fine silt on migration .... See Entry 105962

Contribution of photoelasticity measurements to the evaluation of operating safety of nuclear facilities (photoelasticimetric determination of stress intensity coefficient) .... See Entry 105966

Process and transportation safety evaluation of a synthetic basaltic waste form .... See Entry 106065

Heat transfer in the supercritical region at low pressure and mass velocity .... See Entry 106081

Post-accident monitoring at Arkansas One .... See Entry 106082

Large test rigs verify Clinch River control rod reliability .... See Entry 106083

Susquehanna one startup test program .... See Entry 106094

Computer applications for reactor control and diagnosis .... See Entry 106100

Innovations and observations from boiling water reactor plant startup and operation .... See Entry 106101

Integration of the safety parameter display system in control room design .... See Entry 106105

Use of a heat transfer coefficient for describing the radiative exchange between water vapour and the bounding walls .... See Entry 106106

Study of dilute reagent decontamination for application in boiling water reactors .... See Entry 106107

Thermal mixing in a rectangular geometry model of a cold leg with high-pressure injection and a downcomer .... See Entry 106108

Investigation of phosphate-sludge interactions .... See Entry 106109

Effect of Fe-56 anisotropic scattering on neutron penetration .... See Entry 106175

28.50 FISSION REACTOR TYPES AND APPLICATIONS

106153 Benefiting from standardization in Russia and Western Europe. G.Greenhalgh.
Nucl. Eng. Int. (GB), vol.28, no.345, p.26-9 (Aug. 1983).
Like countries in the west, the CMEA countries have been reducing earlier estimates of future nuclear capacity, but this still leaves a substantial programme that is expected to result in around a 100 GWe of nuclear plant installed by 1990. A feature of the Russian approach is the high level of standardization, with components being supplied from a variety of sources in several countries. There is also strict control over the fuel cycle with all spent fuel being returned to Russia for reprocessing and storage. (no refs.)

106154 Operating experience of Manhattan College's critical reactor. G.Kane, J.Augustus (Manhattan Coll., Riverdale, NY, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.38-9 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
Manhattan College initiated the first critical reactor of any kind in New York City on March 24, 1964. It still possesses the only licensed and operating critical reactor of any kind in New York City. This is a heterogeneous pool-type reactor, light-water moderated, and fueled with 92% enriched uranium. It is intended solely for teaching undergraduate students and training operators. As part of its use as an educational tool, students are given demonstrations of startup and operation procedures, and perform various experiments on the critical reactor facility, including approach to criticality, neutron flux distribution, reactor period and reactivity, void coefficient measurement, and gamma-ray spectrum in the vicinity of the reactor core. (no refs.)

106155 Penn State Breazeale reactor operation's management. R.E.Totenbier, S.S.Kim, H.Levine (Pennsylvania State Univ., University Park, PA, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.39-40 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
Research reactor operation began at Penn State in 1955. For ten years, the original reactor core, which used MTR-type fuel, was operated at power levels up to 200 kW. In December 1965, a TRIGA Mark III reactor was installed with a 1000-kW maximum steady-state power level and a 2000-MW pulsing capability. Operations management of the Penn State Breazeale Reactor (PSBR) can be broken down into three major categories: scheduling, to ensure efficient use of both facilities and personnel; fuel management, to ensure that the reactor core is or can be made adequate to handle the schedule load; and accounting, to provide a means of justifying operating costs to the university and fuel efficiency to the US Department of Energy (DOE), which provides Penn State with a fuel replacement grant. (3 refs.)

106156 Eighteen years of operation with a sodium-cooled reactor: EBR-II. W.H.Perry, E.A.Clifton (Argonne Nat. Lab., Idaho Falls, ID, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.40-1 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
The Experimental Breeder Reactor II (EBR-II) is a sodium-cooled fast reactor with a design power of 62.5 MW(th) and net output at full power of 20 MW(e). The reactor is operated by Argonne National Laboratory for the US Department of Energy and is located at the Idaho National Engineering Laboratory in southeast Idaho. EBR-II (including the adjacent Fuel Cycle Facility) was completed in 1963, after five years of construction, at a cost of $32,500,000. EBR-II is now the longest operating breeder in the world and the only complete (with power plant) breeder operating in the United States. During its operating history, EBR-II has demonstrated that it is a versatile facility in performing varying programs. (5 refs.)

11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s' .... See Entry 105022

Fuel cycles: A bibliography of AECL publications .... See Entry 105056

Extension of fission product model for use in lattice calculation of thorium fueled BWR .... See Entry 105948

A fuel-ringed external irradiation cavity for the annular core research reactor .... See Entry 105949

Calculational procedures used to extend MITR-II fuel burnup .... See Entry 105950

CORE-MASTER—the ASEA-ATOM boiling water reactor core analysis system .... See Entry 105951

Modeling of natural circulation phenomena in nuclear reactor cooling loops .... See Entry 105956

Successful on-load refuelling at Hinkley Point AGR .... See Entry 105963

Evaluation of boron-10 depletion during pressurized water reactor operation .... See Entry 105973

Integrated testing of equipment for FBR fuel reprocessing .... See Entry 106075

Heat transfer in the supercritical region at low pressure and mass velocity .... See Entry 106081

Large test rigs verify Clinch River control rod reliability .... See Entry 106083

A theoretical analysis of the DC electromagnetic flow coupler .... See Entry 106084

Repairs to the coolant circuit of the Universities Research Reactor .... See Entry 106085

Design, installation, and use of experimental facilities at the Texas A&M University Nuclear Science Center .... See Entry 106087

Reinitiation of pulsing operations at the Texas A&M Nuclear Science Center .... See Entry 106088

Thermal hydraulic studies for upgrading the Virginia Polytechnic Institute and State University Argonaut reactor from 100 to 500 kW .... See Entry 106089

EBR-II reactor transient qualification tests .... See Entry 106090

Signal validation for a boiling water reactor suppression pool .... See Entry 106091

Pressurized water reactor chemistry/radiochemistry sampling programs .... See Entry 106092

Susquehanna one startup test program .... See Entry 106094

Design of an automatic control rod drive system for transient power testing at EBR-II .... See Entry 106099

Innovations and observations from boiling water reactor plant startup and operation .... See Entry 106101

Evaluation of primary feed-and-bleed cooling capability of pressurized water reactor systems .... See Entry 106102

Use of a heat transfer coefficient for describing the radiative exchange between water vapour and the bounding walls .... See Entry 106106

Study of dilute reagent decontamination for application in boiling water reactors .... See Entry 106107

Thermal mixing in a rectangular geometry model of a cold leg with high-pressure injection and a downcomer .... See Entry 106108

Role of electrochemistry in causes and measurement of corrosion in PWR steam generators .... See Entry 106110

Fatigue performance of Ni-Cr-Fe alloy 600 under typical PWR steam generator conditions .... See Entry 106111

Quantification of the contribution of light water reactor core melt frequency of loss of offsite power .... See Entry 106113

Effects of crud diameter on shutdown dose rate of recirculation pipes in boiling water reactors .... See Entry 106120

Water accumulation phenomena in upper plenum during reflood phase of PWR-LOCA by using CCTF data .... See Entry 106122

Simulation test on interactions of Zircaloy claddings deforming in fuel assembly under LOCA conditions .... See Entry 106123

Starting on a new phase at Loft .... See Entry 106125

NRC program for emergency preparedness upgrade at research and test reactors .... See Entry 106132

The review and evaluation of emergency preparedness at research and test reactors .... See Entry 106133

Establishing an effective relationship between the nonpower reactor licensee and regulator .... See Entry 106134

SEP operating history review of the Millstone Unit 1 nuclear power plant .... See Entry 106135

Davis-Besse safety/power-operated relief valve test and modification program per NUREG-0737 .... See Entry 106137

Automated security functions .... See Entry 106138

Vermont Yankee gamma-TIP versus neutron-TIP experience .... See Entry 106139

Emergency plan development and training for the Ohio State University Research reactor .... See Entry 106140

Summary of Fast Flux Test Facility emergency planning .... See Entry 106141

The effects of Three Mile Island on nuclear plant operations .... See Entry 106143

The effects on operation of combustion engineering reactors caused by Three Mile Island .... See Entry 106144

Kinetics of iodine and cesium reactions in the CANDU reactor primary heat transport system under accident conditions .... See Entry 106148

Sandia Pulse Reactor personnel dose reduction program .... See Entry 106176

Joint exercise to compare fatigue crack growth data obtained on type 304/316 stainless steel .... See Entry 109512

28.52 FUSION REACTORS

(for confinement, see 52.55)

106157 High resolution measurement of ^{3}He depth profile. H.Sekiguchi, H.Watanabe, T.Nishijima.
Bull. Electrotech. Lab. (Japan), vol.47, no.6, p.441-54 (1983). In Japanese.
In the investigation of the behaviours of He atoms in the first wall materials of controlled thermonuclear reactor depth profiles in metals implanted with ^{3}He have been measured. In order to improve the depth resolution and to obtain a large solid angle simultaneously in beam experiments, a magnetic deflector which deflects secondary electrons and forward scattered deuterons is put in front of the solid state detector. The depth resolutions of ^{3}He profiles in Ta and Nb metals implanted at energy of 500 keV are 135 Å and 166 Å respectively, and the solid angle is 5×10^{-4} Sr. A magnetic spectrograph is constructed combining a 90 degree deflecting magnet and a position sensitive solid state detector. It is estimated that the resolving power of ^{3}He depth profile in Ta is about 100 Å, and that the solid angle is about 5×10^{-4} Sr. (30 refs.)

106158 Inner frozen metal blanket concept for an ICF reactor. R.Tsuji, S.Ido (Inst. of Laser Engng., Osaka Univ., Osaka, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.6, p.987-91 (June 1983).
A new blanket concept for an inertial confinement fusion (ICF) reactor is proposed for protecting the structural materials from the impact of X-rays and plasma and controlling the plasma expansion. The inner blanket consists of several cm of frozen metal with holes for entry of the laser beams and for blow-off of the plasmas. The inner blanket is injected from the top of the reactor chamber at a speed of about 50 m/s. It is located near the fuel pellet (~10 cm from the pellet and ~5 m from the structural materials). When a microexplosion occurs, the inner frozen metal blanket is melted by the neutron heating and falls into the liquid metal pool, expanding and being guided by the magnetic field. The performance and neutronics calculations of the inner blanket are presented here using a simple model. (14 refs.)

106159 Zero-dimensional analysis of burn control with compression-decompression. M.Okamoto, M.Ohnishi (Inst. of Atomic Energy, Kyoto Univ., Kyoto, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.5, p.366-78 (May 1983).
A simple but realistic method of active feedback control of a self-ignited tokamak reactor by major radius compression-decompression is presented, in which the thermal fusion output power and the ion temperature are envisaged as the variables that could be adopted as object of control. Error inherent in the measuring system for the controlled variable is taken into account in the analysis. Numerical calculations based on a point reactor model are performed, which indicate that the proposed method of control is capable of completely suppressing thermal runaway without involving any significant change in the major radius or in the fusion output power. Matching the reactor output to changes in load is shown also to be possible from a numerical example. The thermal stability of an igniting plasma governed by this feedback control is analysed without prescribing any particular transport scaling. It is revealed that the control is achievable for a suitably chosen gain even with a response time lag longer than the thermal runaway time. Strong dependence of the stability on the scaling law is indicated. (15 refs.)

106160 Numerical analysis of hydrogen isotope separation characteristics in improved dual temperature exchange reaction system between water and hydrogen gas. Y.Asakura (Energy Res. Lab., Hitachi Ltd., Hitachi, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.5, p.422-32 (May 1983).
A dual temperature hydrogen isotopic exchange reaction system between water and hydrogen gas is numerically analysed. The system has two features; high efficiency of isotope exchange reaction and operation under atmospheric pressure. To achieve them, the low temperature section of the system is composed of water mist and hydrogen gas cocurrent reactor units. For the high temperature section, a multistage-type reactor, in which a bubble plate, superheater and catalyst bed are alternatively arranged, is applied. From a material balance between these reactors, enrichment and decontamination factors for the system are expressed as functions of seven parameters: unit number of the low temperature co-current reactor (X); stage number of the high temperature section (Y); flow ratio of tritium enriched water to decontaminated water (P/W), flow ratio of feed water to hydrogen gas (F/G); reaction temperatures of the low and high temperature sections (T_c, T_h); and bubble plate temperature (T_b). Numerical calculations show that enrichment factor depends remarkably on F/G and T_b as well as X and Y. In order to understand the separation characteristics visually, the McCabe-Thiele diagrams for the present system are drawn and compared with the results calculated. (18 refs.)

106161 Lithium isotope separation by displacement chromatography using cryptand resin. S.Fujine, K.Saito, K.Shiba (Div. of Nuclear Fuel Res., JAERI, Ibaraki, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.5, p.439-40 (May 1983). (11 refs.)

106162 Analysis of cleavage fracture potential of martensitic stainless steel fusion structures. I. Micromechanical models and material properties. G.R.Odette, G.E.Lucas (Dept. of Chem. & Nuclear Engng., Univ. of California, Santa Barbara, CA, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.264-75 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
The major disadvantage of martensitic stainless steels for structural applications in fusion reactors is currently considered to be their potential for low temperature brittle cleavage fractures. The authors review the current understanding of cleavage fracture in steels and the role of microstructure in dictating material resistance to this type of fracture. A parametric analysis of cleavage fracture in a surrogate steel, A533B, is made and the results are used in conjunction with general cleavage fracture theory to establish some potential guidelines for future research in developing the martensitic stainless steels. (44 refs.)

106163 Analysis of cleavage fracture potential of martensitic stainless steel fusion structures. II. Fracture analysis procedures for flawed fusion structures. G.R.Odette, G.E.Lucas (Dept. of Chem. & Nuclear Engng., Univ. of California, Santa Barbara, CA, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.276-86 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
For pt.I see ibid., vol.117, p.264-75 (1983). The potential for brittle cleavage fracture is a major concern for martensitic stainless steels which are candidates for fusion reactor structural materials. The authors attempt to identify for flawed fusion structures the pertinent fracture resistance or failure parameters and the relationships between these parameters and the basic materials properties which govern cleavage fracture. Several procedures for relating test data to failure prediction, including Charpy-V-notch transition temperature referencing and two-parameter interpolation procedures, are considered; and results are discussed with respect to possible research paths for martensitic stainless steel alloy development. (29 refs.)

106164 The dependence of the high temperature mechanical properties of austenitic stainless steels on implanted helium. H.Schroeder, P.Batfalsky (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
J. Nucl. Mater. (Netherlands), vol.117, p.287-94 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
High temperature helium embrittlement effects on the creep properties of AISI 316 SS (solution annealed+aged) and DIN 1.4970 SS (solution annealed+cold worked+aged) have been investigated. The generation of helium due to (n, α) nuclear reactions in a fusion reactor environment has been simulated by homogeneous helium implantation at a cyclotron. The creep rupture tests with various applied tensile stresses have been carried out at 1023K (316 SS) and 1079K (1.4970 SS), respectively, with four differently treated sets of samples: (1) unimplanted controls; (2) after room temperature implantation of 100 appm He; (3) after implantation of 100 appm He at test temperature; (4) creep tested at high temperature during implantation ('in-beam') with implantation rates of 10-100 appm He/h. In contrast, to the ductile behaviour with transgranular failure of the unimplanted controls, all He-implanted samples showed brittle, intergranular early failure. The embrittlement effect was enhanced for the 'in-beam' tested samples. The difference between the differently treated sets of samples can be related to different bubble microstructures investigated by TEM. In addition, a comparison to reactor data for the DIN 1.4970 SS is presented. (12 refs.)

106165 The resistance of 9 Cr-1 MoVNb and 12 Cr-1 MoVW steels to helium embrittlement. R.L.Klueh, J.M.Vitek (Metals & Ceramics Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.295-302 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
Small amounts of helium (15-40 at. ppm) are known to cause embrittlement in a large number of alloys when tensile tested at elevated temperatures. To determine the effect of helium on ferritic steels of interest for fusion reactor applications, tensile specimens of normalized-and-tempered 9 Cr-1 MoVNb with 0.1 and 2% Ni and 12 Cr-1 MoVW with 0.4, 1, and 2% Ni were irradiated in the High Flux Isotope Reactor (HFIR) at ~55°C. Helium up to ~42 at. ppm was produced by a two-step reaction of ^{58}Ni with thermal neutrons. No embrittlement was detected in tensile tests at 700°C. These results are contrasted with the more severe embrittlement reported in the literature for several other types of alloys containing 15-30 at. ppm He. (20 refs.)

106166 The development of small specimen mechanical test techniques. G.E.Lucas (Dept. of Chem. & Nuclear Engng., Univ. of California, Santa Barbara, CA, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.327-39 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
The current program plan for the development of materials for fusion reactors requires testing candidate materials in both fission reactors and high energy neutron sources. Because of the volume limitations of available facilities, both

current and near term, and because of the relatively large number of materials and test conditions that will need to be explored, it is essential that test techniques be developed to extract mechanical property information from small volume specimens. A variety of such test techniques are under development at the University of California, Santa Barbara. These include instrumented microhardness, bulge, shear punch, indentation creep and load relaxation and miniaturized fracture tests for obtaining strength, ductility, time-dependent flow, and fracture information on specimens as small as TEM discs. (34 refs.)

106167 Static and buckling analysis of a cryostat outer wall (Bell-Jar) for the whole magnetic system of the INTOR-NET fusion reactor. M.Biggio, J.Airola, F.Farfaletti-Casali, M.Turri (Comm. of the European Communities, Joint Res. Centre, Ispra, Italy).
Nucl. Eng. & Des. (Netherlands), vol.74, no.3, p.317-24 (1982).
In the framework of the studies performed for the Experimental Fusion Reactor INTOR/NET, the proposal was considered of enclosing the Torus and the whole magnetic system in a single large metallic containment under vacuum, constituting the outer boundary of the cryostat. Such a big containment (called the Bell-Jar) poses severe engineering problems of feasibility and stability. The conceptual design was analysed and developed in detail with extensive use of the finite element method. The studies enable one to identify a configuration which is able to sustain the applied loads in stable equilibrium conditions within the allowable stress limits. (3 refs.)

106168 Fatigue evaluation of the JT-60 vacuum vessel under the dynamic electromagnetic forces. H.Takatsu, M.Shimizu, M.Ohta (JAERI, Ibaraki, Japan), Y.Nakamura, K.Sakai, K.Uchino.
Nucl. Eng. & Des. (Netherlands), vol.74, no.3, p.325-37 (1982).
Fatigue evaluation of the JT-60 vacuum vessel was carried out under the dynamic electromagnetic forces. In the present method, fatigue strength of the vacuum vessel is evaluated not only during the transient response but during the free vibration following the transient response. Stress amplitudes during the transient response are counted using the range-pair count method faithful to the stress strain hysteresis loop. The fatigue damage during the transient response and the free vibration following the transient response is evaluated based on Miner's law. The fatigue evaluation results showed that the JT-60 vacuum vesel has the sufficient fatigue strength and the free vibration has much larger contribution to the fatigue damage than the transient response. (15 refs.)

106169 A conceptual design of light ion beam fusion reactor—UTLIF(1). H.Madarame, S.Iwata, S.Kondo, A.Suzuki, H.Shimotono (Dept. of Nuclear Engng., Univ. of Tokyo, Tokyo, Japan), K.Miya, M.Nakazawa, Y.Oka, S.Tanaka, M.Akiyama, H.Hashikura, H.Kobayashi, S.Tagawa.
Nucl. Eng. & Des. (Netherlands), vol.74, no.3, p.377-92 (1982).
UTLIF(1) is a conceptual design study on a light ion beam driven fusion reactor based on a concept of pin-bundle blanket. The study includes nuclear and structural analyses of the blanket, consideration on materials, tritium handling system and power conversion system designs, pellet and beam driver designs, and economic analysis of the plant. The pin-bundle blanket has been shown to be attractive for light ion beam fusion reactors. (16 refs.)

106170 Instability of fusing plasmas and spin-depolarization processes. B.Coppi, F.Pegoraro, J.J.Ramos (MIT, Cambridge, MA, USA).
Phys. Rev. Lett. (USA), vol.51, no.10, p.892-5 (5 Sept. 1983).
A plasma mode driven by the anisotropy of the velocity distribution of charged fusion-reaction products can resonate with the spin precession frequency of one of the plasma components. When these spins are initially polarized, resonant depolarization can occur at a rate considerably faster than the fusion reaction rate, if spatial inhomogeneity effects do not depress excessively the mode amplitude. (6 refs.)

106171 Neutronic evaluations of activations in graphite-thorium assemblies, 14 MeV neutron sources: Comparisons with measurements. S.A.Kushneriuk, P.Y.Wong.
Report AECL-8060, Atomic Energy Canada Ltd., Chalk River, Ont. (April 1983), 52 pp.
Results are presented of neutronic evaluations of activations induced in foils irradiated at various positions within the INRS irradiation facility; comparisons with the results of measurements are made. The activities considered were those induced via the $^{27}Al(n, p)^{27}Mg$, $^{27}Al(n, \alpha)^{24}Na$, $^{63}Cu(n, 2n)^{62}Cu$, $^{127}I(n, 2n)^{126}I$, $^{90}Zr(n, 2n)^{89}Zr$, $^{115}In(n, \gamma)^{116m}In$, $^{197}Au(n, \gamma)^{198}Au$, $^{232}Th(n, \gamma)^{233}Th$ and $^{232}Th(n, f)^{89}Rb$ reactions. The calculations were made using the MORSE Monte Carlo neutronics code. (14 refs.)

Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute .... See Entry 105031

Rate of nuclear fusion reaction in a magnetoplasma .... See Entry 105942

Reply to the comment 'Rate of nuclear fusion reaction in a magnetoplasma' .... See Entry 105943

Response of an orthotropic cylindrical shell to sudden heating .... See Entry 107008

The role of atomic collisions in fusion .... See Entry 107336

Laser irradiation of disk targets at 0.53 μm wavelength .... See Entry 107415

Finite element analysis of the magnetomechanical behavior of a toroidal coil with magnetic mirrors .... See Entry 107424

Modeling TFTR plasma physics .... See Entry 107425

The effect of neutron and He-irradiation on the crack modes of type 316 stainless steel .... See Entry 107751

Displacement cascades in polyatomic materials .... See Entry 107752

Debonding of epoxy from glass in irradiated laminates .... See Entry 107762

Effects of 14 MeV neutron irradiation on creep of nickel and niobium .... See Entry 107775

Crack propagation characteristics in neutron irradiated type 316 stainless steel microspecimens .... See Entry 107776

Void formation and solute segregation in ion-irradiated niobium-base alloys .... See Entry 107786

Effect of argon ion sputtering of surface on hydrogen permeation through vanadium .... See Entry 108053

Determination of Luders strains and flow properties in steels from hardness/microhardness tests .... See Entry 109643

28.58 INTEGRATED REACTOR SYSTEMS

106172 The molten salt hybrid: a 'leisurely walk' to a fusion economy. C.P.Hager,Jr. (Indiana Univ., Bloomington, IN, USA).
Fusion (USA), vol.4, no.9, p.36-40 (July 1981).
Describes a hybrid system using a molten salt fission reactor and a fusion reactor, which should reduce the time to achieve commercial fusion power. A molten fluoride salt system is discussed. (5 refs.)

28.80 RADIATION TECHNOLOGY, INCLUDING SHIELDING

(see also 87.60 Medical and biomedical uses of fields, radiations and radioactivity)

106173 Waste management and environmental controls in the Australian uranium mining industry. D.G.Walker, R.M.Fry, I.W.Morison.
At. Energy Aust. (Australia), vol.25, no.3-4, p.7-19 (July-Oct. 1982). [received: Sept. 1983] (12 refs.)

106174 A modern approach to radiation metrology. H.H.Eisenlohr.
Int. At. Energy Agency Bull. (Austria), vol.25, no.2, p.16-19 (June 1983).
Increasing public concern about radiation safety has generated a strong demand for reliable and accurate dose measurements. This demand for assurance of radiation safety applies to the protection not only of man but of his environment also, and covers all activities in which ionizing radiation is intentionally used, including radiotherapy and industrial radiation processing. (no refs.)

106175 Effect of Fe-56 anisotropic scattering on neutron penetration. N.Yamano, K.Koyama (Dept. of Nuclear Safety Evaluation, JAERI, Ibaraki, Japan), M.Kawai.
J. Nucl. Sci. & Technol. (Japan), vol.20, no.5, p.435-8 (May 1983). (8 refs.)

106176 Sandia Pulse Reactor personnel dose reduction program. J.S.Philbin, T.F.Luera (Sandia Nat. Lab., Albuquerque, NM, USA).
Trans. Am. Nucl. Soc. (USA), vol.44, suppl., no.1, p.17-19 (1983). (11th Biennial Conference on Reactor Operating Experience 'Plant Startup and Operations in the '80s', Scottsdale, AZ, USA, 1-3 Aug. 1983).
Sandia National Laboratories is undertaking extensive modifications of its Sandia Pulse Reactor (SPR) Facility in the interest of personnel dose reduction and increased experiment throughput. The SPR Facility consists of an instrumentation building, a control building, and a reactor building (or Kiva) in which two bare, fast burst reactors, SPR-II and SPR-III, are operated. Only one reactor is operated at a time in the center of the dome-shaped Kiva. A dose reduction/facility modernization program comprised of several major components was instituted in the summer of 1982. The major components of the program are: modifications of the Kiva; modifications to the SPR-III reactor stand; procurement of a remotely controlled forklift; design, fabrication, and use of a personnel maintenance shield; administrative changes. The goal of the program is to reduce the total radiation exposure of personnel in the operation and maintenance of the reactor by 33%. (no refs.)

106177 Operational quantities for use in external radiation protection measurements. An investigation of concepts and principles.
Report EUR 8346 EN, Comm. European Communities, Luxembourg (1983), 40 pp.
Contains a detailed discussion of the operational quantities used in or proposed for calibration of radiation instruments. This subject is treated in the context of the conceptual basis provided by the definition of quantities for general use with ionising radiation, the selection of quantities for the specification of dose limitations and the requirements specifically applicable to the operational quantities. The emphasis of the report lies on the conceptual foundation of these requirements, such as e.g. additivity, direct measureability, traceability to primary standards within the 'calibration chain', and on the critical discussion of a set of quantities in the light of these requirements. (22 refs.)

106178 Introduction to radiation protection principles. J.M.White.
Report AECL-8057, Atomic Energy Canada Ltd., Chalk River, Ont. (Jan. 1983), 48 pp.
The fundamentals of radiation hazards and their control are outlined. The purposes of the document is to outline the fundamentals of radiation protection, to describe methods that enable employees to work safely with radiation and to acquaint employees with the CRNL radiation and industrial safety organisation.

106179 Practical remote maintenance. J.P.Hamric (Dept. of Energy, Idaho Operations Office, Idaho Falls, ID, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.412
The approach to maintenance at the Idaho Chemical Processing Plant (ICPP) is changing from direct contact to remote. This is because the mission of the ICPP has changed from a pilot plant mode to a production mode. The remote application is achieved by centrally locating high failure components. Piping runs are routed such that the component is located on one side of a remote maintenance corridor and facing shielded windows, closed circuit TV cameras, and remote manipulators. The HEPA filters are also located in the remote maintenance area. Replacement is accomplished with standard mechanical principles as rails and pins for alignment and platform support, lever arm, captured nuts and bolts on flanges, adjustable hooks, pull cables, standard and modified electrical connectors, and mechanical fittings. Finally, the remote maintenance corridor is connected by a shielding labyrinth to a remote decontamination cell so that the failed components can be cleaned for contact repair. (no refs.)

106180 A risk assessment for the transportation of radioactive zeolite liners. R.H.V.Gallucci (Pacific Northwest Lab., Richland, WA, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.510-14
The accident risk is estimated for the shipment of two zeolite liners containing radioactive cesium and strontium. Each liner, assumed to hold 68200 Ci and sealed inside a CNS 1-13C, type-B shipping cask, is transported by truck over a 4200-km route. The risk to the population along the route is calculated for potential transportation accidents involving fire, impact, and puncture forces. The total risk is 5.3E-7 man-rem (50-year inhalation dose) and the maximum dose (from the least-likely accident) is 0.7 man-rem. Both estimates are less than 0.1% of comparable risk measures for natural background radiation and spent fuel shipment accidents. (13 refs.)

Development and testing of prototype alpha waste incinerator off-gas systems .... See Entry 105988

10 CFR 61 waste form requirements .... See Entry 106038

Evaluation of geologic materials to limit biological intrusion of low-level waste site covers ....See Entry 106043

In-situ stabilization of a low-level radioactive site—a case history ....See Entry 106044

Implications of pathway analysis of deminimus concentrations of radioactive waste ....See Entry 106061

Developments in breeder reprocessing technology and design concepts—the remote operation and maintenance aspects ....See Entry 106076

Effects of crud diameter on shutdown dose rate of recirculation pipes in boiling water reactors ....See Entry 106120

A neA?rly mono-energetic 6-7 MeV photon cA?librA?tion source ....See Entry 106191

The point of zero charge and adsorption properties of natural magnetite ....See Entry 109781

Neutron fluence-to-dose equivalent conversion factors: a comparison of data sets and interpolation methods ....See Entry 110176

Measurement of potential alpha energy concentration of radon and thoron daughters using an electret dosemeter ....See Entry 110177

Annealing and fading properties of CaF_2:Tm (TLD-300) ....See Entry 110178

Response of an area albedo neutron dosimeter ....See Entry 110182

Measurement and shielding of the secondary radiation from betatrons ....See Entry 110190

28.90 OTHER TOPICS IN NUCLEAR ENGINEERING AND NUCLEAR POWER STUDIES

106181 Will the United States change its approach to regulation. M.Elliott (Internat. Energy Associates, Washington, DC, USA).
Nucl. Eng. Int. (GB), vol.28, no.345, p.14-16, 23 (Aug. 1983).
Proposals now being debated in Congress are the first significant step in nuclear power licensing and regulation reform in America since the Atomic Energy Act of 1954. The author discusses the background to the proposals and assesses the chances that reforms will be enacted. (no refs.)

106182 The new waste calcining facility at ICPP. R.R.Smith, G.E.Bingham, F.D.Bench (Exxon Nuclear Idaho Co. Inc., Idaho Falls, ID, USA).
Treatment and Handling of Radioactive Wastes, American Nuclear Society Topical Meeting, Richland, WA, USA, 19-22 April 1982 (Richland, WA, USA: Battelle Press 1983), p.445-8
A new waste calcining facility (NWCF) has been constructed at the Idaho Chemical Processing Plant (ICPP) to replace the waste calcining facility (WCF) that was built to demonstrate fluidized-bed solidification of highly radioactive wastes. The NWCF is designed to produce capability for processing a variety of waste compositions at a higher throughput, more corrosion-resistant materials of construction, more effective cleanup of effluent streams, and extensive remote maintenance and equipment replacement capability. The NWCF also incorporates extensive decontamination capability in the event contact maintenance becomes necessary. Construction was completed in December 1980 and testing is approximately 95% complete, with completion in the spring of 1982. Hot operation is scheduled to begin in mid-year 1982. (4 refs.)

29.00 EXPERIMENTAL METHODS AND INSTRUMENTATION FOR ELEMENTARY-PARTICLE AND NUCLEAR PHYSICS

Yamada Conference VI on Neutron Scattering in Condensed Matter ....See Entry 105020

29.15 ELECTROSTATIC AND LINEAR PARTICLE ACCELERATORS

106183 The impedance of an electrodynamic, coaxial plasma accelerator. I.F.Kvartskhava, R.D.Meladze, E.Yu.Khautiev, N.G.Reshetnyak, K.V.Suladze.
J. Eng. Phys. (USA), vol.43, no.5, p.1296-9 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR),* vol.43, no.5, p.837-41 (Nov. 1982). [received: Sept. 1983]
The properties of the impedance of an electrodynamic plasma accelerator are investigated. Drawing upon an analysis of the generalized Ohm's law, the factors resulting in a decrease in impedance, observed when the 'extension currents' of the coaxial gun are blocked, are discussed. (6 refs.)

29.20 CYCLIC ACCELERATORS AND STORAGE FACILITIES

(for plasma accelerators, see 52.75)

106184 Equilibrium bunch length of beam current in electron storage rings. Y.Miyahara (Synchrotron Radiation Lab., Univ. of Tokyo, Tokyo, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.6, p.992-5 (June 1983).
A simple formalism for bunch lengthening in electron storage rings is given as an equilibrium state of the electron distribution in the longitudinal phase space, which is determined by the balance of quantum excitation, radiation damping, longitudinal coherent instability and Landau damping of the instability. The parameter dependence of the bunch lengthening is compared with other formulas. A numerical application of the new formula is given for several electron storage rings. (16 refs.)

106185 Fermilab $p\bar{p}$ collider. A.V.Tollestrup.
Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.313-50
The author reports on the status of the Fermilab $p\bar{p}$ collider program. The center of mass energy will be 2 TeV, and preliminary running is being planned for mid 1985. In order for this program to come to fruition, three components must be successfully completed: the energy saver, the $\bar{p}$ source consisting of a debuncher and an accumulator ring, and the detectors. (no refs.)

106186 Hadron colliders versus e^+e^- colliders. M.Basile (CERN, Geneva, Switzerland), G.Bonvicini, G.Cara Romeo, L.Cifarelli, A.Contin, M.Curatolo, G.D'Ali, C.Del Papa, B.Esposito, P.Giusti, T.Massam, R.Nania, G.Natale, F.Palmonari, G.Sartorelli, M.Spinetti, G.Susinno, L.Votano, A.Zichichi.
Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.409-32
The authors consider the merits of hadron colliders versus e^+e^- colliders, using experimental data observed at the ISR and extrapolated to extreme energies. The new very heavy flavours and multiparticle production are discussed, both favouring very high energy hadron colliders. (29 refs.)

106187 Practical and foreseeable limitations in usable luminosity for the collider. S.van der Meer (CERN, Geneva, Switzerland).
Third Topical Workshop on Proton-Antiproton Collider Physics Proceedings, Rome, Italy, 12-14 Jan. 1983 (Geneva, Switzerland: CERN 1983), p.555-61
The present situation and possible short-term improvements of the $p\bar{p}$ collider are discussed. A long-term plan, aiming at an increase in luminosity by an order of magnitude, is then described. (2 refs.)

Measurement and shielding of the secondary radiation from betatrons ....See Entry 110190

29.25 PARTICLE SOURCES AND TARGETS, PREPARATION AND TECHNOLOGY

(see also 07.77 Particle production and handling; targets)

106188 Optimum sample thickness for total cross section measurements. V.F.Sears (AECL, Chalk River, Ontario, Canada).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.2-3, p.561-2 (1 Aug. 1983).
It is shown that the error in the total collision cross section due to counting statistics is a minimum when the transmission of the sample is 11%. (4 refs.)

106189 The mechanism of implanted ion tapping in thick targets investigated by Mossbauer technique. A.Kotlicki, J.J.Wlodarczyk, A.Wojtasiewicz (Inst. of Experimental Phys., Warsaw Univ., Warsaw, Poland).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.2-3, p.565-6 (1 Aug. 1983).
The mechanism of implanted ion trapping during preparation of thick targets is investigated by the Mossbauer technique. The analysis of Mossbauer spectra of implanted samples has shown that the implanted ions are located in a surface layer which is formed mainly of carbon. (3 refs.)

106190 Electron dynamics and strong ion beam production in magnetically insulated ion diode operated in long pulse mode. Y.Nakagawa (Res. Inst. for Atomic Energy, Osaka City Univ., Osaka, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.6, p.L328-30 (June 1983).
By an annular magnetically insulated ion diode operated in long pulse mode, total ion current of 5 kA and ion current density over 30 times the Child-Langmuir limit are achieved. Average length of electron drift by $E\times B$ force in the gap is measured to be about three times the gap length. Based on fundamental theory, the ion production efficiency is estimated by this length to be consistent with the experimental value (20%). The value of $E\times B$ current evaluated from this length is enough to change the applied magnetic field. It is predicted by the theory describing ion flow enhancement. (9 refs.)

106191 A neA?rly mono-energetic 6-7 MeV photon cA?librA?tion source. D.W.O.Rogers (Phys. Div., Nat. Res. Council of Canada, Ottowa, Canada).
Health Phys. (GB), vol.45, no.1, p.127-37 (July 1983).
A photon source has been developed which delivers about 85% of its photon dose equivalent from photons with energies of 6.1, 6.9 and 7.1 MeV produced in the $^{19}F_2(p, \alpha\gamma)^{16}O$ reaction. The source uses up to 50 μA of 2.7 MeV protons incident on a 6 mg/cm^2 target of CaF_2. It produces a photon field with a dose equivalent rate of up to 6 mSv/h (600 mrem/h) over a large area 100 cm from the target. The field can be calibrated in terms of photon fluence to within ±5%. In common with other high-energy photon sources, there is considerable contamination of the field by knock-on electrons and scattered photons. Experiments with various filter materials and detailed Monte-Carlo calculations with the EGS electron-photon transport code have been done to investigate the importance of these contaminants. (18 refs.)

106192 Multigamma-ray calibration sources. R.A.Meyer, T.N.Massey (Nuclear Chem. Div., Lawrence Livermore Nat. Lab., Livermore, CA, USA).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1073-84 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
A self-consistent set of multigamma-ray standards have been calibrated using an automated multi-spectrometer γ-ray counting facility. Pure sources of long-lived activity were produced by mass separation and, or, chemical purification. The sources were counted individually and in combination on several different calibrated spectrometer systems. These systems utilize various detectors ranging from small (X-ray) detectors to large volume high-purity Ge detectors. This has allowed the use of the most ideal individual detector-efficiency characteristics for the determination of the relative γ-ray intensities. Precise energy measurements, reported earlier (Meyer, 1976) have been performed by an independent method. Both the energy and γ-ray-emission probabilities the authors determined compare well with independently established values such as the recent ICRM intercomparison of ^{152}Eu. (25 refs.)

106193 On the density oscillations of a warm particle bunch. P.J.Channell (Los Alamos Sci. Lab., Los Alamos, NM, USA), A.M.Sessler, J.S.Wurtele.
Phys. Fluids (USA), vol.26, no.8, p.2281-91 (Aug. 1983).
The density oscillations of warm particle bunches is investigated theoretically. Two different mathematical approaches are employed to derive the basic equation describing density oscillations; one is a fluid approach and the second is a more general Green's function formulation. The motion is analyzed in first-order perturbation theory where it is shown, under the assumption of no degeneracy, that there are only stable oscillations. Second-order perturbation theory gives damping of the motion. The perturbation theory is examined, and a criterion is exhibited for its proper use. Thus, when the resistivity is large the motion is essentially unstable with a growth rate which is that of an unbunched beam. The criterion is approximately evaluated using a model for a bunched beam. (15 refs.)

106194 Studies of condensed matter with a pulsed neutron source (KENS). Y.Ishikawa (Phys. Dept., Tohoku Univ., Sendai, Japan).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.3-14 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Summarises the experimental results obtained with various spectrometers installed at the KEK pulsed spallation neutron source (PSNS) and, in the light of these results, discusses the potential of the pulsed neutron sources for

the studies of condensed matter researches. Emphasis is placed on the fact that the PSNS can make a new significant contribution to the subjects for research for which the PSNS has long been considered to be unfavourable. (33 refs.)

106195 Pulsed neutrons: one year of experience with the new source at Argonne National Laboratory. G.H.Lander (Argonne Nat. Lab., Argonne, IL, USA).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.15-24 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The Intense Pulsed Neutron Source (IPNS) at Argonne National Laboratory is a spallation neutron source based on a 500 MeV proton accelerator operating at 30 Hz and with an average proton current of ~ 10 μA. Neutron scattering instruments for elastic scattering include two powder diffractometers, a single-crystal diffractometer based on the Laue method and employing a large (30×30 cm) position-sensitive scintillation detector, a small-angle diffractometer using a position-sensitive detector, and a polarised-neutron diffractometer which will utilise the spin-refrigerator device to obtain a beam of white polarised neutrons. For inelastic scattering the system presently has the crystal-analyser spectrometer, and two chopper spectrometers capable of providing monoenergetic incident neutron beams of between 100 and 600 meV. (8 refs.)

106196 Condensed matter research at the Los Alamos pulsed neutron source (WNR). J.Eckert (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.25-30 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The experimental program at the WNR in condensed matter research at present is aimed principally at utilising the high epithermal neutron flux available at a spallation neutron source. Interesting new results have been obtained in several areas including hydrogen vibrations in metals, chemical vibrational spectroscopy and the structure of liquids. For example, extensive vibrational spectra were obtained by hydrogen in Nb which could be described in terms of a three-dimensional localised anharmonic oscillator, deuterium substitution methods were used to determine the variation with O-O distance of the hydrogen bending mode frequency in extremely short intramolecular hydrogen bonds, and model-independent partial structure factors were determined for liquid water. (18 refs.)

106197 A new steady state medium flux neutron source. B.Farnoux, D.Cribier (Lab. Leon Brillouin, CENS, Gif-sur-Yvette, France).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.31-6 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
A new steady state neutron source is in operation at the Atomic Energy Commission site of Saclay (France). It is a pool type nuclear reactor, using enriched uranium fuel elements together with a heavy water tank as moderator, and is specially designed to provide neutron beams for fundamental and applied research. At full power of 14 Mw, the maximum unperturbed neutron flux reaches 3×10^{14} n/cm^{2}s and the reactor is operated twenty-four hours per day in a three-month cycle. Twenty horizontal neutron beams can be used in the reactor hall or transmitted to a large external hall by cold neutron guides. Several vertical tubes allow radioisotope production and activation analysis. In a first stage, nineteen experimental facilities are planned including thirteen spectrometers for elastic scattering studies and six spectrometers for spectrometry studies. (no refs.)

106198 First experience on the high intensity pulsed reactor IBR-2. I.M.Frank, P.Pacher (Lab. of Neutron Phys., Joint Inst. for Nuclear Res., Dubna, USSR).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.37-44 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The IBR-2 pulsed fast reactor has been constructed in the Laboratory of Neutron Physics, JINR, for scientific research. The tests and power startup of the high flux neutron source based on periodic reactivity modulation are in the course of completion. The operation experience of the reactor is discussed and the measured characteristics are given. Being a pulsed neutron source the IBR-2 can be well combined with the time-of-flight technique and, therefore, the basic field for its application is neutron spectrometry. The first instruments installed for condensed matter and molecular biology investigations are described and the research programme is outlined. (8 refs.)

106199 Polarised neutron scattering using pulsed spallation neutron source at KEK. Y.Endoh, Y.Sasaki, H.Ono, S.Mitsuda (Dept. of Phys., Tohoku Univ., Sendai, Japan), S.Ikeda.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.45-50 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The authors present results of one year's experience with the polarised neutron spectroscopy at the pulsed spallation neutron facility at KEK. They discuss the feasibility of a new method manipulating the dual time indicators of both pulses and neutron spin rotations. (14 refs.)

106200 Characteristics of a thermal neutron source based on an intermediate energy proton accelerator. M.A.Lone, W.N.Selander, B.M.Townes, J.Latouf, E.C.Svensson, G.A.Bartholomew.
Report AECL-7839, Atomic Energy Canada Ltd., Chalk River, Ont. (March 1983), 39 pp.
The envisaged development program leading to a 1 GeV, 300 MW accelerator breeder pilot plant would require construction of three high-current proton test accelerators of progressively increasing energy. These accelerators would also be available to drive neutron sources for other applications. This report explores the characteristics of the high-intensity thermal neutron source that would be provided as part of the Electronuclear Materials Test Facility (EMTF), which is envisaged as a multipurpose test system based on the accelerator of intermediate energy. Two options, a 300 mA CW proton beam at 100 MeV and a 70 mA CW proton beam at 200 MeV are considered. It is shown that the 70 mA, 200 MeV accelerator with a Pb-Bi eutectic target would provide an unperturbed peak thermal neutron flux of $\approx1.5\times10^{15}$ n.cm^{-2}.s^{-1} in a relatively large volume of a D_2O moderator. The 300 mA, 100 MeV accelerator with a Li target and graphite moderator would provide a peak thermal neutron flux of $\approx6.0\times10^{14}$ n.cm^{-2}.s^{-1}. Thermal neutron fluxes in various other moderators and heat limitations in various target configurations are also investigated. (44 refs.)

Curved neutron mirror system as an improved polariser .... See Entry 105418

Vertically focusing Heusler alloy monochromators for polarised neutrons .... See Entry 105419

Thermal diagnostics of pulsed 0-2 MeV electron beams and bremsstrahlung .... See Entry 105425

X-rays from synchrotron: new challenge for neutron scattering .... See Entry 105435

Cross-sections of materials used as neutron monochromators and filters .... See Entry 105946

Equilibrium bunch length of beam current in electron storage rings .... See Entry 106184

Practical and foreseeable limitations in usable luminosity for the collider .... See Entry 106187

Combination source for gamma-ray spectrometry .... See Entry 106205

Multi-analyser crystal spectrometer (MAX) for pulsed neutron source and its application to various problems .... See Entry 106214

Collision experiment on highly ionized ions using a vacuum spark source .... See Entry 106533

Study of Ge-Si solid solution crystals by X-ray topography and neutron diffraction .... See Entry 107614

29.30 RADIATION SPECTROMETERS AND SPECTROSCOPIC TECHNIQUES

106201 Progress in energy resolution of mercuric iodide (HgI_2) X-ray spectrometers. A.J.Dabrowski, W.M.Szymczyk , J.S.Iwanczyk, J.H.Kusmiss (Inst. for Phys. & Imaging Sci., Univ. of Southern California, Marina del Rey, CA, USA), W.Drummound, L.Ames.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.89-94 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
A brief discussion of the main factors which affect the energy resolution of HgI_2 X-ray spectrometers is presented. A short review of the progress made in the process of improving the energy resolution is given. The latest experimental results obtained with a state-of-the-art cryogenically cooled low-noise preamplifier are shown. Ways of lowering the currently attainable room-temperature electronic noise level other than cryogenic cooling are discussed. (13 refs.)

106202 Gamma-ray spectrometry with thick mercuric iodide detectors. A.Beyerle, K.Hull, J.Markakis, B.Lopez (EG&G, Santa Barbara Operations, Goleta, CA, USA), W.M.Szymczyk.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.107-13 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
Gamma-ray spectra with energies up to 1.3 MeV have been detected for the first time with 1 cm thick HgI_2 semiconductor detectors at room temperature. The spectra can be taken using a 'long', 10 μs, or a 'short', 0.5 μs, charge collection time. The latter has produced better results with better peak efficiency, higher peak-to-valley ratio, and fewer low energy counts with little sacrifice in resolution. Spectra for energies between 100 keV and 1.3 MeV and descriptions of the techniques for their acquisition are presented. The thick detectors need a conditioning treatment, which is described, prior to showing spectra response. (8 refs.)

106203 Some remarks on the spiral orbit spectrometer. H.R.Faust, F.Blonnigen (Inst. Laue-Langevin, Grenoble, France).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.2-3, p.545-6 (1 Aug. 1983).
The electron paths in the so called 'spiral orbit' spectrometer are investigated for different magnetic fields. (5 refs.)

106204 A fall-focussing gravity spectrometer for very slow neutrons. M.Utsuro (Res. Reactor Inst., Kyoto Univ., Osaka, Japan).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.2-3, p.557-60 (1 Aug. 1983).
The possibility of a high resolution ($\Delta E\lesssim10^{-7}$ eV) gravity spectrometer working on the principle of fall-focussing of very slow neutrons scattered in 4π-directions is shown. The simultaneous use of the time-of-flight analysis should give a higher energy resolution and also information on the scattering angle. (6 refs.)

106205 Combination source for gamma-ray spectrometry. T.Genka, I.Ishikawa (Dept. of Radioisotope Production, JAERI, Ibaraki-ken, Japan).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1067-72 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
An acrylic-resin-made one-eighth-sector source in which radioactive material was mounted at the angular position was constructed. Sources of this type may be used in various combinations of up to eight sources of the same or different kinds of nuclides, giving a nearly point source configuration. Characterization and performance as well as applications of the combination source are discussed. (8 refs.)

106206 Tables for cascade-summing corrections in gamma-ray spectrometry. F.J.Schima, D.D.Hoppes (NBS, Washington, DC, USA).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1109-14 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
Calculations of the spectral distortion caused by the simultaneous detection of cascade radiations in gamma-ray spectrometry involve terms containing the relative probability for the coincident emission of the radiations involved. The authors present tables of these probabilities ('summing coefficients') for the most probable gamma rays of some frequently encountered radionuclides, to be combined with measured full-energy-peak or total efficiencies of a particular system to calculate emission rates that would be measured without cascade summing. (7 refs.)

106207 Coincidence-summing corrections in gamma-ray spectrometry for normalized geometries. J.Morel, B.Chauvenet, A.Kadachi (LMRI, CENS, Gif Sur Yvette, France).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1115-22 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
Some standardized geometries for γ-ray-spectrometry measurements are presented. The importance of coincidence summing is evaluated for some radionuclides commonly used for calibration purposes. (11 refs.)

106208 A neutron spin echo triple axis spectrometer. C.M.E.Zeyen (Inst. Laue-Langevin, Grenoble, France).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.70 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Summary form only given, as follows. Describes a neutron spin-echo set-up for the ILL D10 triple axis spectrometer. This set-up consists of vertically focusing Heusler alloy polariser/analyser systems, iron yoke spin precession electromagnets mounted on air cushion tables similar to the classical spectrometer tables and air-wound flipper and field correction coils. The polarised neutron intensity in the detector is reduced by a factor of five as compared to the classical TAS with PG crystals. The energy resolution, on the other hand, is improved by two orders of magnitude. This has been demonstrated for

quasielastic scattering where 1 μeV resolution at 15 meV incident energy has been reached. Experiments involving finite energy transfers for phonon lifetime measurements are also reported. (no refs.)

106209 Time-of-flight spectrometer for ultra-cold neutrons. J.W.Lynn, W.A.Miller (Dept. of Phys., Univ. of Maryland, College Park, MD, USA), T.W.Dombeck, G.R.Ringo, V.E.Krohn, M.S.Freedman.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.114-17 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The production and use of ultra-cold neutrons has been by considerable interest in recent years both because of the possibility of increasing the measurement precision of the intrinsic properties of the neutron itself as well as improving the energy resolution of conventional scattering experiments. The authors have constructed a rotating-crystal Doppler shifter at the pulsed neutron source at Argonne which shifts neutrons of speed ~400 m/s into the ultra-cold range (<10 m/s), and used this source to develop a high resolution time-of-flight spectrometer. To demonstrate the utility of those spectrometer they present measurements of iron films evaporated on titanium foils. The data reveal the polarization dependence of the transmission as a function of velocity, as well as the quantum-mechanical interference caused by the waves scattered by the iron and titanium. The data collection rates (at ZING-P′) are about two orders-of-magnitude higher than achieved at other ultra-cold neutron sources. Energy resolution of 10^{-7}-10^{-8} eV is readily achieved. (10 refs.)

106210 A new system of gravity spectrometer with fall focusing of ultra cold neutrons. M.Utsuro (Res. Reactor Inst., Kyoto Univ., Osaka, Japan), Y.Kawabata.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.118-21 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
A high resolution gravity spectrometer for ultra cold neutrons (UCN) and the UCN source of a supermirror turbine are described. The possibilities of the fall focusing of UCN emitted into the 4π or 2π directions to a localized point of a sample or a detector are analysed, and a result it is shown that a focusing mirror arranged in the form of a modified ellipsoid can be used both as a monochromator and as an analyser with the highest geometrical efficiency for UCN. Numerical calculations for a typical case of the proposed spectrometer with an equivalent radius of 50 cm gave an energy resolution of $\sim 2 \times 10^{-8}$ eV in the optimized arrangement for a neutron velocity of 5 m/s. Thus, the proposed system can be used for high resolution experiments of incoherent scattering or low-q coherent scattering with small energy transfer of $\epsilon \lesssim 1$ μeV. (7 refs.)

106211 Design and use of a 6 meter neutron small-angle scattering spectrometer at KUR. S.Komura, T.Takeda, H.Fujii (Faculty of Integrated Arts & Hiroshima Univ., Hiroshima, Japan), K.Osamura, K.Mochiki, K.Hasegawa.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.122-5 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
A 6 meter neutron small-angle scattering spectrometer has been constructed at the Kyoto University Reactor (KUR) and has been used successfully in various fields of application. The design principles and the characteristics of the spectrometer are described briefly. Some examples of the scattering measurements are presented. (7 refs.)

106212 A resonance detector spectrometer at KENS. J.M.Carpenter, N.Watanabe, S.Ikeda, Y.Masuda, S.Sato (Nat. Lab. for High Energy Phys., Ibaraki-ken, Japan).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.126-30 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The authors have tested a resonance detector spectrometer at the KENS neutron source, using ^{181}Ta, ^{121}Sb and ^{149}Sm resonances and bismuth germanate (BGO) scintillators. In the process they encountered and solved numerous background problems, and discovered a time-focusing principle. They measured the scattering from a number of materials and have so far analyzed results for bismuth, vanadium and graphite. Tests of cooled absorbers indicate that resolution of 70 meV is possible with ^{181}Ta. (7 refs.)

106213 Crystal analyser TOF spectrometer (CAT). S.Ikeda, N.Watanabe (Nat. Lab. for High Energy Phys., Ibaraki-ken, Japan), K.Kai.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.131-5 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Reports the design and performance of a high resolution crystal analyzer spectrometer (CAT) which has been built and operated at KENS. Energy resolution of the instrument is $\Delta\epsilon/\epsilon=0.02$-$0.03$ in the range of energy transfer $\epsilon=0.05$-1 eV. The local modes of hydrogen in various metallic hydrides have been measured by this spectrometer. Higher harmonics of the local modes have been observed, and their fine structure, up to 5th order for TiH_2, $ZrH_{1.41}$ and $ZrH_{1.93}$. Anharmonicity parameters of the hydrogen potential for $ZrH_{1.41}$, TiH_2 and $TaH_{0.1}$ (30K) have been determined from their energy shifts relative to the harmonic values. (13 refs.)

106214 Multi-analyser crystal spectrometer (MAX) for pulsed neutron source and its application to various problems. K.Tajima (Dept. of Phys., Keio Univ., Yokohama, Japan), Y.Ishikawa, K.Kanai, S.Tomiyoshi, Y.Todate.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.136-9 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The multi-analyser crystal spectrometer (MAX) is an inverted type TOF spectrometer recently installed at KENS (spallation neutron source at KEK) for inelastic neutron scattering. Fifteen counters in the spectrometer are able to make time-of-flight scans along a desired in reciprocal lattice space, covering a wide range of the energy transfers corresponding to the fifteen analyser crystals. The magnetic excitations in antiferromagnetic γFeMn alloy were measured by the MAX at various temperatures up to 1.5 T_N and the results are demonstrated as the contour map of the intensity in the $\hbar\omega$-Q space. The high energy excitations from the metallic hydrides such as ZrH_2 and VH_2 have also been measured. (5 refs.)

X-rays from synchrotron: new challenge for neutron scattering .... See Entry 105435

Multigamma-ray calibration sources .... See Entry 106192

Pulsed neutrons: one year of experience with the new source at Argonne National Laboratory .... See Entry 106195

A new steady state medium flux neutron source .... See Entry 106197

Polarised neutron scattering using pulsed spallation neutron source at KEK .... See Entry 106199

Search for improved surface treatment procedures in fabrication of HgI_2 X-ray spectrometers .... See Entry 106222

Gamma-ray spectrometry with solid-state detectors by current pulse height analysis .... See Entry 106231

Scintillation spectrometry with HgI_2 as the photodetector .... See Entry 106232

Accurate evaluation of gamma-ray spectra for the measurement of gamma-ray emission probabilities .... See Entry 106255

An electrodynamic coaxial spectrometer for multichannel plasma pulse analysis .... See Entry 107442

29.40 RADIATION DETECTORS

(for mass spectrometers, see 07.75)

106215 New thermal-neutron solid-state electronic detector based on HgI_2 single crystals. M.Melamud, Z.Burshtein (Nuclear Res. Centre, Negev, Beer Sheva, Israel), A.Levi, M.M.Schieber.
Appl. Phys. Lett. (USA), vol.43, no.3, p.275-7 (1 Aug. 1983).
The use of HgI_2 as a thermal-neutron solid-state electronic detector, in particular its application for neutron diffractometry, is demonstrated for the first time. A single crystal HgI_2 detector is used to count prompt gamma emissions (0.2-5 MeV) from (n,γ) nuclear reactions in Gd or Cd foils. The neutron counting efficiency depends on the HgI_2 detector thickness. For a 1-mm thickness of HgI_2 the efficiency is about 10% compared to the efficiency of a $^{10}BF_3$ gas detector. (15 refs.)

106216 Inductive monopole detector employing planar high order superconducting gradiometer coils. C.D.Tesche, C.C.Chi, C.C.Tsuei, P.Chaudhari (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Appl. Phys. Lett. (USA), vol.43, no.4, p.384-6 (15 Aug. 1983).
The characteristics and performance of a family of high-order planar gradiometer detectors for inductive detection of magnetic monopoles are discussed. Conventional superconducting magnetometers used for monopole detection must be operated in an extremely stable, low field environment. This places a severe restriction of the cross-sectional area of such detectors. However, planar gradiometer detectors permit the use of relatively large area detectors in coincidence without requiring a corresponding increase in the stability of the ambient field. (4 refs.)

106217 Review of mercuric iodide development program in Santa Barbara. H.A.Lamonds (EG&G, Santa Barbara Operations, Goleta, CA, USA).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.5-12 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
Crystal growth and device fabrication methods used at EG&G Santa Barbara are reviewed. The chemical and structural characterization of the grown crystals are briefly described. The experimental results presented, especially with respect to the spectral response of detectors with thicknesses of 1 cm or more, indicate the large potential of mercuric iodide as a material for future detector applications. (16 refs.)

106218 Technology of high-purity HgI_2. Y.F.Nicolau (Lab. d'Electronique et de Technol. de l'Informatique, CEA-CENG, Grenoble, France).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.13-18 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
The synthesis and purification methods of high-purity HgI_2 by recrystallization, electrolysis and sublimation are reviewed. The results are discussed based on the SSMS analyses. Low temperature sublimation at 135-200°C proves to be less efficient than expected. Distillation at 255°C is more efficient than low temperature sublimation. (27 refs.)

106219 Mass transport, nucleation and monocrystal growth of HgI_2 with the forced flux method. J.Omaly, M.Robert, P.Brisson, R.Cadoret (UER Sci., Aubiere, France).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.19-26 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
Experimental results of mass transport under steady state conditions, analysed with the 1-D diffusion model enable more insight into the properties of the HgI_2 physical vapour transport in a closed tube to be gained. Nucleation of HgI_2 on the glass surface as a function of the supersaturation and temperature analysed with the nucleation theories dealing with the cluster saturation number exhibits a strong interaction with the substrate. Growth rate measurements are in agreement with the BCF or Chernov theories. (19 refs.)

106220 Nuclear response and phase transformation of melt grown, SbI_3-doped HgI_2. J.Nissenbaum, I.Shilo, A.Burger, A.Levi, M.Schieber (School of Appl. Sci & Technol., Hebrew Univ. of Jerusalem, Jerusalem, Israel), L.Keller, C.N.J.Wagner.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.27-30 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
Slow solidification of 1.5 wt.% SbI_3-doped HgI_2 yielded a large-grained polycrystalline boule which in thin section exhibited transparent areas. When these areas were contacted with aquadag, a nuclear radiation counter was produced which showed severe polarization effects. Slow solidification of undoped HgI_2 had no transparent areas. Detector fabricated from sliced sections of that boule gave no response to nuclear radiation. In a crystallographic and a thermodynamic study of SbI_3-doped HgI_2, it was found that an orange-colored high-temperature phase, which is crystallographically identical to the known yellow phase, appeared in all SbI_3-doped HgI_2 samples. (14 refs.)

106221 Fabrication of HgI_2 nuclear radiation detectors by machine cleaving. A.Levi, A.Burger, M.Schieber (School of Appl. Sci. & Technol., Hebrew Univ. of Jerusalem, Jerusalem, Israel), L.Van Den Berg, W.B.Yelon, R.W.Alkire.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.31-4 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
A new device has been designed to facilitate the cleaving of thin sections from bulk crystals of mercuric iodide. Crystallographic perfection of the machine-cleaved sections was established by gamma-ray diffraction rocking curves and was found to be higher than the perfection of hand-cleaved sections or of as-grown thin platelets, approaching the perfection of string-sawn section of HgI_2. A correlation was found between the perfection and thickness of the machine-cleaved sections, i.e., the thicker the section the more perfect it is. Reproducibility of the fabrication was significantly improved by using machine cleaving in the fabrication process. (7 refs.)

106222 Search for improved surface treatment procedures in fabrication of HgI_2 X-ray spectrometers. A.Levi, A.Burger, J.Nissenbaum, M.Schieber (School of Appl. Sci. & Technol., Hebrew Univ. of Jerusalem, Jerusalem, Israel), Z.Burshtein.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.35-8 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
The influence of various fabrication parameters on the surface quality of HgI_2 X-ray spectrometers has been studied in detail. Exposure of etched HgI_2 to ambient atmosphere for $\sim$24 h may reduce the electron surface recombination velocity by almost an order of magnitude. Reduction of the etching solution temperature (KI in water) to about 0°C and an increase of the KI concentration to $\sim$20 wt% are also important. (9 refs.)

106223 Spark source mass spectrographic analyses of α-HgI_2: a comparison of samples from different laboratories. J.T.Muheim, T.Kobayashi, E.Kaldis (Swiss Federal Inst. of Technol., Zurich, Switzerland).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.39-42 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
α-HgI crystals from different laboratories grown at varied conditions show typical concentration spectra for both elemental impurities and hydrocarbon fragments. The average concentration of the various impurities may easily attain a few hundred ppm. This fact is attributed to the layer structure of α-HgI. (4 refs.)

106224 Characterization of extended defects in α-HgI_2 single crystals. S.Gits (Lab. de Mineralogie-Cristallographie, Paris, France).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.43-50 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
The paper deals with firstly the calculation of the direction of growth dislocation lines and the interpretation of the development of plastic defects observed in X-ray topographs, and secondly the characterization of as-grown crystals obtained by the forced-flux method. (8 refs.)

106225 Low temperature photoluminescence of detector-grade HgI_2. J.L.Merz, Z.L.Wu (Dept. of Electrical & Computer Engng., Univ. of California, Santa Barbara, CA, USA), L.Van Den Berg, W.F.Schnepple.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.51-64 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
The low temperature photoluminescence of HgI_2 is reported. Three main luminescence bands are observed, with peaks at $\sim$2.30, 2.20, and 2.00 eV at 77K. At 4.2K, the highest energy peak shows considerable structure. The temperature dependence of these lines indicates both free and bound exciton recombination, and very small exciton binding energies ($\sim$3-5 MeV) have been estimated. A comparison of the results of sublimation and doping experiments suggests that the lowest energy band may be related to impurities, whereas the middle-energy band is related to I content. The two strongest bound exciton lines comprising the high-energy band show systematic correlations with the middle-energy, I-related band. Further correlations between these spectral features and the performance of nuclear radiation detectors fabricated from these samples are also noted. The temperature coefficient of the band gap is estimated from the spectral shift of luminescence lines to be approximately -1.13×10^{-4} eV/K between 32K and 45K. (20 refs.)

106226 Influence of temperature upon dislocation mobility and elastic limit of single crystal HgI_2. F.Milstein, B.Farber, K.Kim (Dept. of Mech. & Environmental Engng., Univ. of California, Santa Barbara, CA, USA), L.Van Den Berg, W.F.Schnepple.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.65-76 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
The practical importance of studying mechanical properties and dislocation structure of HgI_2 is reviewed briefly. Specifically, the performance of single crystal HgI_2 radiation detectors is evidently sensitive to crystalline imperfections, including dislocations. This work examines the influence of temperature upon dislocation mobility and plasticity in vapor grown single crystals of mercuric iodide. Dislocation mobility is determined by measuring the lengths of the longest arms of dislocation etch pit rosettes on (001) surfaces following microhardness indentation and chemical etch. Measurements were made at temperatures ranging from room temperature to the phase transition temperature of 127°C. Dislocation mobility was found to increase with temperature, with the effect accelerating as the 127°C phase transition is approached. Increasing temperature was also found to lower the critical resolved shear stress for plastic deformation or slip on (001) planes. In these contexts, the vapor grown crystals are clearly 'softer' at their elevated growth temperatures. The results are discussed in terms of a dislocation model involving 'soft' and 'hard' glide dislocations. (12 refs.)

106227 Search for correlations between electrical characteristics and stoichiometry in mercuric iodide. A.Tadjine, D.Gosselin, J.M.Koebel, P.Siffert (Groupe de Phys. & Applications des Semiconducteurs, CRN, Strasbourg, France).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.77-82 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
A series of HgI_2 crystals has been grown by the TOM method under various conditions, in order to correlate electrical characteristics, nuclear spectroscopic properties and stoichiometry. It is shown that the peak observed by TSC at 173K plays a major role in the detector's performance. Furthermore, by chemical analysis severe stoichiometric deviations are found, which introduce deep levels. (24 refs.)

106228 Rise time study of mercuric iodide detectors. A.Holzer (Kevex Corp., Foster City, CA, USA).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.83-8 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
A rise time study of mercuric iodide detectors irradiated with gamma ray enables one to identify the influence of several trapping centers on the detection performance of the devices. A careful analysis of the rise time spectra identifies some of the dominant traps as having detrapping times of 300 and 900 ns, and a less intense one as having a detrapping time of 200 ns. These findings have been used to get better performance from the detectors. Discriminating those parts of the pulses that have been subjected to these trapping centers dramatically improves detection performance, especially at high energies. Tuning the electronics to avoid statistical noise due to these traps also improves performance, as does cooling the detector to about 0°C, thus 'freezing' the trapping centers and producing better energy resolution. These modes of operation allow thicker detectors to be used for high energies, still maintaining good performance. At low energies ($\simeq$6 keV), much better energy resolution was obtained. Polarization effects were eliminated, and lower backgrounds and more symmetric peaks were achieved. (8 refs.)

106229 Mercuric iodide imaging detectors. C.Ortale, L.Padgett, W.F.Schnepple (EG&G, Santa Barbara Operations, Goleta, CA, USA).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.95-101 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
Linear and two-dimensional monolithic arrays of different configurations have been fabricated using photolithographic techniques. The fabrication technology, electronic setup, and pinhole imaging experiments are described. Spatial resolutions of 1-2 mm have been achieved. (2 refs.)

106230 Larger volumes of HgI_2 used as portable gamma-ray counters. J.L.Warren (EG&G, Santa Barbara Operations, Goleta, CA, USA).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.103-5 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
Mercuric iodide detectors up to 1.5 cm in thickness and with active areas of up to 17 cm^2 were fabricated and used as room-temperature, portable, gamma-ray counters. Most of the detectors show no photopeak spectral resolution, but the end point energies of various gamma radiation sources are linear with energy. The detectors are biased with about 10^3 V/cm, which can be provided in a portable package with a rechargeable capacitor. The nuclear performance of these counters is described. (4 refs.)

106231 Gamma-ray spectrometry with solid-state detectors by current pulse height analysis. W.M.Szymczyk, A.J.Dabrowski, J.S.Iwanczyk, J.H.Kusmiss, G.C.Huth (Inst. for Phys. & Imaging Sci., Univ. of Southern California, Marina del Rey, CA, USA), K.Hull, A.Beyerle, J.Markakis.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.115-22 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
The traditional way of doing gamma-ray spectrometry with semiconductor detectors depends on being able to collect the ionization charge. In most cases, hole trapping limits the spectrometric performance of room-temperature detectors made from compound semiconductors. Recently it has been shown for thick HgI_2 detectors (A. Beyerle et al., 1983) that significant improvement can be made by using a technique of unconventionally short differentiation of the detector pulses. The present paper presents the concept underlying the technique and gives its theoretical background. The method consists of measuring the amplitude of ionization current pulses before charge collection is completed rather than measuring the amount of charge collected. Hole collection is obviated, and the transport of electrons becomes the most important consideration. The conditions under which this novel method can be applied to various semiconductor materials are discussed. Two different approaches toward the electronic implementation of the technique are compared. (12 refs.)

106232 Scintillation spectrometry with HgI_2 as the photodetector. J.S.Iwanczyk, J.B.Barton, A.J.Dabrowski, J.H.Kusmiss, W.M.Szymczyk, G.C.Huth (Inst. for Phys. & Imaging Sci., Univ. of Southern California, Marina del Rey, CA, USA), J.Markakis, W.F.Schnepple, R.Lynn.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.123-6 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
A mercuric iodide (HgI_2) photodetector has been used to detect light pulses from gamma-ray and alpha-particle interaction in scintillators. The photocurrent response of an HgI_2 photodetector to light has been measured and found to be favorable for detecting light from most scintillators, which have their maximum emission between 400 and 560 nm. Energy spectra for alpha particles or gamma-rays from combinations of an HgI_2 photodetector with various scintillators are presented. The energy resolution of the photopeak from annihilation gamma-rays is 19% with a CsI(Tl) crystal and 24% with a BGO crystal. Fabrication of HgI_2 photodetectors and their optical coupling to a scintillator crystal is described. The advantages of this new solid-state radiation detector compared to the combination of scintillator and PMT, and some proposed applications, are discussed. (12 refs.)

106233 Mercuric iodide (HgI_2) semiconductor devices as charged particle detectors. F.D.Becchetti, R.S.Raymond, R.A.Ristinen (Dept. of Phys., Univ. of Colorado, Boulder, CO, USA), W.F.Schnepple, C.Ortale.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.127-32 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
The properties of HgI_2 semiconductor devices as charged particle detectors have been investigated. Nearly linear energy response with FWHM resolution of 5-15% is observed for ^{1,2}H and ^{3,4}He ions, $E<40$ MeV. Fast proton damage is observed for $>10^{10}$ protons/cm^2. However, based on measurements with two HgI_2 detectors, little fast neutron damage is apparent at fluences up to 10^{15} neutrons/cm^2. This suggests considerably greater resistance to radiation damage than is observed for Si and other solid state devices. (9 refs.)

106234 A multichannel detector system for small-angle neutron scattering investigations. M.M.Agamalyan, G.A.Panev (Leningrad Inst. for Nuclear Phys., Acad. of Sci., Leningrad, USSR), A.A.Zavedia.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.2-3, p.489-93 (1 Aug. 1983).
Describes a one-coordinate multidetector system for the study of small-angle neutron scattering. The multidetector consists of 41 identical channels, separated by cadmium sheets. The basic element of the system is a standard ^{3}He counter of the SNM-50 type. The distance between the counters is 14.6 mm. The proposed construction assures complete elimination of rescattering in the multidetector and makes it possible to take measurements without a beam-stop. The analysis showed that the ^{3}He counter is responsible for thermal instability of the channels. A procedure of multidetector calibration is developed and small-angle neutron scattering by the block copolymer superlattice is examined. (6 refs.)

106235 **On the use of polyethyleneterephthalate as solid state nuclear track detector: kinetics and mechanism of particle track etching.** H.B.Luck (Akad. der Wissenschaften, Zentralinst. fur Kernforschung, Rossendorf/Dresden, Germany).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.2-3, p.507-11 (1 Aug. 1983).
Kinetics of particle track etching in polyethyleneterephthalate is controlled by different rate-determining mechanisms. While at a low etchant activity the track etch rate v_t depends on the product of water activity and the second power of the hydroxide activity a saturation of v_t is reached at higher etchant activity. For NaOH the whole v_t curve can be calculated in a normality range of 0.25-10 moles/l when the saturation value is known. The discrepancy between the hydroxide activity dependence of the surface etch rate v_s and v_t found at low etchant activity can be explained in terms of the Donnan law and the conduction of over-all electroneutrality in the track solution. The saturation of v_t may be the result of a transport equilibrium between the produced tetraphthalic anions and the hydroxide ions required forr etching at the track tip. The response functions fo both the kinetic regions have been established. (15 refs.)

106236 **Study of ${}_8^{16}$O ion tracks in cellulose nitrate plastic detectors.** S.M.Farid, A.P.Sharma (Dept. of Phys., Kurukshetra Univ., Kurukshetra, India).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.2-3, p.513-15 (1 Aug. 1983).
Cellulose nitrate (CN) plastic track detectors exposed to 8.75 MeV/n ${}_8^{16}$O ions have been obtained from JINR, Dubna, USSR. The bulk etch rate of CN detectors and the track etch rate of ${}_8^{16}$O ions in this detector have been measured for different temperatures. From the data, the activation energy for bulk etching and track etching are calculated. The range of ${}_8^{16}$O ions in a CN detector is determined by measuring the track length. The maximum etched track length agrees with the theoretically computed range as well as with those reported by earlier workers. From the response curve the 'critical energy loss' $(dE/dx)_c$ has been determined for this detector material. (9 refs.)

106237 **Calculations of the peak efficiency of high-purity germanium detectors.** L.Moens, J.Hoste (Inst. for Nuclear Sci., Rijksuniv. Gent, Gent, Belgium).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1085-95 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
The applicability of a method for the calculation of the peak efficiency of gamma-ray detectors is experimentally tested for point and cylindrical sources at various distances from a high-purity Ge detector. An overall uncertainty of 3 to 4% was achieved. (13 refs.)

106238 **Detector-efficiency calculation based on point-source measurement.** J.Lippert (Riso Nat. Lab., Roskilde, Denmark).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1097-103 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
Describes an extension of the method for efficiency calculation presented by Moens et al. (Nucl. Instrum. and Methods, vol.187, p.451-72, 1981). Their program allows computation of efficiencies for sources of diameters less than the detector diameter. However it is desirable also to be able to calculate values for sources with diameters larger than the detector diameter such as larger beakers, Marinelli type containers and, for verification, off-axis point sources. To do this, the numerical integration is extended to surface elements on the cylindrical part of the detector. Experimental results show good agreement with the calculated values especially for medium gamma-ray energies. (4 refs.)

106239 **Variation of Ge-detector efficiency with source diameter and radial source position.** R.G.Helmer (Idaho Nat. Engng. Lab., EG&G Idaho Inc., Idaho Falls, ID, USA).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1105-8 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
For two Ge detectors, the γ-ray efficiency obtained with a disk source was determined relative to that for a point source. These ratios were measured by two methods and calculated by a third method and are compared. (2 refs.)

106240 **Multifilament counter with a 5% energy resolution for 5.9 keV photons.** V.D.Peskov, E.R.Podolyak (Inst. of Phys. Problems, Acad. of Sci., Moscow, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.6, pt.2, p.1498-1501 (Nov.-Dec. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.6, p.165-8 (Nov.-Dec. 1982).
Describes a multifilament gas counter with an energy resolution of $\sim$5% (for 5.9 keV photons) and a coordinate resolution of $\sim$0.5 mm. The high energy resolution is obtained by evaluating data on the antennuation of the radiation in the gas volume with the maximum likelihood method. (8 refs.)

106241 **High-frequency power transistor as a pulsed X-ray detector.** V.V.Zykov, V.V.Sil'vestrov (Inst. of Hydrodynamics, Acad. of Sci., Novosibirsk, Ukrainian SSR).
Instrum. & Exp. Tech. (USA), vol.25, no.6, pt.2, p.1502-4 (Nov.-Dec. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.6, p.168-70 (Nov.-Dec. 1982).
The authors investigated the possibility of building a pulsed X-ray detector on the basis of the collector-base junction (diode) of KT908 and KT912 high-frequency silicon power transistors. By contrast to the conventional semiconductor detectors, this detector does not require a special production technology nor high supply voltage and is distinguished by a sensitivity capable of reliably recording radiation pulses with a dose rate of 10^5-10^6 rd/sec which is typical for widely employed X-ray equipment. (3 refs.)

106242 **Large area air proportional counter.** N.Akiyama, H.Tatsuta (Atomic Energy Society of Japan, Tokyo, Japan).
J. At. Energy Soc. Jpn. (Japan), vol.25, no.6, p.480-5 (June 1983). In Japanese.
A large area air proportional counter has been developed as an α-ray surface contamination detector. The effective area of the counter is 20×50 cm; to decrease the effect of electron attachment to oxygen molecules, the detector's thickness was made relatively thin (1 cm) and the distance between each anode wire narrow (5 mm). The detection efficiency of the counter was 25% for standard U-source, and the distribution of the efficiency above the window surface was within 10%. The minimum detectable contamination density, when 100 cm^2 area was uniformly contaminated with U-source and measured 10 s, was 1.2×10^{-6} μCi/cm^2. (12 refs.)

106243 **Evaluation of LiYF$_4$ as a neutron scintillation detector.** A.R.Spowart (Phys. Dept., Nat. Inst. for Higher Education, Dublin, Ireland).
J. Phys. D (GB), vol.16, no.9, p.1819-22 (14 Sept. 1983).
LiYF$_4$ doped with 1% Ce, and manufactured using fully enriched 99.6% ${}_3^6$Li, has been evaluated as a neutron detector in a comparison with an optimum form of Ce-doped lithium aluminosilicate glass. Room temperature absorption and excitation spectra are presented and discussed. The pulse height of the ${}_3^6$Li (n,α) reaction using moderated Am/Be neutrons is shown to be a factor of approximately six times poorer than that of the glass. (12 refs.)

106244 **Load characteristics of nonselfquenching counters.** V.I.Shumshurov, M.V.Tel'tsov, Z.G.Zueva, A.N.Antropov (Sci. Res. Inst. of Nuclear Phys., Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.5, p.56-62 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.5, p.50-5 (1982).
The urgency of increasing the speed of operation of nonselfquenching counters is shown; the load characteristics of the counters are considered, together with the basic reasons for their low operating speed and means of eliminating them. An equivalent scheme is proposed for calculating the amplitude and other parameters of the electric pulse, the dependence of the deionization rate on the switching circuit is shown, and a switching circuit allowing the speed of operation of the counters to be increased is described. (18 refs.)

106245 **Position sensitive neutron detectors using ^{6}Li glass scintillators.** N.Niimura, K.Yamada, T.Kubota (Lab. of Nuclear Sci., Tohoku Univ., Sendai, Japan), A.Matsumoto, S.Hoshina.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.104-7 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Position sensitive neutron detectors (PSD) using ^{6}Li glass scintillators and a fibre optic encoding method have been designed, constructed and tested. The area covered by the PSD is 3 cm$\times$28 cm. It was applied to the time-of-flight (TOF) neutron diffraction experiments of a KBr single crystal and a silicon polycrystal. (2 refs.)

106246 **A study of the registration properties of cellulose nitrate KHU.** A.M.Marenny (Inst. for Biomed. Problems, Moscow, USSR), G.P.Hertzen, S.A.Dashin, D.Hasegan.
Rev. Roum. Phys. (Rumania), vol.28, no.5, p.467-70 (1983).
Results of a study of KHU cellulose nitrate detectors produced in the USSR are presented. The following registration properties have been studied: bulk etching rate, track etching rate, registration threshold, critical registration angle, material homogeneity and latent track stability. The obtained results demonstrate that the KHU cellulose nitrate is an effective detector for medium and high energy ion studies. (11 refs.)

Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors .... See Entry 105014

Radioactive half-life measurements in a freshman or sophomore laboratory .... See Entry 105080

Survey of standardization possibilities with a NaI(Tl) well-type detector .... See Entry 105303

Progress in energy resolution of mercuric iodide (HgI$_2$) X-ray spectrometers .... See Entry 106201

Gamma-ray spectrometry with thick mercuric iodide detectors .... See Entry 106202

A time averaged background compensator for Geiger-Muller counters .... See Entry 106248

Counting losses from pulsed optical-feedback preamplifiers used with semiconductor detectors .... See Entry 106249

A mercuric iodide detector system for X-ray astronomy I. Design considerations and predictions of background and sensitivity .... See Entry 110907

A mercuric iodide detector system for X-ray astronomy. II. Results from flight tests of a balloon borne instrument .... See Entry 110908

29.60 COUNTING CIRCUITS AND NUCLEAR ELECTRONICS

106247 **Simple serial data link.** B.Gottschalk (Harvard Cyclotron Lab., Cambridge, MA, USA).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.2-3, p.547-9 (1 Aug. 1983).
Describes a simple scheme for serial data-swapping between two devices over one line. A specific circuit using TTL logic is presented and explained. It requires a single supply and about a dozen ICs at each end and can transmit well over a megabit/s. (no refs.)

106248 **A time averaged background compensator for Geiger-Muller counters.** R.C.Bhattacharya, P.K.Ghosh (Phys. Res. Wing, Projects & Dev.(India), Dhanbad.Ltd.,India).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.2-3, p.553-5 (1 Aug. 1983).
The GM tube compensator described stores background counts to cancel an equal number of pulses from the measuring channel providing time averaged compensation. The method suits portable instruments. (1 ref.)

106249 **Counting losses from pulsed optical-feedback preamplifiers used with semiconductor detectors.** E.Funck (Phys.-Tech. Bundesanstalt, Braunschweig, Germany).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1123-31 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
Problems encountered with semiconductor detectors that are coupled to pulsed optical-feedback preamplifiers have been investigated theoretically. The resetting of the preamplifier causes a deadtime followed by a second deadtime during which the counting of pulses in the multichannel analyzer is inhibited. Counts are lost also by the resetting itself, if this is not prevented by special electronics. In order to account for pile-up and deadtime losses the pulse-generator method is frequently applied. It is shown that this method is inadequate for the problem and that the counting losses depend on the detector- and generator-pulse amplitudes. (4 refs.)

Real time spectrum stabilization by software .... See Entry 106257

29.70 RADIATION MEASUREMENT, DETECTION AND COUNTING

(see also 29.30 Radiation spectrometers and spectroscopy, 29.40 Radiation detectors; for dosimetry, see 87.60M)

106250 **Multiple scattering of protons and deuterons by thick foils.** D.R.Dixon, G.L.Jensen, S.M.Morrill (Dept. of Phys. & Astron., Brigham Young Univ., Provo, UT, USA), R.L.Walter, C.R.Gould.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.2-3, p.525-9 (1 Aug. 1983).
Protons and deuterons from the Triangle Universities Nuclear Laboratory (TUNL) tandem Van de Graaff of energies 3.0, 4.0, and 5.0 MeV were scattered from foils of Al, Ni, Mo and Ta having thicknesses from 6.14 to 47.2 mg/cm^2. Multiple-scattering angular distributions were measured using a

position-sensitive detector to collect data at nine different angles simultaneously. Modified Guassian curves were fitted to the points of the distributions and the angles where the distribution falls to 1/e, 1/10, and 1/100 of its central value are presented. The 1/e data points are compared with calculations using a traditional method of determining multiple-scattering angular distributions. An empirical correction for extending the traditional method into the low-energy and thick-foil region is suggested. (9 refs.)

106251 Energy loss measurements for charged particles and a new approach based on the experimental results. Y.Iga, T.Wada, Y.Yamashita (Dept. of Phys., Okayama Univ., Okayama, Japan), I.Yamamoto.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.2-3, p.531-7 (1 Aug. 1983).
The authors report a new approach to the energy loss process of fast charged particles in gases. This approach gives an analytical formula for the most probable energy loss value. In their approach, common variables are used and the concept of the 'detectable volume' is introduced. Experimental results with fast electrons in an INS-ES test beam are also shown and compared with the calculation. The calculation shows good agreement with the experiments. (19 refs.)

106252 Influence of relative humidity on the charged fraction of decay products of radon and thoron. S.K.Dua, P.Kotrappa, P.C.Gupta (Health Phys. Div., Bhabha Atomic Res. Centre, Bombay, India).
Health Phys. (GB), vol.45, no.1, p.152-7 (July 1983).
A parallel plate mobility analyzer was used for studying the charged fractions. It was found that the diffusion coefficients of the decay products of radon are higher than those of thoron and their values are not influenced by the relative humidity of air for small residence times in the analyzer. The charged fraction of the decay products generally decreases with relative humidity and the decrease is more pronounced at low electric fields. While there is a significant reduction in positively charged decay products of radon at high relative humidity, the decrease is much smaller for thoron decay products. At high electric fields relative humidity plays no significant role in the collection of decay products for the flow conditions studied. (9 refs.)

106253 Needs for radioactivity standards and measurements. W.B.Mann (NBS, Washington, DC, USA).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1041-6 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
At the summer school held in Herceg Novi in 1972, a paper was given on the then contemporary needs in the field of radionuclide metrology. In the intervening years many of the measurements needs have been met and, moreover, the interest in nuclear power in some countries and in its by-products, has waned. Some of the chief interests now lie in the development of the more sensitive methods of measurement such as atom counting to the same level of accuracy as activity measurements, and also in the acquisition of needed and consistent decay data. (14 refs.)

106254 The International Reference System for activity measurements of γ-ray emitting nuclides. A.Rytz (Bureau Internat. des Poids et Mesures, Sevres, France).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1047-56 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
The International Reference System was conceived as a complement to, and an extension of, international comparisons of activity measurements organized by the Bureau International des Poids et Mesures (BIPM). The participating laboratories submit samples of their standardized solutions of radionuclides to the BIPM where the current produced by a sample in a stable ionization chamber is compared with the current obtained upon substitution of a radium reference source. A description is given of the equipment used and of auxiliary measurements carried out in order to establish and maintain long-term stability and reliability. The organization of the International Reference System (which to date includes 250 measurements of 42 radionuclides) is explained, as well as the calculation of results and uncertainties. An empirical efficiency curve allows one to make interpolations and predictions of results regarding radionuclides not yet included. (5 refs.)

106255 Accurate evaluation of gamma-ray spectra for the measurement of gamma-ray emission probabilities. R.Jedlovszky, A.Polacsek, A.Andai (Nat. Office of Measures, Budapest, Hungary).
Int. J. Appl. Radiat. & Isot. (GB), vol.34, no.8, p.1057-65 (1983). (Applied Radionuclide Metrology, Geel, Belgium, 16-17 May 1983).
A brief account is given of the equipment, measuring method, and data processing used for precision gamma-ray spectrometric measurements at OMH. The calculation of the peak area and the OMAN (OMh ANalysis) program package are discussed. The performance of OMAN is discussed in the context of the experimental results. (14 refs.)

106256 Comment on searches for slowly moving magnetic monopoles. S.P.Ahlen (Dept. of Phys., Indiana Univ., Bloomington, IN, USA), D.E.Groom, E.C.Loh, H.R.Nelson, D.M.Ritson.
Phys. Rev. Lett. (USA), vol.51, no.10, p.940-1 (5 Sept. 1983).
Groom et al. (1983) and Bartelt et al. (1983) have recently reported the results of negative searches for slowly moving magnetic monopoles by using arrays of plastic scintillators and proportional counters, respectively. The authors show that the velocity thresholds reported in these papers should be regarded with some caution. (18 refs.)

Applied Radionuclide Metrology .... See Entry 105019

Radioactive half-life measurements in a freshman or sophomore laboratory .... See Entry 105080

Thermal diagnostics of pulsed 0-2 MeV electron beams and bremsstrahlung .... See Entry 105425

Gamma photon backscattering in gauging .... See Entry 105436

Emission of high-energy charged particles in incomplete-fusion reactions .... See Entry 105941

Combination source for gamma-ray spectrometry .... See Entry 106205

Coincidence-summing corrections in gamma-ray spectrometry for normalized geometries .... See Entry 106207

Mercuric iodide (HgI_2) semiconductor devices as charged particle detectors .... See Entry 106233

A multichannel detector system for small-angle neutron scattering investigations .... See Entry 106234

Study of $_8{}^{16}O$ ion tracks in cellulose nitrate plastic detectors .... See Entry 106236

Detector-efficiency calculation based on point-source measurement .... See Entry 106238

Real time spectrum stabilization by software .... See Entry 106257

Measurement and shielding of the secondary radiation from betatrons .... See Entry 110190

29.80 NUCLEAR INFORMATION PROCESSING

106257 Real time spectrum stabilization by software. Z.Kosina (Nuclear Phys. Inst., Rez, Czechoslovakia).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.2-3, p.551-2 (1 Aug. 1983).
A spectrum acquisition routine for computerized MCAs is described which emulates the function of a feed-back digital spectrum stabilizer. Exclusive use of fixed point arithmetic makes it suitable even for simple microprocessor systems. (4 refs.)

29.90 OTHER TOPICS IN HIGH-ENERGY AND NUCLEAR EXPERIMENTAL METHODS AND INSTRUMENTATION

Nuclear instrument maintenance—problems, solutions, and obstacles .... See Entry 110257

30.00 ATOMIC AND MOLECULAR PHYSICS

(for physical chemistry, see 82.)

31.00 THEORY OF ATOMS AND MOLECULES

(see also 71. Electron states in condensed matter)

31.10 GENERAL THEORY OF STRUCTURE, TRANSITIONS AND CHEMICAL BINDING

106258 Strategic design of organic conductors. Structure of a prototypical molecule. J.Y.Becker, J.Bernstein, S.Bittner, N.Levi, S.S.Shaik (Dept. of Chem., Ben-Gurion Univ. of the Negev, Beer-Sheva, Israel).
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4468-9 (29 June 1983).
To design efficient organic conductors composed of donor (D) and acceptor (A) moieties one must achieve the following necessary conditions: (a) enforce a segregated mode of stacking (...DD...‖...AA...) in the solid state; (b) control the D:A stoichiometry; (c) encode ab initio the desired degree of electron transfer (ρ) into the molecular unit; (d) stabilize the delocalized state, ...$D^{\rho+}D^{\rho+}$...‖...$A^{\rho-}A^{\rho-}$..., below the localized ones (e.g., ...D^+D...‖...A^-A...); (e) permit and control the degree of interchain coupling. The systematic control of these conditions will allow the preparation of organic conductors with predesigned properties. (8 refs.)

106259 Theory of the chemical bond. VI. Accurate relationship between bond energies and electronegativity differences. R.L.Matcha (Dept. of Chem., Univ. of Houston, Houston, TX, USA).
J. Am. Chem. Soc. (USA), vol.105, no.15, p.4859-62 (27 July 1983).
A new formula relating bond energies, D_{AB}, to bond polarities, f, is deduced. The formula has the form $D_{AB}=(1-f)\bar{D}_{AB}+252(f/R_e)$, where R_e is the equilibrium bond length and $D_{AB}=(D_{AA}+D_{BB})/2$ is the arithmetic average of bond energies D_{AA} and D_{BB}. For a random sampling of bonds, predicted bond energies are found to vary from measured ones by an average of about 3%. The formula is used in conjunction with the observation $f/R_e \approx 2i/3$, where $i=1-\exp(-\Delta X^2/4)$ corresponds to Pauling's approximation to ionic character, to deduce the relationship $D_{Ab}=\bar{D}_{AB}+K(1-\exp(-30\Delta X^2/K))$, where $K=103$, ΔX represents electronegativity differences X_A-X_B, and $\bar{D}_{AB}$ equals the geometric average $(D_{AA}D_{BB})^{1/2}$. This relationship is shown to yield accurate bond energy estimates for both ionic and covalent bonds. A comparison with Pauling's formula $D_{AB}=\bar{D}_{AB}+30\Delta X^2$ is given. (10 refs.)

106260 Description of conjugation and hyperconjugation in terms of electron distributions. R.F.W.Bader, T.S.Slee, D.Cremer, E.Kraka (Dept. of Chem., McMaster Univ., Hamilton, Ontario, Canada).
J. Am. Chem. Soc. (USA), vol.105, no.15, p.5061-8 (27 July 1983).
The authors present a description of CC bonds in hydrocarbons in terms of the properties of the charge density ρ at a bond critical point. This is the point ($\mathbf{r}_c$), where ρ attains its minimum value along the path of maximum density (the bond path) linking the nuclei of neighboring atoms. A bond order is defined in terms of ρ_b, the value of ρ at $\mathbf{r}_c$. A measure of the deviation of the charge distribution of a bond path from axial symmetry is provided by the bond ellipticity $\epsilon=\lambda_1/\lambda_2-1$, where λ_1 and λ_2 ($|\lambda_1|>|\lambda_2|$) are the two negative curvatures of ρ at $\mathbf{r}_c$. The value of ϵ is zero for the CC bond in ethane of order 1 and attains some maximum value for CC bonds of order 2. The ellipticity thus provides a quantitative measure of the π character of these bonds and the plane of the π distribution is uniquely specified by the direction of the axis associated with the curvature of smallest magnitude, λ_2. The values of ρ_b and ϵ enable one to translate the electronic effects predicted by orbital models into observable properties of ρ. Conjugative interactions between single and double bonds are reflected by $n>1$ and $\epsilon>0$ for the CC bonds of formal order 1. (27 refs.)

106261 Description of homoaromaticity in terms of electron distributions. D.Cremer, E.Kraka, T.S.Slee, R.F.W.Bader, C.D.H.Lau, T.T.Nguyen-Dang, P.J.MacDougal (Lehrstuhl fur Theoretische Chem., Univ. zu Koln, Koln, Germany).
J. Am. Chem. Soc. (USA), vol.105, no.15, p.5069-75 (27 July 1983).
The authors illustrate how the topological theory of molecular structure can be used to provide an answer as to whether or not homoaromatic conjugation is present in a given system. The study hinges upon the particular properties of a cyclopropyl ring. As a consequence of the proximity of the bond and ring critical points in this system, the ring possesses a surface of delocalized charge, thereby affording a number of possible modes of conjugative interaction with an unsaturated fragment. Depending upon the electronic requirements of the unsaturated system to which it is coupled, the charge distribution of the three-membered ring may be deformed so far as to cause its ring critical point to approach the critical point of one of the ring bonds thereby reducing its bond order and enhancing its ellipticity (i.e. its 'π' character) or conversely cause the same critical point to migrate toward one of the ring

nuclei thereby simultaneously imparting these same properties to two of the ring bonds. (24 refs.)

106262 Generator coordinate method based on coherent states. II. Calculation of vibrational states by the double circular orbit method. K.Deguchi, Y.Kato, A.Sado, K.Nishikawa, S.Aono (Dept. of Chem., Kanazawa Univ., Kanazawa, Japan).
J. Phys. B (GB), vol.16, no.16, p.2871-7 (28 Aug. 1983).
For pt.I see ibid., vol.14, no.18, p.3305-11 (1981). The double circular orbit method (DCOM) is proposed to extend the applicability of the generator coordinate method based on coherent states (COM) which has recently been developed by the authors. The efficiency of the DCOM is examined for the Morse, double minimum and cubic anharmonic potential systems and compared with that of the COM. (7 refs.)

106263 General consideration of electronic transitions in many-electron atoms and ions. Z.B.Rudzikas, J.M.Kaniauskas, G.V.Merkelis, E.H.Savicius (Inst. of Phys., Acad. of Sci., Vilnius, Lithuanian SSR).
J. Phys. B (GB), vol.16, no.16, p.2879-90 (28 Aug. 1983).
The relativistic electric multipole transition operators are considered, not specifying the gauge condition of the electromagnetic field potential. The nonrelativistic limit of the relativistic expressions obtained is found. The relativistic corrections to various forms of the electric dipole transition operators are investigated. The electric multipole transition operator contains an arbitrary parameter, the gauge constant, dependence on which can serve as one of the criteria for the accuracy of the wavefunctions used. Calculated examples of the theory, starting with the general expressions found, are presented. The methods described and the formulae presented allow the authors to investigate in an effective way the electric multipole transitions for atoms and their isoelectronic sequences, including very highly ionised atoms. (31 refs.)

106264 Electric and magnetic dipole contributions to a theory of radiation reaction field and atom self-energy: an operator reaction field. A.-S.F.Obada (Internat. Centre for Theoretical Phys., Trieste, Italy), M.H.Mahran.
Physica A (Netherlands), vol.120A, no.1-2, p.314-26 (1983).
The consequences of including magnetic dipole contributions, besides the electric dipole, are considered in the operators for the radiation field. The Bloch equations which describe the two-level atom operators are modified. These equations together with the field operators are discussed, and the contributions are manifested. The spectrum for spontaneous emission and a generalized dynamical Stark effect are obtained. The Rabi frequency is modified. (18 refs.)

106265 Some aspects of the time-dependent coupled-cluster approach to dynamic response functions. E.Dalgaard (Dept. of Chem., Univ. of Aarhus, Aarhus, Denmark), H.J.Monkhorst.
Phys. Rev. A (USA), vol.28, no.3, p.1217-22 (Sept. 1983).
An approximation scheme for dynamic response functions within the coupled cluster or $\exp(T)$ method of Coester (1960) and Kummel (1978) is described in this paper. Particular attention is given to the relationship between the 'vacuum amplitude' $\langle 0|U(t,-\infty)|0\rangle$ for the time development of an exact eigenstate of a many-electron Hamiltonian in the presence of an adiabatically switched-on perturbation, and the amplitude $\langle\Phi_0|U(t,-\infty)|0\rangle$ for the time evolution into an independent-particle reference state $|\Phi_0\rangle$, which is not orthogonal to $|0\rangle$. The latter amplitude plays a prominent role in the time-dependent coupled-cluster calculation of response functions. (20 refs.)

106266 Collisional relaxation and transfer of coherence in excited atomic multiplets of the type $(j_1j_2;j)=(1,{}^1/_2;{}^3/_2$ or ${}^1/_2)$. K.S.Meyer, R.M.Herman (Dept. of Phys., Pennsylvania State Univ., University Park, PA, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1469-86 (Sept. 1983).
Collisional relaxation and transfer of coherence following sudden excitation of a multiplet of the type $(j_1j_2;j)=(1,{}^1/_2;{}^3/_2$ or ${}^1/_2)$ is analyzed theoretically in an attempt to predict the fluorescent intensity as a function of time following excitation. Resonant, pulsed, circularly polarized exciting radiation is considered, with the subsequent fluorescence in each of the three orthogonal optical polarizations being studied. In this type of multiplet the intensity operators form a number of different irreducible tensors, some of which are degenerate with respect to spherical tensor order. These are collisionally mixed, with the result that collisional transfer, as well as relaxation, of coherence occurs, together with a resulting transfer of photobeats between different optical polarizations in fluorescence. As an example, a novel and somewhat surprising result is the prediction of a photobeat collisionally transferred from initially excited σ_- fluorescent polarization to σ_+ fluorescence. With depth of oscillation as large as a few percent, it exists only at higher pressures, where its amplitude varies as the inverse of pressure. Its lifetime is relatively very long, being proportional to pressure, while the photobeat frequency is twice that associated with the energy separation of the excited multiplet. (28 refs.)

106267 Neglect of the target Hamiltonian in corrections to the Glauber approximation. A.Baker (Dept. of Phys. & Appl. Phys., Univ. of Lowell, Lowell, MA, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1857-8 (Sept. 1983).
Systematic corrections to the Glauber approximation for the scattering of charged particles by atoms in general include not only the Wallace correction for potential scattering, but also the effect of target-particle motion and energy change. (5 refs.)

31.15 GENERAL MATHEMATICAL AND COMPUTATIONAL DEVELOPMENTS

106268 Evolution of quantum defect methods. II. U.Fano (Dept. of Phys., Univ. of Chicago, Chicago, IL, USA).
Comments At. & Mol. Phys. (GB), vol.13, no.4, p.157-69 (1983).
For pt.I see ibid., vol.10, p.223 (1981). Recent developments keep branching off from earlier procedures, adapting the theory to a wider range of spectral phenomena. These phenomena involve multichannel processes disregarded in an earlier report. (25 refs.)

106269 Perturbation theory for open-shell systems: simulation of the UHF states by means of the perturbed RHF wave functions. I.Hubac (Dept. of Biophys., Faculty of Math. & Phys., Comenius Univ., Bratislava, Czechoslovakia), P.Carsky.
Int. J. Quantum Chem. (USA), vol.24, no.2, p.141-8 (Aug. 1983).
Second-, third-, and selected fourth-order contributions to the correlation energy were calculated for a series of simple open-shell systems by means of the previously developed double-perturbation theory in the restricted MO formalism. It was found possible to assign some of the diagrams to self-consistency effects and to approximate in this way the ${E_{\mathrm{UHF}}}^{\mathrm{SCF}}-{E_{\mathrm{RHF}}}^{\mathrm{SCF}}$ energy difference. A comparison is made with a more rigorous approach, in which the UHF ground-state wave function is expressed as a first-order perturbation expansion based on the RHF reference wave function. Distinguishing between 'self-consistency' and 'correlation' diagrams for open-shell systems in the RHF formulation represents a special case of a more general problem met in any double-perturbation treatment, such as e.g., treatments of systems in the external field or perturbation expansions with noncanonical orbitals. (17 refs.)

106270 Quantum vs. classical calculation of nonlinear spectra-reduced dynamics and intramolecular entropy. S.Mukamel (Dept. of Chem., Univ. of Rochester, Rochester, NY, USA).
J. Chem. Phys. (USA), vol.79, no.5, p.2126-33 (1 Sept. 1983).
A nonMarkovian reduced equation of motion (REM) is derived for a generating function $P(a,t;a')$ which allows the calculation of two-time correlation functions in nonlinear systems The form of the REM is identical for classical and quantum systems and it depends on an entropy function $\ln g(a)$, a velocity kernel $W(a,a'')$, and a nonMarkovian kernel $K(a,a'',t)$, a being the expectation value of the dynamical variable under consideration. The author gives exact formal expressions for these quantities for the quantum and the classical case. In the linear (harmonic) limit the REM reduced rigorously to a nonMarkovian Fokker-Planck equation. The present approach may allow a convenient and a systematic way for the calculation and the comparison of classical and quantum nonlinear spectra. (31 refs.)

106271 Comment on 'Force in SCF theories' (and reply). P.Pulay (Dept. of Chem., Univ. of Arkansas, Fayetteville, AR, USA), H.Nakatsuji, K.Kanda, T.Yonezawa.
J. Chem. Phys. (USA), vol.79, no.5, p.2491-5 (1 Sept. 1983).
Nakatsuji et al. (1980, 1981, 1982) suggested an alternative to the analytical gradient method, namely the use of the Hellman-Feynman forces in conjunction with an extended family basis set containing the first derivatives of the original basic functions. Pulay points out that earlier objections to this method have been raised (Pulay, 1977) and presents a more detailed analysis of the extended family technique in the Hartree-Fock case. Nakatsuji et al. discuss the computing time requirements of their method and suggest that the insight provided by their method outweighs its disadvantages. (38 refs.)

106272 Method to determine the number of constants of the motion for mutidimensional systems (polyatomic systems). J.R.Stine (Los Alamos Nat. Lab., Los Alamos, NM, USA), D.W.Nold.
J. Phys. Chem. (USA), vol.87, no.16, p.3038-42 (4 Aug. 1983).
A simple numerical method is presented to determine the number of constants of the motion (integrals) for multidimensional nonseparable Hamiltonians with n degrees of freedom. This method is based on the fact that a trajectory with k constants of the motion will be confined to a $2n$-k dimensional surface of phase space. The method is applied to model systems of two and three degrees of freedom. (11 refs.)

106273 Energy level shifts in atoms near a metallic plane. C.A.Lutken, F.Ravndal (Inst. of Phys., Univ. of Oslo, Oslo, Norway).
Phys. Scr. (Sweden), vol.28, no.2, p.209-13 (Aug. 1983).
The vacuum fluctuations of the electric field will shift the energy levels of an atom near a neutral, conducting plate. The authors have calculated these shifts in Rydberg atoms. The results of Casimir and Polder are recovered in the limit where one ignores any permanent dipole moment in the atom. Numerical values of the shifts of the lowest levels are given. (11 refs.)

106274 Energies of three-particle systems with Coulomb interactions. A.V.Gur'yanov, T.K.Rebane (Leningrad State Univ., Leningrad, USSR).
Sov. Phys.-JETP (USA), vol.83, no.5, p.980-2 (Nov. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.5, p.1698-701 (Nov. 1982). [received: Sept. 1983]
The nonrelativistic energy of a symmetric Coulomb system with particle charges $z_1=z_2=\pm1$ and $z_3=\mp1$ and masses $m_1=m_2=m$ and m_3 is expressed in the form $E=m\beta\epsilon(\beta)$, where $\beta=m_3/(2m+m_3)$. An approximate formula for the function $\epsilon(\beta)$, which makes it possible to calculate the energies of the systems for all possible values of the masses m and m_3, is derived. The results of such calculations agree well with previous precise calculations of the energies of symmetric mesic molecules and predict the energies of many diverse Coulomb systems whose energies have not previously been calculated. (13 refs.)

106275 A general population analysis preserving the dipole moment. B.T.Thole, P.T.van Duijnen (Lab. of Chem. Phys., Univ. of Groningen, Groningen, Netherlands).
Theor. Chim. Acta (Germany), vol.63, no.3, p.209-21 (1983).
A new and efficient method is proposed for obtaining atomic charges from molecular wave functions preserving both total charge and dipole moment. The method is independent of the type of wave function (SDF, CI) and does not refer explicitly to the basis set used, nor to integral approximations (e.g. CNDO) applied. The method takes very little time and is better than Mulliken's analysis as a generator of electric potentials. (24 refs.)

Discussion of several analytical approximate expressions for the eigenvalues of the bounded harmonic oscillator and hydrogen atom ....See Entry 105140

Some aspects of the time-dependent coupled-cluster approach to dynamic response functions ....See Entry 106265

Gradient-free representation of the Weizsacker term for atoms ....See Entry 106299

Comment on the energy variation method [and raply] ....See Entry 106324

Comments on energy minimization in subspaces of coordinates and on 'chemical hysteresis' ....See Entry 106524

31.20 SPECIFIC CALCULATIONS AND RESULTS

106276 Ab initio SCF assignment of vibrational spectra of nitrosomethane. J.P.Dognon, C.Pouchan, A.Dargelos (Lab. de Chimie Structurale, Univ. de Pau, Pau, France).
Chem. Phys. Lett. (Netherlands), vol.99, no.4, p.316-21 (12 Aug. 1983).
The force constants of nitrosomethane obtained from an SCF wavefunction using a 4-31G basis set are compared with experimental data, which are critically examined. A calculation of intensities was also performed. The theoretical results suggest a new interpretation of the infrared spectrum. (15 refs.)

106277 The validity of Musher's model for the magnetic properties of aromatic molecules. P.Lazzeretti, R.Zanasi (Istituto di Chimica Organica e Centro di Calcolo Elettronico, Univ. di Modena, Modena, Italy).
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.67-9 (26 Aug. 1983).
Plots of proton magnetic shielding density in the benzene molecule, obtained via accurate coupled Hartree-Fock calculations, are reported. They unequivocally show that proton deshielding is due to local effects arising in the adjacent carbon atom and C-H bond. Therefore downfield chemical shifts observed in proton magnetic resonance spectroscopy can be entirely explained in terms of magnetic anisotropy of the carbon environment. This shows the unphysical character of the ring current model and the reliability of Musher's model (1965-7). (15 refs.)

106278 Ab initio studies on hydrogen-bonded chains. III. The linear, infinite chain of hydrogen cyanide molecules. A.Karpfen (Inst. fur Theoretische Chem. und Strahlenchem., Univ. Wien, Vienna, Austria).
Chem. Phys. (Netherlands), vol.79, no.2, p.211-18 (1 Sept. 1983).
Ab initio crystal-orbital calculations have been performed on the linear, infinite chain of HCN molecules applying basis sets from minimal to double-zeta-plus-polarization quality. From computed potential surfaces many properties of the electronic ground state of (HCN)∞ could be deduced. Equilibrium structure, hydrogen-bond energy, dipole moment per molecule, dipole-moment derivatives, harmonic force constants, vibrational frequencies and electronic band structure are reported. Results on the polymer are compared with monomer, dimer and crystal data. (62 refs.)

106279 Orbital SCF energies in the double proton transfer of the adenine-thymine base pair. J.Maranon (Dept. de Fisica, Facultad de Ciencias Exactas Univ. Nacional de la Plata, La Plata, Argentina), H.Grinberg.
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.1081-8 (July-Aug. 1983).
The double-minimum potential generated by proton motion involved in the two hydrogen bonds of the adenine-thymine base pair can be accounted for through the orbital-energy spectrum. The results show that the greatest interaction between the molecular orbitals is found when the interprotonic distance of the protons is optimum, i.e. at the top of the barrier of the double-minimum potential. This raises the question of charge transfer electronic transitions as a possibility of modelling the behaviour of the double proton transfer in the excited states of this base pair. (17 refs.)

106280 Dynamic polarizability of an exactly solvable model of diatomic molecule. C.Guidotti (Istituto di Chimica Fisica, Univ. di Pisa, Pisa, Italy), F.Biondi, N.Durante, G.P.Arrighini.
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.1097-109 (July-Aug. 1983).
A very simple one-dimensional model for a one-electron diatomic molecule under the agency of a homogeneous, time-dependent electric field is investigated in the linear-response approximation. The behaviour of the dynamic polarizability is studied as a function of the frequency ω and the internuclear separation R. (16 refs.)

106281 Symmetry chains for the atomic shell model. IV. Symmetry chains for mixed configuration. M.S.Thomas (Math. Dept., Royal Military Coll. of Canada, Kingston, Ontario, Canada), B.Gruber.
KINAM Rev. Fis. (Mexico), vol.5, no.2, p.173-8 (1983).
For pt.III see ibid., vol.4, p.139 (1982). The symmetry chains for the atomic shell model are discussed that lead from the group $SO\ [8(l_1+l_2)+9]$ to $SO_j(3)$. The super group i$SO[8(l_1+l_2)+9]$ corresponds to a mixed configuration. Not all symmetry chains have been determined. Some useful classification of mixed states are also given. (14 refs.)

106282 Symmetry breaking in the Hartree-Fock approximation for binuclear transition metal compounds—a theoretical investigation based on a variable model operator. M.C.Bohm (Inst. fur Organische Chemie, Univ. Heidelberg, Heidelberg, Germany).
Int. J. Quantum Chem. (USA), vol.24, no.2, p.185-237 (Aug. 1983).
The validity of the Hartree-Fock (HF) approximation in bis(π-pentadienyl)dinickel (1) and in cyclopentadienyl-allyl-cyclobutadiene-dinickel (2) has been investigated by means of the Thouless instability conditions in the computational framework of a variable model Hamiltonian. Singlet, nonsinglet (triplet), and nonreal instabilities in 1 and 2 have been studied as a function of the one-electron resonance integral $\beta_{\mu\nu}{}^{AB}$ and as a function of the one- and two-center elements of the electron-electron interaction. The one-center integrals of Coulomb ($\gamma_{\mu\nu}{}^{AA}$) and exchange-type ($K_{\mu\nu}{}^{AA}$) have been modified by a multiplicative factor; the two-center integrals ($\gamma_{\mu\nu}{}^{AB}$) have been calculated by means of an exponential interpolation formula with a variable decay amplitude. Additionally the Thouless conditions have been studied for nuclear deformations. The stability domain of the HF solution in the model space spanned by the variable INDO Hamiltonian has been analyzed. The nature of the many-body interactions in the unstable region depends strongly on the parametrization of the model operator. HF instabilities in the high-density region (long-range forces) of 1 have their origin in individual particle-hole fluctuations while negative roots for short-range forces (low-density region) are similar to collective excitations in many-body systems (strong off-diagonal coupling). The opposite behaviour is encountered in the Ni complex (2). The physical origin of these different types of correlation processes are analyzed in a simple two-electron two-orbital model. (82 refs.)

106283 Ab initio molecular orbital calculations on the interconversion of allene and propyne cation radicals and the mechanism for hydrogen loss from $C_3H^+{}_4$. G.Frenking, H.Schwarz (Inst. fur Organische Chem., Tech. Univ. Berlin, Berlin, Germany).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.131-8 (1 Sept. 1983).
Ab initio molecular orbital calculations (6-31G*/MNDO) of the $C_3H_4{}^{+\cdot}$ potential energy surface (electronic ground state) reveal the following features. The molecular ions of allene (**1**) and propyne (**2**) are separated by substantial potential energy barriers which preclude easy interconversion. The minimal energy requirement path for the **1**⇄**2** isomerization proceeeds via two successive 1,2-hydrogen migrations and involves the as yet unknown stable, linear $C_3H_2{}^{+\cdot}$ ion **5**. Isomerization via a direct 1,3-hydrogen migration is, if it is involved at all, energetically less favoured. The ion **5** also serves as the central intermediate for ring closure to the cation radical of cyclopropene (**4**), which itself is the actual precursor for loss of $H^\cdot$ thus generating the cyclopropenylium ion (**3**). The complete geometric data of the various $C_3H_4{}^{+\cdot}$ isomers and the transition states connecting them are reported. (15 refs.)

106284 Electronic structure in the intervalence transfer absorption band of a mixed-valence dimer. E.M.Kober, K.A.Goldsby, D.N.S.Narayana, T.J.Meyer (Dept. of Chem., Univ. of North Carolina, Chapel Hill, NC, USA).
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4303-9 (29 June 1983).
Electronic structure has been observed in the intervalence transfer (IT) absorption band of the weakly coupled mixed-valence dimer $[(bpy)_2ClOs^{II}(PPh_2CH_2Ph_2P)Os^{III}Cl(bpy)_2]^{3+}$ (bpy is 2,2′-bipyridine). The origin of the structure lies in the large spin-orbit (SO) coupling constant (λ_{Os}) for osmium which leads to well separated SO states for the Os^{III} $d\pi^5$ electronic configuration. For Os^{III}-bpy monomers, low-energy $d\pi \rightarrow d\pi$ transitions between the SO states are observed in the near-infrared (near-IR). Optical electron transfer in the mixed-valence dimer results in the formation of a 'new' Os(III) site in one of three possible SO states (1E′, 2E′, or 3E′), and hence the IT manifold should contain three components separated by the energy differences between the SO states at the Os(III) site. In addition to the expected $d\pi$-$d\pi$ absorption bands, the spectrum of the Os(II)-Os(III) dimer in the near-IR shows two broad, solvent-dependent bands which are assignable to IT transitions. The bands are separated in energy by approximately the energy difference between the two lowest SO states as expected. Calculations on the expected position of the third component indicate that it should occur in a spectral region obscured by intense metal-to-ligand charge-transfer bands. (30 refs.)

106285 Interruption of conjugation in polyenes bound to transition-metal fragments. J.W.Chinn,Jr., M.B.Hall (Dept. of Chem., Texas A&M Univ., College Station, TX, USA).
J. Am. Chem. Soc. (USA), vol.105, no.15, p.4930-41 (27 July 1983).
The authors have calculated the molecular orbitals of a large number of molecules in the series $(\eta^n\text{-}C_nH_n)M(CO)_m(XY)$ (n=3-7, m=1-3, XY=CO, N_2, NO, CN). Density difference plots show that the origin of these patterns in the C-C bond lengths is an intramolecular interruption of the conjugated π system of the polyene. The calculations suggest a general rule that C-C bonds in a polyene eclipsed below by a carbonyl or similar ligand will be long while those trans to these ligands will be short. These results are in agreement with recent accurate structures and even with some older structures where the significance of the differences in bond length is questionable. Exceptions to this rule occur for some room-temperature crystal structures in which the C-C distances are not precisely determined and for some systems in which there is a strong specific intermolecular interaction. (63 refs.)

106286 Are the silacyclopentadienyl anion and the silacyclopropenyl cation aromatic?. M.S.Gordon, P.Boudjouk, F.Anwari (Dept. of Chem., North Dakota State Univ., Fargo, ND, USA).
J. Am. Chem. Soc. (USA), vol.105, no.15, p.4972-6 (27 July 1983).
Stabilization energies attributable to aromaticity in the silacyclopentadienyl anion and the silacyclopropenyl cation were found to be small in the former and absent in the latter when calculated from bond-separation reactions employing 3-21G and STO-2G basis sets. The silacyclopentadienyl anion is approximately 25% as aromatic as the all-carbon analogue whereas silabenzene is more than 80% as aromatic as benzene. The introduction of diffuse functions into the basis sets has only a small effect on these results. The silacyclopropenyl cation is actually destabilized but strain is probably a key factor in the comparison. Also found was that the STO-2G basis set gives geometries and relative energies consistent with those of a larger basis set and that the semiempirical INDO method may be useful for predicting the structures of larger systems for which geometry optimizations even with STO-2G may be too time consuming. (18 refs.)

106287 Comments on the cis, trans, and cyclic dimers of NO. J.P.Ritchie (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
J. Phys. Chem. (USA), vol.87, no.14, p.2466-8 (7 July 1983).
Geometry optimizations and force constant calculations have been performed at various levels of theory for the cis, trans, and cyclic isomers of NO. Even at levels including d orbitals, the calculated geometries and relative energies of the cis and trans isomers show substantial errors. σ-aromaticity may play a role in stabilizing the cis isomer. The cyclic structure is verified as a minimum at the SCF level by the calculation of force constants; MINDO/3 and volume calculations lend support to the suggestion that it may be involved in the detonation of NO. (18 refs.)

106288 Lone-pair and core ionization potentials of planar ammonia and phosphine. The use of core and valence ionization potentials to quantify the bonding and antibonding character of molecular orbitals of compounds of nitrogen and phosphorus. C.J.Eyermann, W.L.Jolly (Dept. of Chem., Univ. of California, Berkeley, CA, USA).
J. Phys. Chem. (USA), vol.87, no.16, p.3080-2 (4 Aug. 1983).
For both ammonia and phosphine, the differences between the ionization potentials of the pyramidal and planar forms were calculated by an ab initio SCF method. The lone-pair ionization potential differences, IP(planar)−IP(pyramidal), are −1.0 and −2.3 eV for NH_3 and PH_3, respectively. The core binding energy shifts, E_B(planar)−E_B(pyramidal), are −0.3 and −0.4 eV for NH_3 and PH_3, respectively. By combining these data with appropriate experimental valence and core ionization potentials, it is possible to quantify the bonding or antibonding character of moleculear orbitals of nitrogen and phosphorus compounds. The method is illustrated by using data for several nitrogen- and phophorus-containing species. (20 refs.)

106289 Many-body calculations of atomic properties. I. g_j factors. L.Veseth (Inst. of Phys., Univ. of Oslo, Oslo, Norway).
J. Phys. B (GB), vol.16, no.16, p.2891-12 (28 Aug. 1983).
Many-body perturbation theory has been applied to compute expectation values of the one- and two-electron interactions which yield the relativistic corrections (Abragam-Van Vleck terms) to the atomic g_J factors. A two-electron term due to the motion of the atomic nucleus is also considered. The present calculations are based on analytic expansions of the single-particle states, and a main purpose of the work is to investigate the capability of this method for computations of complex atomic properties. The examples considered are the ground states of the alkali atoms up to rubidium, the ground states of the first-row atoms, and chlorine. The calculations are complete to third order and some fourth-order diagrams are also included. For the first-row atoms energy lowerings ranging from 82-92% of the experimental correlation energies were obtained, showing that a considerable amount of correlation has been included. The computed g_J factors are compared with high-precision experimental values and reasonable agreements for the troublesome cases of nitrogen and the fluorine $^2P_{1/2}$ state are among the present achievements. Correlation effects were in several cases found to be of importance for the computed g_J factors. (28 refs.)

106290 Many-body calculations of atomic properties. II. Spin-orbit coupling. L.Veseth (Inst. of Phys., Univ. of Oslo, Oslo, Norway).
J. Phys. B (GB), vol.16, no.16, p.2913-20 (28 Aug. 1983).
For pt.I see ibid., vol.16, no.16, p.2891-912 (1983). Many-body perturbation theory has been applied to compute the spin-orbit coupling in the ground states of O, F, Al, Si, S and Cl, and in the first excited ^2D state of N and P. The present calculations are based on analytic expansions of the single-particle states and are complete to third order with some important fourth-order diagrams included. In the cases of N, O, Si, P and Cl the present results are found to account for about 80% of the discrepancy between experimental and Hartree-Fock values. For the more troublesome cases of F, Al and S about 60% of the discrepancies are recovered. Core polarisation effects are found to yield the dominant contribution in all cases except fluorine. Correlation contributions were, however, in most cases also found to be of considerable importance. The remaining discrepancies between theoretical and experimental results seem to be mostly related to neglected high-order correlation diagrams. (18 refs.)

106291 Finite-field SCF calculations of the dipole polarisabilities of heavy atoms using relativistic effective potentials. W.J.Stevens, M.Krauss (Nat. Bur. of Standards, Molecular Spectroscopy Div., Washington, DC, USA).
J. Phys. B (GB), vol.16, no.16, p.2921-30 (28 Aug. 1983).
The static dipole polarisabilities of Xe, Lu, Hg^+, Hg, Tl and At have been determined from finite-field SCF calculations within a valence-electron relativistic effective potential formalism. The effect of the self-consistent inclusion of spin-orbit coupling on the calculated polarisabilities have been investigated by comparing j-averaged (L, Λ) results with j-dependent (J,Ω) calculations. The atoms selected provide a range of closed-shell, particle and hole states for comparative study. The results suggest that self-consistent inclusion of spin-orbit coupling is far more important for the particle states than for the hole

states. In the case of Xe, results are presented from calculations using relativistic effective potentials based on both Hamiltonian-consistent and shape-consistent pseudo-orbitals. The shape-consistent approach is found to produce polarisabilities in better agreement with previously determined all-electron Hartree-Fock values. In addition, for Hg the shape-consistent approach yields a polarisability in excellent agreement with all-electron numerical Dirac-Fock calculations. (26 refs.)

106292 A new version of the variational cellular method for polyatomic systems. L.G.Ferreira (Inst. de Fisica, Univ. de Sao Paulo, Sao Paulo, Brazil), M.L.De Siqueira.
J. Phys. B (GB), vol.16, no.17, p.3111-23 (14 Sept. 1983).
The authors present a new version of the variational cellular method of Ferreira and Leite (1979) for the calculation of the electronic structure of polyatomic systems. This version seems to be simple to use, eliminates the muffin-tin potentials and charge densities, and is as fast as the multiple-scattering method. The authors develop programmable procedures for the definition of the cells and choice of points for the surface integrations of polyatomic structures. When applied to methane, the method gave very good results for the energy, interatomic distance, a_1 mode frequency and ionisation energies at a very low computational cost. (21 refs.)

106293 The frozen-core approximation with a nonempirical polarisation potential: the sodium isoelectronic sequence. R.P.McEachran (Dept. of Phys., York Univ., Toronto, Canada), M.Cohen.
J. Phys. B (GB), vol.16, no.17, p.3125-35 (14 Sept. 1983).
Orbital wavefunctions of a large number of levels Na I, Mg II, Al III and Cl VII have been calculated using a frozen-core Hartree-Fock approximation which includes a nonempirical polarisation potential derived from polarised core orbitals. The calculated ionisation energies are in very good agreement with precise measurements. Electric dipole oscillator strengths derived from the computed wavefunctions and energies are found to be of generally high accuracy. (58 refs.)

106294 Ab initio one-electron property calculations. V. Miscellaneous heterocycles and related compounds. G.de Brouckere (Van der Waals Lab., Univ. of Amsterdam, Amsterdam, Netherlands), G.Berthier.
Mol. Phys. (GB), vol.49, no.6, p.1417-41 (20 Aug. 1983).
For pt.IV see ibid., vol.47, no.1, p.209 (1982). SCF one-electron property calculations are reported for p-benzo-quinone, trans-acrolein, trans-glyoxal, α- and γ-pyrone, vinylene carbonate, maleic anhydride, formaldehyde, as well as for a series of three-membered ring systems, that is cyclopropene, ethylenimine, ethylene oxide, ethylene sulphide, methylene cyclopropene, cyclopropenone, cyclopropane. The dipole moments are usually in good agreement with Stark effect measurements except for some small ring systems for which the independent particle model seems to be insufficient. The predicted values of the observables issued from Zeeman microwave experiments are rather good except for ethylenimine. The vertical ionization potentials are generally also in good agreement with the photoelectron spectroscopy data. ^{17}O and ^{14}N nuclear quadrupole couplings are in line with their experimental counterparts for p-benzoquinone, maleic anhydride, formaldehyde and ethylenimine, sole data reported on the above compounds. Deuteron couplings are calculated for all the above molecules too, an excellent agreement with observation being found merely for formaldehyde, the single compound for which these data have been reported. Octupole moments have also been derived. (54 refs.)

106295 Corrections to the orbital magnetic properties for diatomic molecules. J.Rychlewski (Faculty of Chem., A. Mickiewicz Univ., Poznan, Poland).
Mol. Phys. (GB), vol.49, no.6, p.1443-50 (20 Aug. 1983).
The mass-dependent terms which are usually neglected in the calculation of second order orbital magnetic properties for diatomic molecules are derived starting with the spinless hamiltonian. The magnitude of the mass-dependent contributions to the magnetizability and rotational *g*-factor is calculated for the ground state of H_2 and D_2. The correction terms improve the agreement between the theoretical and experimental values, although a small discrepancy for the rotational *g*-factor of H_2 still exists. (13 refs.)

106296 Ab initio SCF-LCAO-MO study of conformational stability and internal rotation in n-butane, ethyl methyl ether and ethyl methyl sulphide. J.L.Bredas, M.Dufey, J.G.Fripiat, J.M.Andre (Lab de Chimie Theorique Appl., Facultes Univ. Notre-Dames de la Paix, Namur, Belgium).
Mol. Phys. (GB), vol.49, no.6, p.1451-60 (20 Aug. 1983).
The authors present STO-3G and 4-31G ab initio SCF-LCAO-MO geometry optimizations on n-butane, ethyl methyl ether and ethyl methyl sulphide. For these three compounds they study and compare the evolution of the geometrical parameters upon internal rotation of the molecule around its central bond, that is from the trans to the gauche conformation, as well as the relative stabilities of the trans and gauche conformers and the barrier to the trans-gauche rotation. (36 refs.)

106297 Diagrammatic perturbation theory: an application to the beryllium dimer using a universal even-tempered basis set. S.Wilson (Dept. of Theoretical Chem., Univ. of Oxford, Oxford, England).
Mol. Phys. (GB), vol.49, no.6, p.1489-93 (20 Aug. 1983).
Diagrammatic many-body perturbation theory is applied to the ground state of the beryllium dimer using a universal even-tempered basis set of exponential-type functions. (15 refs.)

106298 Unique labelling of *J*-states in octahedral symmetry. D.J.Newman (Dept. of Phys., Univ. of Hong Kong, Hong Kong).
Phys. Lett. A (Netherlands), vol.97A, no.4, p.153-4 (22 Aug. 1983).
An induced representation method is used to solve the problem of unique labelling for the components of angular momentum states in octahedral symmetry. (5 refs.)

106299 Gradient-free representation of the Weizsacker term for atoms. R.K.Pathak (Dept. of Chem., Univ. of North Carolina, Chapel Hill, NC, USA), S.R.Gadre.
Phys. Rev. A (USA), vol.28, no.3, p.1808-9 (Sept. 1983).
It has been demonstrated that the Weizsacker inhomogeneity term may be replaced by a gradient-free form for atomic systems. This forms a realization of a previous conjecture made by the authors [see ibid., vol.25, p.668 (1982)]. In the variational context, numerical computations have been performed with such a representation with the first-row atoms employed as test cases. The resulting energies are seen to match very well with their Hartree-Fock counterparts. (21 refs.)

106300 Chemical applications of topology and group theory. XIII. Chirality and framework groups. R.B.King (Dept. of Chem., Univ. of Georgia, Athens, GA, USA).
Theor. Chim. Acta (Germany), vol.63, no.2, p.103-32 (1983).
For pt.XII see Inorg. Chem. Acta, vol.57, p.79 (1981). Studies the systematics of chirality arising from different framework groups. In this connection framework groups can be classified into four different types: linear, planar, achiral, and chiral. Chiral framework groups lead to chiral systems for any ligand partition including that with all ligands equivalent. The chirality of four-, five-, and six-site framework groups is discussed in terms of the maximum symmetry ligand partitions resulting in removal of all of the symmetry elements corresponding to improper rotations S_n (including reflections S_1 and inversions S_2) from achiral and polarized planar framework groups. The Ruch-Schonhofer group theoretical algorithms for the calculation of chiral ligand partitions and pseudoscalar polynomials of lowest degree ('chirality functions') are adapted for use with these framework groups. Other properties of framework groups relevant to a study of their chirality are also discussed: these include their transitivity (i.e. whether all sites are equivalent or not), their normality (i.e. whether proper rotations correspond to even permutations and improper rotations correspond to odd permutations), and the number of sites in their symmetry planes. (31 refs.)

Hyperfine-induced *n* mixing in high Rydberg states of ^{87}Sr .. See Entry 106318

Shake theory predictions of excited-state populations following 1s ionisation in argon .... See Entry 106327

Analysis of $3d^7 4s$-$3d^7 4p$ transitions in the Zn V spectrum .... See Entry 106335

Photoionisation of Cs 6p and Cs 7p subshells .... See Entry 106366

Vibrational frequencies of the HCCN molecule. A near degeneracy between bent cyanocarbene and linear allene-related geometries .... See Entry 106382

The electronic structure and spectra of UO^+ .... See Entry 106389

Interactions between unbound groups in the molecules $\phi CX_{(1)}X_{(2)}X_{(3)}$. Influence on the secondary transition intensity .... See Entry 106394

Experimental and theoretical studies of ^{13}C-^{13}C coupling constants. II. Conformational and substituent dependencies of geminal coupling constants $^2J(^{13}C$-$^{13}C)$ .... See Entry 106444

Relative intensities in X-ray photoelectron spectra. X. Near-threshold structure of photoionization cross-sections of molecular valence shells .... See Entry 106517

Ionization of the hydrogen atom by electron impact with the use of the polarized-orbital method .... See Entry 106595

Theoretical study of electron impact mass spectrometry. I. Ab initio MO study of the fragmentation of *n*-butane .... See Entry 106612

Potential energy curves for dissociative recombination .... See Entry 106620

Interaction of saturated hydrocarbons with transition-metal films: molecular orbital calculations .... See Entry 108167

A simple perturbational approach for the determination of favourable reaction pathways .... See Entry 109710

31.20E Ab initio LCAO and GO SCF calculations

106301 Theoretical study of the structure and reactivity of the pentazole anion. Minh-Tho Nguyen (Lab. voor Quantum Chem., Katholieke Univ. te Leuven, Heverlee, Belgium), J.Elguero, M.Sana, G.Leroy.
Can. J. Chem. (Canada), vol.61, no.7, p.1435-9 (July 1983). In French.
Ab initio LCAO-SCF-MO calculations using the 4-31G basis set were carried out in order to study the supersystem N_5^-. The three possible stable structures (azide ion+molecular nitrogen, pentazene ion and pentazole ion) and their reactions paths were calculated. The pentazole anion is less stable than the reagents $N_3^- + N_2$, but much more stable than the pentazene anion; it could constitute a reasonable synthetic target. The activation energies of the different paths were compared with those of the neutral supersystem N_5H. (20 refs.)

31.20G Other accurate, or nearly ab initio calculations (DIM method, SAMO method, etc.)

106302 Nonadditive effects of polysubstitution in CH_4 and CH_3: a test of ab initio and semiempirical MO methods. N.C.Baird (Dept. of Chem., Univ. of Western Ontario, London, Ontario, Canada).
Can. J. Chem. (Canada), vol.61, no.7, p.1567-72 (July 1983).
The effects to the bond lengths and molecular energy of making multiple substitutions at the same carbon atom in methane and the methyl free radical are studied using various molecular orbital methods. All ab initio calculations were based upon the Hartree-Fock formalism (unrestricted in the case of free radicals) and employed the STO-3G (with *d* orbitals on chlorine), 3-21G and 4-31G bases, the last both with and without a set of Gaussian *d* orbitals on the carbon. The semiempirical methods used were the MINDO/3 and MNDO methods; computations for polysubstituted-ethanes by these two methods also are reported. The ab initio methods which use a split valence shell basis set account very well for the trends in bond lengths and heats of formation, at least when the polysubstituent is fluorine or hydroxyl. In contrast, the semiempirical calculations and the ab initio STO-3G results gave very poor results. (20 refs.)

A theoretical investigation on the role of solvent in solvolytic reactions. VI. An ab initio MO calculation for dissociation of fluoromethane in hydrofluoric acid .... See Entry 106332

Spectroscopic and theoretical studies of binuclear molybdenum(II) carboxylates .... See Entry 106433

Angle-resolved photoelectron spectroscopy of HCl from a photon energy of 16 to 80 eV .... See Entry 106499

Calculation of photoelectron spectra of group IV tetrachlorides and carbon tetrahalides by SCF-X_α-SW method .... See Entry 106500

31.20L Statistical model calculations (Thomas-Fermi and Thomas-Fermi-Dirac models)

Bremsstrahlung of electrons in an atomic potential: the classical character of the spectrum; scaling laws .... See Entry 106585

31.20N Semi-empirical NDO calculations (CNDO, INDO, MINDO, PCILO methods, etc.)

106303 Equilibrium geometries of transition metal complexes. A comparison of approximate molecular orbital theory and experiment. D.S.Marynick, F.U.Axe, C.M.Kirkpatrick, L.Throckmorton (Dept. of Chem., Univ. of Texas, Arlington, TX, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.406-10 (19 Aug. 1983).
Optimized metal-ligand bond distances have been obtained for fifteen transition metal complexes using PRDDO, an approximate molecular orbital method. Of the twenty-nine unique distances, only six are in error by more than 0.05 Å, and the average error is ≈ 0.03 Å. (35 refs.)

106304 Structures and rearrangements of closo-boron hydrides. D.J.Fuller, D.L.Kepert (School of Chem., Univ. of Western Australia, Nedlands, W.Australia, Australia).
Polyhedron (GB), vol.2, no.8, p.749-59 (1983).
The bonding in closo-boron hydrides, $B_nH_n^{2-}$ (where 5-12), is considered to be the sum of all possible $n(n-1)/2$ boron-boron interactions. The bonding energy u between any pair of boron atoms is taken to depend only upon the internuclear distance d, and to be given by $u=1/d^2-1/d$. This scheme can be used to rationalize details of molecular geometry and also allows the relative importance of various intramolecular rearrangement pathways to be assessed. This method is compared with alternative approaches to treating the bonding in these molecules. (33 refs.)

106305 An INDO-CI method in π-approximation for the calculation of transition metal complexes with organic ligands—application to iron(II)-trisdiimine complexes. C.Jung, O.Ristau (Central Inst. of Molecular Biology, Acad. of Sci., Berlin, Germany), C.Jung.
Theor. Chim. Acta (Germany), vol.63, no.2, p.143-59 (1983).
An INDO-CI method in π-approximation extended for transition metal complexes with organic ligands is presented. The σ-polarization in the complex is estimated using a two-dimensional EHT calculation and considered in the π-calculation by means of the diagonal Fock matrix elements. The method is tested for four trisdiimine iron(II) complexes. In agreement with the experimental absorption spectra the calculations show that diimine complexes with non-heterocyclicly bound nitrogen atoms exhibit a large red-shift of the characteristic charge-transfer transition increasing the number of aromatic rings. Contrarily, for diimine complexes with heterocyclicly bound nitrogen atoms no shift of the charge-transfer transition was obtained. (38 refs.)

Nonadditive effects of polysubstitution in CH_4 and CH_3: a test of ab initio and semiempirical MO methods .... See Entry 106302

Nuclear magnetic shielding calculations in the finite perturbation method involving GIAOs at the INDO level and London's approximation. II. Carbon-13 and nitrogen-15 .... See Entry 106316

The T_1 state of *p*-nitroaniline and related molecules: a CNDO/S study .... See Entry 106330

Experimental and theoretical studies of ^{13}C-^{13}C coupling constants. I. Conformational and substituent dependencies of long range coupling constants $^4J(^{13}C$-$^{13}C)$ .... See Entry 106443

Nuclear magnetic resonance and PCILO study of the side-chain conformations in *m*-anisaldehyde and 2,5-dimethyloxybenzaldehyde .... See Entry 106452

Semiempirical calculation of ^{13}C NMR screening tensors of organic molecules .... See Entry 106468

Gas-phase solvation of NO_2^- and NO_3^- by ethyl nitrate .... See Entry 109720

31.20P Other semi-empirical calculations (Hückel, generalized Hückel, PPP methods, etc.)

106306 EHT calculations for interstitial hydrogen bonding in nickel. C.Opitz (Sektion Chem., Friedrich-Schiller-Univ. Jena, Jena, Germany), H.Muller, H.Miessner.
Phys. Status Solidi b (Germany), vol.118, no.2, p.K85-7 (1 Aug. 1983).
A theoretical investigation of the interstitial hydrogen bonding in nickel is given. The EHT method is able to treat this problem properly and gives results of the same quality as the other semi-empirical methods. The authors repeat the EHT calculation for this problem taking double-ζ functions instead of the 3d Slater type orbitals for Ni and changing the 1s orbital exponent. (11 refs.)

Porphyrins. XLIV. Electronic states of Co, Ni, Rh, and Pd complexes .... See Entry 106325

31.20R Valence bond calculations (ab initio or not)

106307 Coordination 2 of phosphorus: quantum chemical study of P=N and P=C systems. D.Gonbeau, G.Pfister-Guillouzo (Lab. de Phys.-Chimie Moleculaire, IURS, Pau, France), J.Barrans.
Can. J. Chem. (Canada), vol.61, no.7, p.1371-8 (July 1983). In French.
Using ab initio valence double zeta as a basis, a quantum-chemical approach was developed for the models HP=NH and $PH=CH_2$. The geometric parameters were determined by a variable metrics minimization process. The $2p_\pi$-$3p_\pi$ bond forces for P=N and P=C were estimated by evaluating the barriers obtained by a 90° rotation of one part of the molecule with respect to the other. The essential correlation effect was considered and a rigorous RHF formalism was used to determine the state at 90° of lower energy. Different electronic characteristics were found for both motives and according to these results, their reaction behaviour was interpreted: dimerization, addition of polar reactants, and protonation site for HP=NH. (35 refs.)

31.20T Electron correlation and CI calculations

106308 A theoretical investigation of the radiative properties of the CN red and violet systems. M.Larsson (Res. Inst. of Phys., Stockholm, Sweden), P.E.M.Siegbahn, H.Agren.
Astrophys. J. (USA), vol.272, no.1, pt.1, p.369-76 (1 Sept. 1983).
The radiative properties of the CN red and violet systems are studied theoretically using the CASSCF method. The transition moments between the states are determined from wave functions with orbitals optimized for each state separately. For this purpose a recently suggested method is used, where the invariance property of active orbital rotations in a CASSCF wave function is utilized. (28 refs.)

106309 Full CI calibration of model Hamiltonian, large basis set studies of the H_2-H_2 van der Waals interaction. P.G.Burton (Chem. Dept., Univ. of Woolongong, Woolongong, NSW, Australia).
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.51-8 (26 Aug. 1983).
The non-variational CEPA2 PNO ansatz, recently employed in detailed studies of the H_2-H_2 van der Waals interaction by Burton and Senff (1982) and the full CI extrapolation studies on the same system by Burton (1982) are discussed in relation to the explicit full CI study of Harrison and Handy (1983) for the planar T configuration of H_2-H_2 ($R=6.5\ a_0$) in a basis of 80 functions. (26 refs.)

106310 Ab initio CI study of the photodissociation of nitrosyl chloride (ClNO). D.Solgadi, F.Lahmani, C.Lardeux (Lab. de Photophys. Moleculaire, Univ. de Paris-Sud, Orsay, France), J.P.Flament.
Chem. Phys. (Netherlands), vol.79, no.2, p.225-33 (1 Sept. 1983).
Potential-energy curves for the ground and excited singlet states of nitrosyl chloride (ClNO) in the energy region up to 8.5 eV have been calculated by means of the CIPSI method, which combines variation and perturbation techniques in order to take into account electron correlation effects. The calculated dissociation energy D_e for the ground state is 1.58 eV which can be compared with the experimental value of 1.55 eV. The three first A'' and two first A' symmetry states at low energy are all repulsive along the Cl-N coordinate and are responsible for the direct dissociative processes obtained in the 6000-3000 Å energy range. At ≈2000 Å a bound state has been observed which clearly indicates that the photofragmentation in $NO(X)+Cl\ ^2P^0$ is not due to a direct dissociation but shoud involve a predissociative mechanism through a crossing with a triplet state or a rapid internal conversion to the hot ground state. Between 1700 and 1200 Å the electronic states are numerous and involve a large contribution of Rydberg orbitals. These states dissociate towards NO $A^2\Sigma^+$, $C^2\Pi$ and $D^2\Sigma^+$ corroborating experimental observations. (34 refs.)

106311 Electromagnetic properties of BH ($^1\Sigma^+$) using CASSCF wavefunctions. G.T.Daborn, N.C.Handy (Chem. Lab., Univ. of Cambridge, Cambridge, England).
Mol. Phys. (GB), vol.49, no.6, p.1277-88 (20 Aug. 1983).
The perturbation equations for the calculation of static, second order electromagnetic properties at the MCSCF level of approximation are derived and discussed, with particular application to the CASSCF method. Results are given for the energy, electric dipole moment, polarizability and magnetizability of BH at various internuclear distances. In agreement with previous calculations, BH is predicted to be paramagnetic. (26 refs.)

106312 Doubly positive diatomic molecules. I. N_2^{2+}. P.R.Taylor (CSIRO Div. of Chem. Phys., Clayton, Victoria, Australia).
Mol. Phys. (GB), vol.49, no.6, p.1297-314 (20 Aug. 1983).
Calculations on the molecule N_2^{2+} are described. The complete active space SCF (CASSCF) method is used to generate electronic wavefunctions and potential energy curves for a number of bound and unbound N_2^{2+} states. Spectroscopic constants are obtained from rovibrational energy level calculations for the bound states. Details of the computational methods used are given and the computed results are compared with optical spectroscopy, Auger spectroscopy and mass spectroscopy measurements. The agreement between the CASSCF and experimental results is as good as has been observed for other molecules, yielding spectroscopic constants of semi-quantitative accuracy. Natural orbital analyses of the CASSCF wavefunctions are given, but no simple picture of the origins of the binding in N_2^{2+} emerges. All the electronic states are poorly described by a single electronic configuration. (47 refs.)

106313 An ab initio study of the excited states of OH^+. D.M.Hirst (Dept. of Chem. & Molecular Sci., Univ. of Warwick, Coventry, England), M.F.Guest.
Mol. Phys. (GB), vol.49, no.6, p.1461-9 (20 Aug. 1983).
Potential curves have been calculated by the ab initio MRD CI method for states of OH^+ correlating with $O(^3P, {}^1D, {}^1S)+H^+$ and $O^+(^4S, {}^2D, {}^2P)+H$. Spectroscopic constants derived from the calculated potential curves are in good agreement with the available experimental data. The calculations support the experimental assignment of vibrational quantum numbers for levels perturbing the $A^3\Pi$ state. (13 refs.)

106314 An ab initio CI study of the ground and excited states of p-benzoquinone. T.-K.Ha (Lab. of Phys. Chem., Swiss Federal Inst. of Technol., Zurich, Switzerland).
Mol. Phys. (GB), vol.49, no.6, p.1471-9 (20 Aug. 1983).
Configuration interaction (CI) studies of ground, $n\rightarrow\pi^*$, $\pi\rightarrow\pi^*$ electronically excited singlet and triplet states and of the ionized states (cations) are reported for p-benzoquinone. The splittings between two $n\pi^*$ states, both for singlet and triplet, are very small confirming recent experimental results. A lower lying $\pi\pi^*$ triplet state ($^3B_{1u}$) has been thereby assigned. The photoelectron spectra (PES) for the low-energy ionization region have been assigned. Contrary to the MO ordering, $2b_{3g}(\pi_u)$, $1b_{1g}(\pi_g)$, $4b_{3g}(n_g)$, $5b_{2u}(n_u)$, the CI result predicts that the four first PES bands may be assigned to $^2B_{3g}(n_g)$, $^2B_{2u}(n_u)$, $^2B_{3u}(\pi_u)$ and $^2B_{1g}(\pi_g)$ in order of increasing energy. (30 refs.)

106315 Ab initio studies on ONH_3, ONF_3 and OCF_3^-, using polarization functions and configuration interaction methods. F.Grein, L.J.Lawlor (Dept. of Chem., Univ. of New Brunswick, Fredericton, Canada).
Theor. Chim. Acta (Germany), vol.63, no.2, p.161-75 (1983).
SCF geometry optimizations, using double-zeta basis sets with polarization functions, either as *d*-orbitals or bond functions, were performed on ONH_3, ONF_3, and OCF_3^-. The bonding in these molecules is discussed with the help of orbital density plots and Mulliken population analyses. ONF_3 can be explained as donor-acceptor product of O with NF_3. For OCF_3^-, diffuse functions have also been added to the basis set. The *CF* distance is predicted to be 1.39 Å, in qualitative agreement with the known infrared spectrum. With the best basis set, the NF distance as well as the ON distance in excellent agreement with experimental results. (26 refs.)

Energy levels of silicon, Si I through Si XIV .... See Entry 105044

An INDO-CI method in π-approximation for the calculation of transition metal complexes with organic ligands—application to iron(II)-trisdiimine complexes .... See Entry 106305

Vibrational frequencies of the HCCN molecule. A near degeneracy between bent cyanocarbene and linear allene-related geometries .... See Entry 106382

Probabilities for transition processes crucial to Li lasers .... See Entry 106748

31.30 CORRECTIONS TO ELECTRONIC STRUCTURE

106316 Nuclear magnetic shielding calculations in the finite perturbation method involving GIAOs at the INDO level and London's approximation. II. Carbon-13 and nitrogen-15. E.C.Vauthier (Univ. Pierre et Marie Curie, Paris, France), S.Fliszar, F.Tonnard, S.Odiot.
Can. J. Chem. (Canada), vol.61, no.7, p.1417-21 (July 1983).
Magnetic shielding constants, calculated for C-13 and N-15 nuclei in the finite perturbation method using INDO and London's approximations, are analyzed in terms of mono-, di-, and tricentric contributions, thus permitting an assessment of the relative importance of local vs. nonlocal contributions. For both C-13 and N-15, it appears that the changes in total shielding are almost entirely dictated by those of the local paramagnetic contribution, i.e. $\Delta\sigma_{total}\simeq\Delta\sigma_{local}{}^P$. (15 refs.)

106317 On the exception values of relativistic corrections to the hamiltonian. I.J.Ketley (Math. Dept., Univ. of Southampton, Southampton, England), R.E.Moss.
Mol. Phys. (GB), vol.49, no.6, p.1289-95 (20 Aug. 1983).
The use of closed form operators and the corresponding power series expanded operators in Foldy-Wouthuysen transformations is discussed. In general, different transformed hamiltonians arise. This is demonstrated using the free electron part of the Dirac hamiltonian; the operators and their expectation values using hydrogenic functions are considered. (7 refs.)

106318 Hyperfine-induced *n* mixing in high Rydberg states of ^{87}Sr. R.Beigang, W.Makat, A.Timmermann, P.J.West (Inst. fur Atom- und Festkorperphys., Freie Univ. Berlin, Berlin, Germany).
Phys. Rev. Lett. (USA), vol.51, no.9, p.771-4 (29 Aug. 1983).
The hyperfine structure of high Rydberg states of ^{87}Sr was studied for principal quantum numbers $80 \leq n \leq 150$. The hyperfine interaction causes a strong singlet-triplet mixing between levels with the same total angular momenta F but different quantum numbers n. Semiempirical calculations show excellent agreement with experiment. (13 refs.)

106319 Broken symmetry in the local-spin-density approximation and its application to relativistic atoms. D.M.Bylander, L.Kleinman (Dept. of Phys., Univ. of Texas, Austin, TX, USA).
Phys. Rev. Lett. (USA), vol.51, no.10, p.889-91 (5 Sept. 1983).
The ground state of the (d^4s^2) configuration shifts by 1.725 eV relative to that of the (d^5s) on going from Mo to W. This shift, which arises mainly from relativistic contributions to the W energy, is calculated with 2% accuracy by use of the authors' relativistic pseudopotential and the local-spin-density approximation. That the single determinantal broken-symmetry local-spin-density approximation wave function accounts for the spin-orbit energy, which otherwise could be obtained from the spin-orbit mixing of several multideterminantal terms, may be surprising. (18 refs.)

106320 $\alpha(Z\alpha)^2E_F$ binding corrections to hyperfine splitting in hydrogenic atoms. J.R.Sapirstein (Newman Lab. of Nuclear Studies, Cornell Univ., Ithaca, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.11, p.985-7 (12 Sept. 1983).
A perturbative expansion of the electron's Dirac Coulomb propagator around a nonrelativistic form is used to evaluate the one-loop nonrecoil corrections to ground-state hyperfine splitting in hydrogenic atoms. A contribution previously estimated as $(\alpha/\pi)(Z\alpha)^2 \times (18.36 \pm 5)E_F$ is found to be $(\alpha/\pi)(Z\alpha)^2 (15.10 \pm 0.29)E_F$. Theory and experiment are compared for muonium hyperfine splitting and consequences for the fine-structure constant are discussed. (17 refs.)

General consideration of electronic transitions in many-electron atoms and ions ....See Entry 106263

The validity of Musher's model for the magnetic properties of aromatic molecules ....See Entry 106277

Shake theory predictions of excited-state populations following 1s ionisation in argon ....See Entry 106327

Accurate wavelength measurements of He-like resonance lines of titanium through zinc from a high-temperature plasma ....See Entry 106339

Configuration $1s^22s3p$ in the sequence Ne VII-Fe XXIII: level energies and lifetimes ....See Entry 106356

The electronic structure and spectra of UO^+ ....See Entry 106389

Resonance Raman spectra of the ground and excited states of specifically deuterated tris(2,2′-bipyridine)ruthenium(II) ....See Entry 106406

Infrared spectra of the *n*-butyl and *n*-pentyl radicals ....See Entry 106410

Infrared spectra of matrix-isolated metal complexes of octaethylporphine ....See Entry 106411

Isotope effects of benzylic deuterons on chemical shifts of ortho carbons. Correlation with π-bond orders as an indication of a hyperconjugative contribution ....See Entry 106447

Fluorescence excitation spectrum of triptycene in a supersonic jet ....See Entry 106494

31.50 EXCITED STATES

106321 Rydberg atoms. J.E.Bayfield (Dept. of Phys., Univ. of Pittsburgh, Pittsburgh, PA, USA).
Am. Sci. (USA), vol.71, no.4, p.375-83 (July-Aug. 1983).
The development of lasers has greatly enhanced the range and quality of experiments with Rydberg atoms. These new light sources can be made highly monochromatic and intense. If their wavelength is tuned to an appropriate line of the Rydberg series, they can quickly stimulate transitions of atoms from the ground state to the high energy states that characterize Rydberg atoms. This excitation process can very selectively produce as many as 10^{12} Rydberg atoms in one cubic centimeter of low-pressure gas. Laser spectroscopy of Rydberg atoms has permitted precise determination of the energies and lifetimes of many atoms and has triggered new developments in the theory of multielectron atoms and molecules. (8 refs.)

106322 The $T_3(\pi,\pi^*)$ state of acridine. N.Periasamy (Chem. Phys. Group, Tata Inst. of Fundamental Res., Bombay, India).
Chem. Phys. Lett. (Netherlands), vol.99, no.4, p.322-5 (12 Aug. 1983).
The 0-0 band maximum of the transition $T_3(\pi,\pi^*) \leftarrow T_1(\pi,\pi^*)$ of acridine occurs at $\approx 10200 \pm 20$ cm^{-1} in inert (*n*-hexane, benzene, CCl_4), at 10220 ± 20 cm^{-1} in polar (acetonitrile) and at 10170 ± 50 cm^{-1} in hydrogen-bonding (methanol, 2-propanol and alkaline water) solvents. Based on the solvent-independent energy of $T_1(\pi,\pi^*)$, the $T_3(\pi,\pi^*)$ state of acridine is estimated at 26050 ± 50 cm^{-1} in all the solvents. (28 refs.)

106323 Cross-quadratic terms involving modes of different symmetry in the nuclear potential of metalloporphyrins. B.Scharf (Dept. of Chem., Ben-Gurion Univ. of the Negev, Beer-Sheva, Israel).
Chem. Phys. Lett. (Netherlands), vol.99, no.4, p.358-63 (12 Aug. 1983).
The existence of cross-quadratic terms involving modes of different symmetry in the nuclear potential of the excited electronic states corresponding to the visible and Soret (UV) bands of metalloporphyrins is elucidated. The 'intrastate' and 'interstate' sources of these terms are discussed for various degrees of mixing of the two lowest excited allowed electronic configurations. (59 refs.)

106324 Comment on the energy variation method [and raply]. H.G.Miller, T.Geveci (Nat. Res. Inst. for Math. Sci., CSIR, Pretoria, S Africa), J.Hendekovic, J.Kucar.
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.115-18 (26 Aug. 1983).
For original paper see J. Hendekovic ibid., vol.90, no.3, p.198 (1982). Miller and Geveci point out that the classical minimax principle plays a significant role in the derivation of Hendekovic's results. They conjecture that Hendekovic's results may be generalized. Hendekovic and Kucar reply by reinforcing the assertion that the energy variation theorem for excited states follows from the classical minimax principle. The problem of minimising the manifold energy of the nonorthogonal basis is also solved. (14 refs.)

106325 Porphyrins. XLIV. Electronic states of Co, Ni, Rh, and Pd complexes. A.Antipas, M.Gouterman (Dept. of Chem., Univ. of Washington, Seattle, WA, USA).
J. Am. Chem. Soc. (USA), vol.105, no.15, p.4896-901 (27 July 1983).
For pt.XLIII see ibid., vol.104, p.6278 (1982). Iterative extended Huckel (IEH) calculations are presented with the aim of understanding the near-UV, visible, and near-IR absorption spectra and the emission properties of Co, Rh, Ir, Ni, Pd, and Pt porphyrins. UV-visible spectra are reviewed for 30 such complexes; new near-IR spectra are presented for Co^{II}, Ni^{II}, and Pd^{II} complexes of octaethyl-and tetraphenylporphyrin (OEP and TPP). It is also reported that three Co^{III} complexes and one Pt^{IV} complex show no emission. While the calculations do not well predict shifts of the visible spectra, they are able to explain quenching by transitions at lower energy than the usual ring phosphorescent state $^3T_1(\pi,\pi^*)$ and fluorescent state $^1Q(\pi,\pi^*)$. In the near-IR absorption, bands in Co^{II} porphyrins corresponding to $^2(\pi,d)$ are reported. The authors also locate absorptions in the near-IR corresponding to the $^2T_1(\pi,\pi^*)$ state of Co^{II}(OEP) and the $^3T_1(\pi,\pi^*)$ states of Pd^{II}(OEP), Pd^{II}(TPP), and $Pt^{IV}(TTP)Cl_2$ [TTP=mesotetratolylporphyrin]. The $^1(\pi,d)$ state of Ni^{IV} and Pd^{IV} porphyrins is expected to the red of 1100 nm, the limit of the current studied. (38 refs.)

106326 Multiphoton excitation and frequency tripling in xenon. Y.Salamero, H.Asselman, A.Birot, H.Brunet, J.Galy, P.Millet (Centre de Phys. Atomique, Univ. Paul Sabatier, Toulouse, France).
J. Phys. B (GB), vol.16, no.16, p.2971-9 (28 Aug. 1983).
The experiment demonstrates at low pressure the resonant excitation of the $^3P_1$ atomic state of xenon by three-photon absorption; as the pressure increases the xenon molecules in the ground state intervene in the absorption process. The emission spectra present the VUV continua characteristic of the excimer. In the same experimental conditions but with observation along the excitation axis, the frequency tripling phenomenon is seen close to the resonance line at 147 nm and the authors have measured new values of the phase matching parameter C_{Xe} between 145 and 147 nm. (12 refs.)

106327 Shake theory predictions of excited-state populations following 1s ionisation in argon. K.G.Dyall (Theoretical Chem. Dept., Oxford Univ., Oxford, England).
J. Phys. B (GB), vol.16, no.17, p.3137-47 (14 Sept. 1983).
A method is presented for the calculation of populations following an ionisation event of individual states of more than one degree of ionisation, in the sudden approximation, using only bound-state wavefunctions. It is applied to 1s ionisation on argon, where it is shown that single excitation is twice as probable as single ionisation from the outer shell, and doubly-excited or singly-excited singly-ionised states have nonnegligible populations. Relativistic effects are found to substantially mix states of different *LS* symmetry, so the monopole selection rules for shake-up/shake-off in *LS* coupling are not strictly obeyed. (24 refs.)

106328 Extension of the measurements of the np $^2P_{1/2,3/2}$ and nd $^2D_{3/2,5/2}$ Rydberg series in neutral indium. G.J.N.E.de Vlieger, H.Wijnen, A.Donszelmann (Zeeman-Lab., Univ. Amsterdam, Amsterdam, Netherlands).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.241-9 (1983).
Stepwise excitation by means of two dye lasers has been used to study the np $^2P_{1/2,3/2}$ and nd $^2D_{3/2,5/2}$ Rydberg levels in indium, with $16 \leq n \leq 31$. The fine structure of the ^2P series shows a hydrogenic behaviour also in this region. The fine structure splitting of the ^2D series varies as n^{*-3} for $n > 35$ and as a linear combination of n^{*-3} and n^{*-5} for $16 \leq n \leq 35$. The perturbation of the nd ^2D series, due to configuration interaction with the $5s5p^2$ ^2D term, is reanalysed. New values for the position of the $5s5p^2$ $^2D_{3/2,5/2}$ levels are given. (17 refs.)

106329 Highly excited hydrogen-atom states located in an external field near the symmetry axis of the field. M.Yu.Sumetskii (Leningrad Electrotech. Communications Inst., Leningrad, USSR).
Sov. Phys.-JETP (USA), vol.83, no.5, p.959-66 (Nov. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.5, p.1661-74 (Nov. 1982). [received: Sept. 1983]
Quantization rules are obtained and bands of stability loss in a strong magnetic field as well as in parallel electric and magnetic fields are observed for highly excited hydrogen states concentrated near the symmetry axis of the external field. The band boundaries are identical with the classical resonances at which a classical trajectory lying on the symmetry axis loses stability. The calculation is based on matching of the Schrodinger-equation solutions that are valid near the center of the atom with those valid at a distance from the center and concentrated near the field symmetry axis. The elements of the dipole transitions from the ground state to highly excited states are calculated. In the case of a weak magnetic field the oscillator strengths obtained agree well with the numerical calculations of Clark and Taylor [J. Phys. 13B, L737 (1980)]. For a strong magnetic field as well as for sufficiently weak parallel electric and magnetic fields the oscillator strengths show a spike near one stability-band boundary and a dip near the other. (17 refs.)

106330 The T_1 state of *p*-nitroaniline and related molecules: a CNDO/S study. R.W.Bigelow (Xerox Webster Res. Center, Webster, NY, USA), H.-J.Freund, B.Dick.
Theor. Chim. Acta (Germany), vol.63, no.3, p.177-94 (1983).
The nature of the lowest energy triplet state (T_1) of *p*-nitroaniline (PNA), N,N-dimethyl-*p*-nitroaniline (DMPNA) and nitrobenzene (NB) is rexamined using the semiempirical CNDO/S-CI method with selected parameter options. The results indicate that in the case of the unperturbed molecules the short-axis polarized $\pi^* \leftarrow n(\pi)$ triplet largely localized at the acceptor end of the molecule may lie lower in energy than the triplet manifold counterpart of the intense intramolecular charge-transfer $D^+ \rightarrow A^-$ singlet excitation. Computations suggest, however, that polar solvents strongly stabilize the PNA and DMPNA $\pi^* \leftarrow \pi$ charge-transfer triplet relative to other excitations, whereas specific solvent hydrogen-bonded interactions stabilize the $\pi^* \leftarrow N(\sigma)$ triplet of NM below those of $\pi^* \leftarrow \pi$ character. (63 refs.)

106331 Some problems on the structure of molecules in the electronic excited states as studied by resonance Raman spectroscopy. A.Y.Hirakawa, M.Tsuboi (Faculty of Pharmaceutical Sci., Univ. of Tokyo, Tokyo, Japan).
In book: *Vibrational spectra and structure. A series of advances. Vol.12*, J.R.Durig [Ed.], p.145-204. Amsterdam, Netherlands: Elsevier (1983), xvi+497 pp. [0 444 42197 1]
The authors derive an excited state geometry from a set of observed resonance Raman data, with a brief survey of the theoretical background of this method of derivation, and then review the present status of the application of this method to various molecules. (102 refs.)

Vibrational spectra and structure. A series of advances. Vol.12 ....See Entry 105049

Collisional relaxation and transfer of coherence in excited atomic multiplets of the type $(j_1,j_2;j)=(1,{}^1/_2;{}^3/_2$ or ${}^1/_2)$ ....See Entry 106266

Ab initio CI study of the photodissociation of nitrosyl chloride (ClNO) ....See Entry 106310

An ab initio study of the excited states of OH^+ ....See Entry 106313

An ab initio CI study of the ground and excited states of p-benzoquinone ....See Entry 106314

Hyperfine-induced *n* mixing in high Rydberg states of ^{87}Sr ..See Entry 106318

Influence of AC Stark shifting on relative rates for two-colour multiphoton ionisation of Xe and Cs .... See Entry 106346

Measurements of oscillator strengths for the transitions from the metastable ^3P levels of alkaline-earth atoms. IV. Calcium-high-*n* members .. See Entry 106351

Collision broadening and shift of excited *s* states in thallium .... See Entry 106353

Time dependence of absorption lineshapes .... See Entry 106355

Extractoion of accurate autionisation widths from the emission spectrum of doubly-excited He .... See Entry 106361

Autoionizing states of the hydrogen atom in strong magnetic fields .... See Entry 106363

Two-dimensional analysis of the ring-puckering and PH inversion vibrations of 3-phospholene .... See Entry 106383

The B($^1\Sigma^+$) and X($^1\Sigma^+$) states of HF and DF: RKR curves and Franck-Condon factors .... See Entry 106386

Millimeter and submillimeter wave spectrum of oxygen in the a$^1\Delta_g$ state .... See Entry 106395

Resonance Raman spectra of the ground and excited states of specifically deuterated tris(2,2′-bipyridine)ruthenium(II) .... See Entry 106406

Observation of transient resonance Raman spectra of the S$_1$ state of trans-stilbene .... See Entry 106424

Theoretical interpretation of the resonance Raman spectrum of gaseous chlorine .... See Entry 106428

Resonance Raman investigation of the π^* antibonding distribution in excited triplet aqueous *p*-benzoquinone .... See Entry 106432

Internal heavy-atom effect on the T$_1$ states on monochloroquinolines and monochloronaphthalenes .... See Entry 106487

Site dependence of the 1 ^1A_g to 2 ^1Ag transition of all-trans-1,3,5,7-octatetraene .... See Entry 106493

State-selective resonant excitation-ionization of H$_2$ with tunable VUV laser light .... See Entry 106514

Crossed-beam measurements of absolute rate coefficients in associative ionisation collisions between Na*(np) and Na(3s) for $5 \leq n \leq 15$ ...... See Entry 106553

Calculation of proton-impact excitation of the $n=4$ level of atomic hydrogen .... See Entry 106562

Single electron capture by Ar^{2+} and Ar^{3+} ions impacting helium .... See Entry 106573

Velocity dependence of Rydberg $n \rightarrow n'$ charge transfer cross sections .... See Entry 106576

Electron impact double excitation in heliumlike ions 07 .... See Entry 106596

Double electron excitation in heliumlike ions .... See Entry 106605

Excited state dipole moments of some monosubstituted benzenes from solvent effect on electronic absorption spectra .... See Entry 106630

Probabilities for transition processes crucial to Li lasers .... See Entry 106748

Detection of triplet states in a laser dye from linear and circular polarization studies .... See Entry 106752

Topoenergetic aspects of quenching processes of atomic and molecular excited species in rarefied gases .... See Entry 107314

Mode specificity of unimolecular rate constants in the Henon-Heiles system .... See Entry 109709

31.70 EFFECTS OF MOLECULAR INTERACTIONS ON ELECTRONIC STRUCTURE

(see also 34. Atomic and molecular collision processes and interactions)

31.70D Environmental and solvent effects

106332 A theoretical investigation on the role of solvent in solvolytic reactions. VI. An ab initio MO calculation for dissociation of fluoromethane in hydrofluoric acid. A.Gamba, B.Manunza (Istituto di Chimica Fisica, Univ. di Sassari, Sassari, Italy), C.Gatti, M.Simonetta.
Theor. Chim. Acta (Germany), vol.63, no.3, p.245-53 (1983).
The dissociation curve of fluoromethane in hydrofluoric acid was calculated by an ab initio SCF MO technique using the minimal STO-3G basis set. The model of the solvent includes eleven HF molecules, simulating the first solvation shell. A preliminary ab initio study of solvation of CH_3^+ and F^+ in H_2O and HF justifies this assumption. (17 refs.)

The T$_3$(π,π^*) state of acridine .... See Entry 106322

The *T*$_1$ state of *p*-nitroaniline and related molecules: a CNDO/S study .... See Entry 106330

Quantitative interpretation of the absorption and emission spectra of 1,8-diphenyl-1,3,5,7-octatetraene .... See Entry 106392

Influence of nature of solvent on IR and NMR spectra of ethyl cyanoacetate and formaldehyde .... See Entry 106413

Binomial solvent suppression .... See Entry 106457

Shift and quenching of fluorescence of tetrahydronaphthols due to hydrogen bonding .... See Entry 106486

31.70F Potential-energy surfaces for collisions

(see also 82.20K in chemical kinetics, 34.20 Intermolecular forces, 34.50L in beam studies)

Calculation of differential cross sections for rotational excitation in D$_2$+CO collisions at 87.2 meV .... See Entry 106541

Single electron capture by Ar^{2+} and Ar^{3+} ions impacting helium .... See Entry 106573

Potential energy curves for dissociative recombination .... See Entry 106620

Search for saddle points of energy hypersurfaces using a multi-dimensional space of 'guiding' coordinates .... See Entry 109711

31.90 OTHER TOPICS IN THE THEORY OF ATOMS AND MOLECULES

(inc. properties other than energy)

106333 Gas-phase thermochemical information from triple quadrupole mass spectrometers: relative proton affinities of amines. S.A.McLuckey, R.G.Cooks (Dept. of Chem., Purdue Univ., West Lafayette, IN, USA), J.E.Fulford.
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.165-74 (1 Sept. 1983).
Proton-bound dimers of amines fragment to give the individual protonated bases in proportions which depend upon the proton affinities of the amines, the collision energy, and the target gas thickness in a triple quadrupole mass spectrometer. The behavior of these dimers observed with the triple quadrupole is similar to that observed with a reversed geometry mass spectrometer suggesting that the kinetic method of assigning amine proton affinities is applicable to the triple quadrupole. This is shown explicitly. The effect of precursor-ion internal energy on this measurement is delineated through MS/MS experiments covering excitation through collisions at various energies and target pressures. The effects of varying target thickness and collision energy are small when structurally similar amines comprise the dimer, but in the cases of dimers of phenylethylamine and pyridine with primary alkylamine partners, differences between literature values of proton affinities and the measured gas-phase basicities are observed. These entropic effects are interpreted on the basis of the relative steric hindrance to protonation of phenylethylamine (PEA), pyridine (PYR) and the primary alkylamines (ALK), that is, the order of steric hindrance appears to be PEA>ALK>PYR. For the primary alkylamine dimers, entropic effects appear to cancel within experimental error. Using data taken under various collision conditions, the proton affinity of 3-aminopentane is assigned as 221.7 ± 0.3 kcal mol^{-1}. (16 refs.)

Ab initio studies on hydrogen-bonded chains. III. The linear, infinite chain of hydrogen cyanide molecules .... See Entry 106278

Ab initio CI study of the photodissociation of nitrosyl chloride (ClNO) .... See Entry 106310

Two-dimensional analysis of the ring-puckering and PH inversion vibrations of 3-phospholene .... See Entry 106383

32.00 ATOMIC SPECTRA AND INTERACTIONS WITH PHOTONS

32.20 ATOMIC SPECTRA GROUPED BY WAVELENGTH RANGES

Energy levels of silicon, Si I through Si XIV .... See Entry 105044

Collision broadening and shift of excited *s* states in thallium .... See Entry 106353

Comments on the Planck-Larkin partition function .... See Entry 110881

32.20J Visible and ultraviolet spectra

(for fluorescence and phosphorescence spectra, see 32.50)

106334 Measurement of relative oscillator strengths for Ti I. III. Weak transitions from levels a^{3}F$_{3,4}$ (0.02 eV, 0.05 eV), a^{5}F$_{1-5}$ (0.81 eV-0.85 eV), a^{1}D$_2$ (0.90 eV), a^{3}P$_{0-3}$ (1.05 eV-1.07 eV) with solar analysis. D.E.Blackwell, S.L.R.Menon, A.D.Petford (Dept. of Astrophys., Univ. of Oxford, Oxford, England).
Mon. Not. R. Astron. Soc. (GB), vol.204, no.3, p.883-90 (Sept. 1983).
For pt.II see ibid., vol.201, no.2, p.611-7 (1982). Relative oscillator strengths are given for 18 weak 1 eV and two 0 eV lines of Ti I, which has been omitted from the previous study (Blackwell et al. 1982) of 0 eV lines, chosen to be suitable for the analysis of the spectra of cool stars. These lines have been measured with a relative accuracy of 5 per cent using the Oxford furnace technique. The relative values are placed on the absolute scale already derived for stronger 0 and 1 eV lines. A solar analysis is made for the most suitable lines as a test of their oscillator strengths, but this is not regarded as a definite solar analysis because of the weakness of the solar lines. (24 refs.)

106335 Analysis of $3d^74s$-$3d^74p$ transitions in the Zn V spectrum. T.A.M.VanKleef (Zeeman Lab., Univ. van Amsterdam, Amsterdam, Netherlands), Y.N.Joshi.
Phys. Rev. A (USA), vol.28, no.3, p.1446-59 (Sept. 1983).
The spectrum of zinc was photographed in the region 500-2000 Å on 6.65- and 10.7-m normal-incidence spectrographs. The sources used were a triggered spark and a sliding spark. The new observations have led to the establishment of all 38 levels of the $3d^74s$ configuration and 17 unknown levels of the $3d^74p$ configuration of Zn V. The Hartree-Fock and least-squares calculations support the analysis. Four hundred and forty seven additional lines have been classified in this spectrum. (14 refs.)

106336 Spectroscopic observations of the radiative charge transfer and association of helium ions with neon atoms at thermal energy. R.Johnsen (Dept. of Phys. & Astron., Univ. of Pittsburgh, Pittsburgh, PA, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1460-8 (Sept. 1983).
The radiation emitted by the radiative charge transfer $He^+ + Ne \rightarrow He + Ne^+ + h\nu$ has been observed with the use of a selected-ion drift apparatus in conjunction with spectroscopic instrumentation. The two observed emission features with wavelengths around 4100 and 4240 Å evidently arise from transitions in the short-lived HeNe$^+$ excited molecular ion which is formed in the collision. Mass-spectrometric observations of the product ions indicated that the reaction occurred with a rate coefficient of $1 \pm 0.3 \times 10^{-15}$ cm^3/sec at a gas temperature of 300K. In addition to charge transfer, a second associative reaction channel producing HeNe$^+$ ions is found to have an effective rate coefficient of about 2×10^{-16} cm^3/sec. (13 refs.)

106337 Transition probability measurements of Te I spectral lines by methods of emission and absorption of radiation. A.P.Ubelis, U.V.Berzinsh (Problem Lab. of Spectroscopy, P. Stuchka Latvian State Univ., Riga, Latvian SSR).
Phys. Scr. (Sweden), vol.28, no.2, p.171-5 (Aug. 1983).
The methods of emission and absorption of radiation have been employed for measuring relative transition probabilities of spectral lines in Te I 214.3, 225.9, 238.3, 238.6, 253.1, 277.0 and 296.7 nm. Using known (radiative) lifetimes for the states $5s^25p^36s^3S_1^0$ and $5s^25p^36s^5S_2^0$, absolute values of

transition probabilities have been obtained for the above mentioned lines: $(310\pm12)\times10^6$, $(128\pm4)\times10^5$, $(405\pm35)\times10^5$, $(810\pm65)\times10^5$, $(109\pm8)\times10^4$, $(122\pm40)\times10^4$, $(84\pm34)\times10^2$ s^{-1}, respectively, where the uncertainty is one standard deviation. (18 refs.)

106338 $3p^63d^8$-$3p^53d^9$ transitions in Rb XII and Sr XIII. A.N.Ryabtsev (Inst. for Spectroscopy, Acad. of Sci., Troitsk, USSR).
Phys. Scr. (Sweden), vol.28, no.2, p.176-8 (Aug. 1983).
Spectra of Rb XII and Sr XIII have been studied in the region from 70 to 110 Å by means of a low-inductance vacuum spark and a 3m grazing-incidence spectrograph with a holographic grating 3600 1 mm^{-1}.58 new lines of the $3p^63d^8$-$3p^53d^9$ transitions have been identified. All levels of the relevant configurations have been found. (10 refs.)

Extension of the measurements of the np $^2P_{1/2,3/2}$ and nd $^2D_{3/2,5/2}$ Rydberg series in neutral indium .... See Entry 106328

Photoionisation spectrum of Te I: autoionising series and relative cross section .... See Entry 106369

Beam-foil study of titanium in the EUV using foils of different materials .... See Entry 106564

Comment on 'Radiative decay of lithium-like ions following exchange collisions of 3 keV amu^{-1} C^{4+} with H_2' .... See Entry 106575

32.20R X-ray spectra

106339 Accurate wavelength measurements of He-like resonance lines of titanium through zinc from a high-temperature plasma. S.Morita (Inst. of Plasma Phys., Nagoya Univ., Nagoya, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2673-83 (Aug. 1983).
Kα lines of titanium through zinc have been observed from a high-temperature plasma in a vacuum spark. The transition wavelengths of the He-like resonance lines are first determined under careful experimental procedures. The result is compared with theoretical predictions and is in good agreement with that given by Safronova (1981). The theoretical values, however, include uncertainties in relativistic and QED corrections of the He-like resonance line. More accurate theoretical values are required for comparison with these experimental data. (32 refs.)

106340 Spectroscopy of hydrogenlike and heliumlike argon. J.P.Briand, J.P.Mosse, P.Indelicato, P.Chevallier, D.Girard-Vernhet, A.Chetioui (Inst. Curie, Univ. Pierre et Marie Curie, Paris, France), M.T.Ramos, J.P.Declaux.
Phys. Rev. A (USA), vol.28, no.3, p.1413-17 (Sept. 1983).
The X-ray transitions ($n=2\rightarrow n=1$) emitted by fast hydrogenlike and heliumlike argon ions have been studied. The absolute energy of the Lyman α lines of hydrogenlike ions has been measured and the value of the (1s) Lamb shift of argon evaluated for the first time. The $^3P_{1,2}$ and $^1P_1$ transitions of heliumlike argon have also been studied at very high precision and their energies compared to multiconfiguration Dirac-Fock calculations. The energies of Lyman α lines are of 3323.2 ± 0.5 eV (Lyα_1) and 3318.1 ± 0.5 eV (Lyα_2), and those of $n=2\rightarrow n=1$ transitions for heliumlike argon are of 3123.6 ± 0.25 eV ($^3P_1$), 3126.4 ± 0.4 eV ($^3P_2$), and 3139.6 ± 0.25 eV ($^1P_1$). (15 refs.)

106341 The Kα and Kβ X-ray spectra of sodium in metal and some compounds. O.Keski-Rahkonen, K.Reinikainen, E.Mikkola (Lab. of Phys., Helsinki Univ. of Technol., Espoo, Finland).
Phys. Scr. (Sweden), vol.28, no.2, p.179-87 (Aug. 1983).
The $K\alpha$, $K\alpha$ satellite and $K\beta$ X-ray emission spectra of sodium in metal, Na_2O, NaOH, NaF and NaCl have been measured in electron excitation. Energies and intensities of the satellite structures have been obtained and compared with theoretical predictions. The $K\alpha_{5,6}$-group is interpreted in terms of multiplet transitions for the first time. The position of the $K\beta$ band has been compared with many-body calculations for the metal and with a point ion model for the insulators. The shapes of the $K\beta$-lines are discussed in terms of density of states of the bands of corresponding solids. (78 refs.)

106342 Determination of the $KL^2\rightarrow L^3$ X-ray multiplet structure in Na, Mg, and Al. E.Mikkola, O.Keski-Rahkonen, J.Lahtinen, K.Reinikainen (Lab. of Phys., Helsinki Univ. of Technol., Espoo, Finland).
Phys. Scr. (Sweden), vol.28, no.2, p.188-92 (Aug. 1983).
The energies and intensities of $KL^2\rightarrow L^3$ X-ray satellite multiplet lines are determined from high-resolution measurements of metallic samples. The spectra are interpreted in terms of six multiplet transitions arising from $1s^{-1}2p\rightarrow 2p^{-3}$ transitions. Lines including 2s holes are shown to be weak. The relative intensities of the electron excited KL^2 multiplets show marked deviations from the statistical population of initial states in contrast to the KL multiplets. (34 refs.)

Concerning a long-lived ($^2P^e$)He^- state: lifetime and energy-level measurements of He^- .... See Entry 106357

Auger-electron study of correlation effects in $3d^{-1}$ and $4d^{-2}$ states of Cs in atomic Cs and molecular CsI .... See Entry 106375

Alignment of the M_3 subshell of Au atoms by proton impact .... See Entry 106551

Proton-induced L-shell X-ray emission cross-sections of elements with $24\leq Z_2\leq50$ for projectile energies between 30 and 350 keV .... See Entry 109057

32.50 FLUORESCENCE, PHOSPHORESCENCE

(inc. quenching)

106343 Mechanism for the decay of Ar($^3P_2$) atoms in pure argon. Reconciliation of low pressure and high pressure values for the decay constant. E.R.Manzanares, R.F.Firestone (Dept. of Chem., Ohio State Univ., Columbus, OH, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.1678-83 (15 Aug. 1983).
A new set of decay constant values for Ar($^3P_2$) in pure argon at 298K determined by means of single frequency CW laser probe spectrophotometry in the 100-700 Torr region is reported. An excimer forming mechanism initiated by a reversible termolecular step and carried forward by a sequence of reversible collisional relaxation stages with provision for radiative decay at each stage is proposed to account for the kinetic behavior of Paschen-1s atoms. It is demonstrated that this mechanism is quantitatively consistent with measured collisional decay constant values at pressures in the 0-22 and 100-700 Torr regions and that adherence of such values to form, $k_{3P2}=AP^2+BP$, is fortuitous and that the values of A and B have no mechanistic significance. It is similarly indicated that the nature of the probable decay mechanism precludes the possibility of recovering excited atom precursor decay constant values by analysis of excimer emission and absorption data without detailed numerical modeling. (22 refs.)

106344 The 'physical spectrum' of the light scattered by a strontium-like atom driven by a pulsed laser. J.Czub, S.Kryszewski (Inst. of Theoretical Phys. & Astrophys., Univ. of Gdansk, Gdansk, Poland).
J. Phys. B (GB), vol.16, no.17, p.3171-82 (14 Sept. 1983).
The numerically computed 'physical spectrum' of light scattered near the collisionally perturbed S_0-P_1 resonance is presented. The authors assume that the strong laser pulse is rectangular, and apply the dressed-atom approach generalized to time-dependent processes. The influence of the interferometer of bandwidth Γ on the obtained spectra is discussed. The authors show that Γ either small or large affects the spectra strongly, thus distorting the information about the atomic system. (15 refs.)

106345 Theory of resonance fluorescence in a fluctuating laser field. W.Vogel, D.-G.Welsch (Sektion Phys., Friedrich-Schiller-Univ. Jena, Jena, Germany), K.Wodkiewicz.
Phys. Rev. A (USA), vol.28, no.3, p.1546-59 (Sept. 1983).
A method of calculation of multiple-time correlation functions of the resonance fluorescence light from a two-level atom driven by a realistic laser field with phase and amplitude fluctuations is developed. Both kinds of fluctuations are assumed to be Gaussian. The phase fluctuations are treated in the phase-diffusion model. The averaging over the amplitude fluctuations can be performed in a closed way when the relative mean-square amplitude fluctuation is small compared with the ratio of the amplitude correlation decay rate to the characteristic atomic relaxation rate. There is no restriction to Markovian amplitude fluctuations. Arbitrary values for the mean Rabi frequency are allowed. Results are presented for the intensity, the intensity correlation function, and the spectrum of the fluorescent light. It is shown that even in the case when the relative strength of the amplitude fluctuations is small, significant effects can occur due to the finite correlation length of the fluctuations. The results for fast amplitude correlation decay correspond to the situation without amplitude fluctuations. When the correlation time of the amplitude fluctuations becomes comparable with the atomic relaxation times, the Rabi oscillations of the intensity and the intensity correlation function are nearly washed out, and non-Lorentzian line shapes for the side peaks in the spectrum are observed. It is found that the ratio of the heights of the central peak to the side peak increases with increasing correlation time. (38 refs.)

Radiative transition rates of collisionally perturbed atoms in an intense monochromatic field .... See Entry 106358

Observation of optical pumping effects in collinear atomic beam-laser beam(s) interaction .... See Entry 106359

Cross-section measurement for the energy-transfer collisions Na(3P)+Na(3P)$\rightarrow$Na(5S,4D)+Na(3S) .... See Entry 106547

Inelastic collisions between selectively excited rubidium 6^2D-state atoms and noble-gas atoms: fine-structure-state mixing .... See Entry 106560

Comment on 'Radiative decay of lithium-like ions following exchange collisions of 3 keV amu^{-1} C^{4+} with H_2' .... See Entry 106575

32.60 ZEEMAN AND STARK EFFECTS

106346 Influence of AC Stark shifting on relative rates for two-colour multiphoton ionisation of Xe and Cs. P.Kruit, W.R.Garrett, J.Kimman, M.J.van der Wiel (FOM-Inst. for Atomic & Molecular Phys., Amsterdam, Netherlands).
J. Phys. B (GB), vol.16, no.17, p.3191-200 (14 Sept. 1983).
An electron spectroscopic study is reported of multiphoton ionisation of Xe and Cs using two laser beams. One of the two beams is tuned to multiphoton resonance with an intermediate state and causes a considerable AC Stark shift. The second beam acts as a probe of the population and shift of the intermediate state. In Xe the authors deal with a three-photon resonance with the 6s level ($\lambda\simeq440$ nm); in Cs with two-photon resonances with Rydberg levels of the *nd* series. As probes, beams of either $\lambda=1064$ or 532 nm have been used. (8 refs.)

106347 Interpretation of the Stark effect of H^- resonances. C.D.Lin (Dept. of Phys., Kansas State Univ., Manhattan, KS, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1876-8 (Sept. 1983).
Resonances in the photodetachment cross sections of H^- in a strong DC electric field are studied theoretically in hyperspherical coordinates in the adiabatic approximation. In terms of the variation of one-dimensional effective potentials with electric field for different channels, the experimental results of Gram et al. [Phys. Rev. Lett. 40, 107, 1978] are interpreted. In particular, the linear Stark splitting of the Feshbach resonance at low fields and the stability of the shape resonance against electric fields up to a few thousand kV/cm are understood from their associated effective potential curves. A new mechanism of field ionization for the 'blue-shifted' Stark states is also discussed. (9 refs.)

106348 Effects of field-induced splitting of levels having high angular momenta. K.A.Nasyrov, A.M.Shalagin (Inst. of Automation & Electrometry, Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.83, no.5, p.973-9 (Nov. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.5, p.1685-97 (Nov. 1982). [received: Sept. 1983]
The authors investigate manifestations of field-induced splitting in the spectrum of a test field in the presence of a strong field resonant to an adjacent transition in a three-level system with states degenerate in the orientations of the angular momentum. They show that since the splitting effect is different for different M-transitions the spectrum of the test-field operation consists of a set of individual spectral components that can overlap at $J\gg1$ and form a broad common spectrum. They note that the envelope of the integral spectrum includes narrow spectral structures that preserve information on the natural line width. They analyze the dependence of the shapes of the spectra on the types of transitions in a three-level system and on the polarization states of the test and strong fields. For linear and circular polarization of the strong field, the problem is solved by a rigorous quantum-mechanical approach. A classical description of the orientation of the angular momentum is used in the case of elliptic polarization of the strong field. (8 refs.)

Highly excited hydrogen-atom states located in an external field near the symmetry axis of the field .... See Entry 106329

32.70 SPECTRAL LINE SHAPES AND INTENSITIES

106349 Oscillator strengths of $3p^63d^2D\rightarrow3p^53d4s^2P°$, $^2D°$, $^2F°$ transitions in Co IX, Cu XI, and Zn XII ions. S.N.Tiwary (Dept. of Appl. Math. & Theoretical Phys., Queen's Univ. of Belfast, Belfast, N Ireland).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.781-3 (15 Sept. 1983).
Configuration interaction wave functions have been used to calculate the excitation threshold and the length and velocity form of the oscillator

strengths (f_L and f_V, respectively) for $3p^6 3d^2D \rightarrow 3p^5 3d4s\ ^2P°$, $^2D°$, and $^2F°$ transitions in Co IX, Cu XI, and Zn XII ions of the potassium isoelectronic sequence within the *LS* coupling framework. The agreement between length and velocity values of the oscillator strengths is reasonably good. (9 refs.)

106350 Synchronized quantum beat spectroscopy and its application to the measurement of pressure shifts of the hyperfine splitting in $3^2S_{1/2}$ of sodium atoms. K.Kondo (Dept. of Phys., Kagawa Univ., Takamatsu, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2340-9 (July 1983).
The method of synchronized quantum beat spectroscopy has been improved by introducing amplitude modulation on the excitation pulse train. By using an amplitude-modulated train of picosecond pulses from a CW mode-locked dye laser, the author has obtained resonance enhancement of the substate coherence (quantum beat) at $f_0 = nf_p + n'F_m$ (n, n': integer, f_0: sublevel splitting, f_p: pulse repetition frequency, f_m: modulation frequency), which can be detected by monitoring the optical anisotropy due to the substate coherence. Resonances can be obtained in the frequency domain by sweeping f_m. Pressure shift coefficients of the hyperfine splitting in Na $3^2S_{1/2}$ are measured to be 82, 61, -1 and -47 Hz/Torr for He, N_2, Ar and Kr, respectively, within an accuracy of ± 3 Hz/Torr. (12 refs.)

106351 Measurements of oscillator strengths for the transitions from the metastable ^3P levels of alkaline-earth atoms. IV. Calcium-high-*n* members. K.Ueda (Res. Inst. for Sci. Measurements, Tohoku Univ., Sendai, Japan), Y.Hamaguchi, K.Fukuda.
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2666-72 (Aug. 1983).
Oscillator strengths (f values) for the transitions $4s4p\ ^3P - 4snd\ ^3D$ with $n=6$ to 12 and $-3d5s\ ^3D$ of Ca have been determined relative to those of the multiplet $4s4p\ ^3P - 4p^2\ ^3P$ by means of the hook method. The resulting f values are 12-35% smaller for $n=6$, 7 and 8 than the data of NBS compilation by Wiese et al. Those for other members are first reported in this paper. The spectral density of the f values is found to have a minimum value around $3d5s\ ^3D$ and $4s9d\ ^3D$. This behavior is quantitatively explained by means of a multichannel quantum defect theory.

106352 Radiative and thermal widths of Landau-excited hydrogen atoms in very strong magnetic fields. G.Wunner, H.Herold, H.Ruder (Lehrstuhl fur Theoretische Astrophys., Univ. Tubingen, Tubingen, Germany).
J. Phys. B (GB), vol.16, no.16, p.2937-43 (28 Aug. 1983).
It is proved that in magnetic fields $B \gtrsim 10^7$ T, which are characteristic of neutron stars, the lifetime of an electron in an excited Landau level ($N \geq 1$) bound to a proton becomes identical to that of an electron moving freely along the magnetic field lines, viz. the lifetime with respect to cyclotron transitions. The associated widths are found to be larger than or at least comparable with the Coulomb binding energies (depending on the magnetic field strength) whence the nature of these states as discrete states is obliterated. The authors show that the anomalous magnetic moment of the electron and the finite mass of the proton cause additional level shifts comparable in magnitude with the Coulomb energies. Furthermore, they investigate thermal line broadening and find that, as a consquence of the pronounced anisotropy of the effective masses for motion parallel and perpendicular to the field, thermal broadening is strongly reduced for emission perpendicular to the field. (28 refs.)

106353 Collision broadening and shift of excited *s* states in thallium. J.Kielkopf (Phys. Dept., Univ. of Louisville, Louisville, KY, USA).
J. Phys. B (GB), vol.16, no.17, p.3149-69 (14 Sept. 1983).
The collision broadening by xenon of the 6p-*ns* absorption transitions in thallium has been studied with a high resolution spectrometer and a charge-integrating photodiode array detector. The spectra have excellent signal-tonoise ratio, and can be analysed directly with profiles calculated from unified line broadening theory and a Fermi interaction potential. For the first time, the calculations are made with a numerical potential, rather than an approximate analytical form. This allows meaningful comparisons without the adjustment of potential parameters. The agreement between experimental profiles and these exact unified theory calculations improves with increasing n^* and is quite good for values of n^* greater than 6.25, corresponding to the 11s state. Analysis of line shifts follows the simpler Fermi shift expression at large n^*, as expected. Deviations of the profiles and shifts at smaller n^* from those theoretically expected seem related to the increased size of the effective range theory corrections to the scattering length of the valence electron. Evidence is also presented for the nonlinear dependence of line width on density for large n^* when the impact approximation is not valid. (25 refs.)

106354 Measured lifetimes in mercury using the photon-photon delayed coincidence technique. K.A.Mohamed (Dept. of Phys., Aligarh Muslim Univ., Aligarh, India).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.30, no.3, p.225-8 (Sept. 1983).
The photon-photon delayed coincidence technique has been used to measure the 6^3P_1, 7^3S_1, and 7^1S_0 level lifetime in mercury atoms. The measured mean lifetimes are $6^3P_1(116 \pm 5)$ ns, $7^3S_1(7.7 \pm 0.4)$ ns and $7^1S_0(30.5 \pm 4.3)$ ns, respectively. (35 refs.)

106355 Time dependence of absorption lineshapes. F.Bassani (Scuola Normale Superiore, Pisa, Italy), A.Quattropani, R.Girlanda.
Phys. Lett. A (Netherlands), vol.97A, no.4, p.150-2 (22 Aug. 1983).
The authors study the dependence of the absorption lineshape on the time of interaction with the electromagnetic field, taking into account the finite lifetime of the excited state. They find important deviations from the Lorentzian lineshape (broadening of the central peak and oscillatory structures) when the interaction time is comparable with the natural lifetime. Experimental implications are discussed. (12 refs.)

106356 Configuration $1s^2 2s3p$ in the sequence Ne VII-Fe XXIII: level energies and lifetimes. D.G.Ellis (Univ. of Toledo, Toledo, OH, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1223-7 (Sept. 1983).
Energies were computed for the $2s3p$ levels in the Be isoelectronic sequence from $Z=10$ to 26. Multiconfiguration wave functions of form ($2s3p$, $2p3s$, $2p3d$) were obtained from the program MCHF77. The Pauli relativistic corrections were calculated and the 2×2 spin-orbit-interaction matrix was diagonalized to obtain the $^1P_1$-$^3P_1$ interval and mixing coefficient. Results agree with observations and with other self-consistent-field calculations at $Z=10$, 23, and 26. The avoided crossing of the two $J=1$ levels is found to occur at $Z=21$. Finally, the radiative-decay probabilities of the mixed $J=1$ levels were calculated; results are compared with other calculations and checked against a recent experiment in Ne VII. (20 refs.)

106357 Concerning a long-lived $(^2P^e)\mathrm{He}^-$ state: lifetime and energy-level measurements of He^-. G.D.Alton, R.N.Compton (Oak Ridge Nat. Lab., Oak Ridge, TN, USA), D.J.Pegg.
Phys. Rev. A (USA), vol.28, no.3, p.1405-12 (Sept. 1983).
The question concerning the existence of a long-lived doublet $(^2P^e)\mathrm{He}^-$ state has been addressed by measuring the lifetime and energies of autodetaching electrons from 20-120-keV He^--ion beams formed by charge exchange in Ca vapor—a vapor conducive with $(^2P^e)\mathrm{He}^-$ formation. The measured lifetime and electron energy levels agree closely with accepted values for components of the $(^4P_J{}^0)\mathrm{He}^-$ states. No other structures were detected in the electron energy spectrum encompassing the anticipated energy level of the autodetached electron from the $(^2P^e)\mathrm{He}^-$ state. (33 refs.)

106358 Radiative transition rates of collisionally perturbed atoms in an intense monochromatic field. F.Schuller (Lab. des Interactions Moleculaires et des Hautes Pressions, CNRS, Villetaneuse, France), G.Nienhuis.
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.281-94 (1983).
The authors study the collisional perturbation of the absorption rate and the fluorescence rate of an atom in a strong monochromatic radiation field. The field dependence of the binary-collision relaxation operator is included and they adopt a perturbation expansion of this operator to second order in the atom-perturber interaction. The resulting expression for the relaxation operator can be expressed in terms of the frequency-dependent width and shift that determine the line profile as measured at low intensity. (17 refs.)

Tables of Auger transition amplitudes .... See Entry 105040

Study of isotope shifts, isotone shifts and nuclear compressibility from the analysis of muonic X-ray transitions .... See Entry 105736

Highly excited hydrogen-atom states located in an external field near the symmetry axis of the field .... See Entry 106329

Measurement of relative oscillator strengths for Ti I. III. Weak transitions from levels $a^3F_{3,4}$ (0.02 eV, 0.05 eV), a^5F_{1-5} (0.81 eV-0.85 eV), a^1D_2 (0.90 eV), a^3P_{0-3} (1.05 eV-1.07 eV) with solar analysis .... See Entry 106334

Transition probability measurements of Te I spectral lines by methods of emission and absorption of radiation .... See Entry 106337

Accurate wavelength measurements of He-like resonance lines of titanium through zinc from a high-temperature plasma .... See Entry 106339

Observation of optical pumping effects in collinear atomic beam-laser beam(s) interaction .... See Entry 106359

Radiative collision-induced electron continuum-continuum scattering .... See Entry 106370

Narrowing of two-photon resonance due to elastic collisions .... See Entry 106376

Collisional redistribution of weak radiation and the factorization approximation .... See Entry 106542

Probabilities for transition processes crucial to Li lasers .... See Entry 106748

The fifth order susceptibility calculus of alkali metal vapours .... See Entry 106807

Hydrogen line broadening in the presence of a magnetic field with the unified classical path theory .... See Entry 110889

On the effect of temperature fluctuations on line intensities .. See Entry 111032

32.80 PHOTON INTERACTIONS WITH ATOMS

Longitudinal Ramsey-Fringe spectroscopy in a calcium beam .... See Entry 105378

Electric and magnetic dipole contributions to a theory of radiation reaction field and atom self-energy: an operator reaction field .... See Entry 106264

32.80B Level crossing and optical pumping

106359 Observation of optical pumping effects in collinear atomic beam-laser beam(s) interaction. N.Bendali, H.T.Duong, J.M.Saint Jalm, J.L.Vialie (Lab. Aime Cotton, CNRS, Orsay, France).
J. Phys. (France), vol.44, no.9, p.1019-23 (Sept. 1983).
The detection of optical resonances by observation of the fluorescence light emitted from a fast atomic beam of Na interacting with a collinear laser beam is limited in sensitivity by optical pumping processes. In the experiment reported, the authors take advantage of the optical pumping by using a second collinear laser beam, achieving then a gain in fluorescence signal. The effects of the lasers power and polarization on line shapes have been studied in the single laser excitation case as well as in the two laser beams one. (14 refs.)

Multiphoton excitation and frequency tripling in xenon .... See Entry 106326

Configuration $1s^2 2s3p$ in the sequence Ne VII-Fe XXIII: level energies and lifetimes .... See Entry 106356

Asymmetry effect in $H^+ + H^-$ neutralization. Application to the $n=3$ pseudocrossing .... See Entry 106566

Storage and time reversal of light pulses using photon echoes .... See Entry 106829

32.80D Autoionization

106360 Study of the autoionising states of the hydrogen atom in intense magnetic fields by the complex coordinate coupled-channel formalism. S.K.Bhattacharya, Shih-I Chu (Dept. of Chem., Univ. of Kansas, Lawrence, KS, USA).
J. Phys. B (GB), vol.16, no.16, p.L471-7 (28 Aug. 1983).
The study of autoionising resonances of a hydrogen atom in intense magnetic fields is formulated as a complex coordinate coupled-channel problem by designating each channel by a Landau quantum number which characterises a set of Coulomb levels below its continuum threshold. For magnetic fields in the range of 4.70×10^9 to 1.175×10^{12} G, the authors have calculated the positions and widths of several autoionising resonances below the first two excited Landau thresholds. (21 refs.)

106361 Extractoion of accurate autionisation widths from the emission spectrum of doubly-excited He. H.Cederquist, M.Kisielinski, S.Mannervik (Res. Inst. of Phys., Stockholm, Sweden).
J. Phys. B (GB), vol.16, no.16, p.L479-84 (28 Aug. 1983).
The autoionisation width of the 2s2p $^3P^0$ level in He I has been determined through measurements of the widths of three different optical transitions, namely 2s2p $^3P^0$-2p3p $^3P^e$, 2s3p $^3P^0$-'2p3p' $^3D^e$ and 2s2p $^3P^0$-'2p4p' $^3D^e$ giving the results 7.12 ± 0.12, 8.36 ± 0.08 and 8.32 ± 0.15 meV respectively. As a tentative explanation for the extra broadening of transitions with $^3D^e$ states as initial states the authors suggest that $^3D^e$ states but not $^3P^e$ states have an unusually large fine-structure splitting. (18 refs.)

106362 On the excitation of the lowest autoionisation state in alkali atoms. R.Peterkop, A.Liepinsh (Inst. of Phys., Acad. of Sci., Riga, Latvian SSR).
J. Phys. B (GB), vol.16, no.16, p.L505-7 (28 Aug. 1983).
The difference in electron impact excitation cross sections of various calculations has been discussed. The results of the authors are confirmed by means of the Bethe formula. (11 refs.)

106363 Autoionizing states of the hydrogen atom in strong magnetic fields. H.Friedrich, M.Chu (W.K. Kellogg Radiation Lab., California Inst. of Technol., Pasadena, CA, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1423-8 (Sept. 1983).
For a hydrogen atom in a uniform magnetic field in the range $B \approx 2.35 \times 10^8$-$2.35 \times 10^9$ G the authors have calculated the energies and widths of resonant states which can autoionize by decay of a Landau excitation. The autoionization widths are quite large with some lifetimes as short as 10^{-15} sec. The widths decrease with increasing azimuthal quantum number $|m|$, hydrogenic quantum number, or magnetic field strength. With decreasing field strength the lower resonances approach the ionization threshold which they cross with finite width and a pseudoresonance structure of finite width persists below threshold in the quantum defects of the bound states. Because of the finite widths, there are no approximate level crossings as these resonances cross the ionization threshold. (24 refs.)

Tables of Auger transition amplitudes .... See Entry 105040

Influence of AC Stark shifting on relative rates for two-colour multiphoton ionisation of Xe and Cs .... See Entry 106346

Photoionisation spectrum of Te I: autoionising series and relative cross section .... See Entry 106369

Recalibration of the Auger spectra of boron .... See Entry 106374

Resonance by the complex coordinate method with Hermitean Hamiltonian .... See Entry 106513

Probabilities for transition processes crucial to Li lasers .... See Entry 106748

32.80F Photoionization and photodetachment

106364 Collision free generation of highly ionized atomic species with 193 nm radiation. T.S.Luk, H.Pummer, K.Boyer, M.Shahidi, H.Egger, C.K.Rhodes (Dept. of Phys., Univ. of Illinois, Chicago, IL, USA).
AIP Conf. Proc. (USA), no.100, p.341-4 (1983). (Topical Meeting on Excimer Lasers, Incline Village, NV, USA, 10-12 Jan. 1983).
The generation of highly ionized iodine (3+), xenon (5+), and mercury (4+) atoms at pressures of $\sim 10^{-6}$ Torr and laser intensities of $\sim 10^{14}$ W/cm^2 at 193 nm is described. A minimum energy in excess of 170 eV, corresponding to ≥ 27 photons, is required to produce Xe^{5+}. (6 refs.)

106365 Angular distribution of Kr 4s$\rightarrow\varepsilon$p photoelectrons: a test of current theory. A.Fahlman, T.A.Carlson, M.O.Krause (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
J. Phys. B (GB), vol.16, no.16, p.L485-8 (28 Aug. 1983).
The angular asymmetry parameter β for Kr 4s$\rightarrow\varepsilon$p photoelectrons has been studied using synchrotron radiation ($h\nu = 31$-63.5 eV). The present results show that earlier calculations based on the relativistic random-phase approximation (RRPA) do not satisfactorily describe the Kr 4s photoionisation process close to the Cooper minimum. This lack of agreement has also been found recently for the Xe 5s excitation. The experimental results are compared with a new, not yet published, theoretical approach which gives good agreement with experiment. (16 refs.)

106366 Photoionisation of Cs 6p and Cs 7p subshells. A.Z.Msezane (Dept. of Phys., Morehouse Coll., Atlanta, GA, USA).
J. Phys. B (GB), vol.16, no.16, p.L489-93 (28 Aug. 1983).
Photoionisation of Cs 6p and Cs 7p subshells has been calculated in the Hartree-Fock approximation (HF) using accurate wavefunctions. The Cs 6p cross sections are in agreement with other theoretical results and experiment near threshold. For Cs 7p the calculation reproduces the measured values of the asymmetry parameter β and the cross section. Good agreement is obtained with the RPA result of Cherepkov (1981). (22 refs.)

106367 Electron angular distributions and total cross sections for photoionisation of polarised Ne($3p^3D_3$) atoms near threshold. A.Siegel, J.Ganz, W.Bussert, H.Hotop (Fachbereich Phys., Univ. Kaiserslautern, Kaiserslautern, Germany).
J. Phys. B (GB), vol.16, no.16, p.2945-59 (28 Aug. 1983).
The authors have measured photoelectron angular distributions for resonant two-photon ionisation of metastable Ne($3s\ ^3P_2$) via Ne($3p\ ^3D_3$) at 0.52 eV photoelectron energy. They derive: (i) the alignment of the Ne($3p\ ^3D_3$) state; (ii) the ratio of the reduced matrix elements for the 3p$\rightarrow\varepsilon$d and 3p$\rightarrow\varepsilon$s transitions and (iii) the difference of the phaseshifts in the final channels. For the absolute cross section at 0.52 eV they find $(2 \pm 1) \times 10^{-18}$ cm^2. At four different photoelectron energies between threshold and 0.7 eV they have studied the dependence of the total cross section on the angle between the polarising and ionising laser fields. These results are analysed to give the ratio of the above mentioned matrix elements at these energies. (28 refs.)

106368 Resonant vacuum ultraviolet photoemission of atomic Fe, Co and Ni. E.Schmidt, H.Schroder, B.Sonntag, H.Voss, H.E.Wetzel (II. Inst. fur Experimentalphys., Univ. Hamburg, Hamburg, Germany).
J. Phys. B (GB), vol.16, no.16, p.2961-9 (28 Aug. 1983).
The photoemission of atomic Fe, Co and Ni has been obtained in the photon energy range 50-80 eV. The strong coupling of the $3p^6 3d^n 4s^2 \rightarrow 3p^5 3d^{n+1} 4s^2$ excitations with the $3p^6 3d^n 4s^2 \rightarrow 3p^6 3d^{n-1} 4s^2$, $3p^6 3d^n 4s$ ionisation of the outer 3d and 4s shells leads to a resonant enhancement of the photoemission lines above the 3p threshold. For Ni the contributions of the $3p^6 3d^8 4s \rightarrow 3p^5 3d^9 4s^2$ and $3p^6 3d^9 4s \rightarrow 3p^5 3d^{10} 4s$ transitions can in part be separated. (32 refs.)

106369 Photoionisation spectrum of Te I: autoionising series and relative cross section. M.Mazzoni, A.M.Cantu (Osservatorio Astrofisico di Arcetri, Firenze, Italy), Y.N.Joshi.
J. Phys. B (GB), vol.16, no.17, p.3183-90 (14 Sept. 1983).
The absorption spectrum of neutral tellurium was obtained in the region 400-1400 Å by flash pyrolysis technique. Of 60 absorption lines observed, many of them autoionising, 48 have been identified as arising out of seven series converging on the $5p^3\ ^2D_{3/2}{}^0$ and $5p^3\ ^2D_{5/2}{}^0$ limits of Te II. The relative photoionisation cross sections to the levels of $5p^3\ 4^S{}_{3/2}{}^0$, $^2D_{3/2,5/2}{}^0$ and $^2P_{1/2,3/2}{}^0$ of Te II have been obtained, and the results are compared with the previously known theoretical values of absolute photoionisation cross sections in the same region. (23 refs.)

106370 Radiative collision-induced electron continuum-continuum scattering. M.Nayfeh, D.B.Geohegan (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1395-400 (Sept. 1983).
The photoionization of an atom is examined in the presence of a foreign atom. The authors find that a two-photon radiative collision process induces large cross sections for electron continuum-continuum scattering. The enhancement is caused by an intensity-induced collisional shift which, when used to cancel out the collisional dephasing between the initial and final scattering states at wide range of internuclear separations, enhances the electron continuum-continuum scattering process. (6 refs.)

106371 Observation of Cooper minima in excited-*s*-state photoionization cross sections in neon and argon. N.S.Kopeika (Dept. of Electrical & Computer Engng., Ben Gurion Univ., Beer Sheva, Israel), R.Shuker, Y.Yerachmiel, Y.Gabai, C.S.Ih.
Phys. Rev. A (USA), vol.28, no.3, p.1517-26 (Sept. 1983).
Observations of Cooper minima in excited-state photoionization cross sections for the Ne 3*s* and Ar 4*s* levels are reported. Prebreakdown Ne and Ar discharges under irradiation by light in the 200-400-nm wavelength range yield spectral dependences of photoionization cross sections with minima at the ionization threshold of these states in Ne and slightly distant from them in Ar. They are in close agreement with certain theoretical predictions. Autoionization structure which exists between the two ionization limits $^2p_{3/2}$ and $^2p_{1/2}$ was not observed in any of the Ne or Ar photoionization spectra due to both low spectral resolution of the high density of levels in this spectral region. Application of these measurements to ultraviolet-radiation detection is examined. High detection sensitivity of ultraviolet light is indicated. (40 refs.)

106372 Photoionization by intense line radiation in laser-produced plasmas. R.C.Elton, R.H.Dixon (Naval Res. Lab., Washington, DC, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1886-9 (Sept. 1983).
Observed depletion of resonance-line emission from heliumlike C^{4+} ions at 308-eV photon energy is associated with photoionization of lithiumlike Na^{8+} ions, as evidenced also by enhanced emission from the latter near the surface of laser-heated sodium-doped carbon targets. The data are analyzed in terms of the total density of Na^{8+} in the absorbing $n=2$ state, the photoionization cross section, and the relative population density of the radiating 3*d* excited state. (11 refs.)

Influence of AC Stark shifting on relative rates for two-colour multiphoton ionisation of Xe and Cs .... See Entry 106346

Interpretation of the Stark effect of H^- resonances .... See Entry 106347

Scattering of electrons by atoms and photodetachment of negative ions in a homogeneous electric field .... See Entry 106593

Novel short-pulse photoionization electron source: Li $(1s2s2p)^4P^{\circ}$ deexcitation measurements in a plasma .... See Entry 106603

32.80H Auger effect and inner-shell ionization

106373 Probability of internal ionization during β^+ decay: importance of the direct-collision mechanism. R.L.Intemann (Dept. of Phys., Temple Univ., Philadelphia, PA, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1288-92 (Sept. 1983).
A theory of the ionization of inner-shell electrons during β^+ decay is obtained by modifying a theory of inner-shell ionization during β^- decay presented previously. The theory includes the contributions of both the shakeoff and direct-collision mechanisms and yields results whose relative accuracy is of order $Z\alpha$. Numerical results for the *K*-shell ionization probability are presented for several nuclides, including ^{58}Co, ^{64}Cu, and ^{65}Zn; they demonstrate that, contrary to the β^- case, the direct-collision mechanism plays an essential role in inner-shell ionization during β^+ decay, confirming a conjecture by Law (1982). When compared with the results of recent experiments, they are found to give significantly better agreement than do the results of previous theoretical work. (23 refs.)

106374 Recalibration of the Auger spectra of boron. K.T.Chong, R.Bruch (Fakultat fur Phys., Univ. Freiburg, Freiburg, Germany).
Phys. Rev. A (USA), vol.28, no.3, p.1418-22 (Sept. 1983).
By using saddle-point technique, 12 autoionizing and two metastable autoionizing states of B III are calculated. To obtain high accuracy relativistic effects and mass polarization effect are included in the computation. Spin-orbit, spin-other-orbit, and spin-spin effects are also considered. Using the B IV $(1s^2)^1S$ result of Pekeris (1958) the corresponding Auger energies are tabulated. These data are then used to recalibrate the reported boron electron spectra of Rodbro, Bruch, and Bisgaard (1979) by about 0.15 eV. The calculated energies enable the authors to make seven new identifications in the boron Auger spectra. The fine-structure calculation also reveals many inverted *J* levels among these core-excited states. (25 refs.)

106375 Auger-electron study of correlation effects in $3d^{-1}$ and $4d^{-2}$ states of Cs in atomic Cs and molecular CsI. H.Aksela, S.Aksela (Dept. of Phys., Univ. of Oulu, Oulu, Finland).
Phys. Rev. A (USA), vol.28, no.3, p.1503-8 (Sept. 1983).
High-resolution electron-beam-excited $M_{4,5}N_{4,5}N_{4,5}$ Auger-electron spectra of Cs have been measured and analyzed both from atomic Cs and molecular CsI vapors. The observed main fine structure is reproduced fairly well with the mixed-coupling calculations based on the closed-shell approximation. Some extra structure exists, which is stronger in the spectrum of molecular CsI than in the spectrum of atomic Cs. This structure is investigated by carrying out Dirac-Fock calculations for the energies of the Auger transitions locating the outermost electron either on the 6*s*, 5*d*, or 4*f* orbital. (14 refs.)

An atomic standard to calibrate analyser modulation in AES .... See Entry 105427

Concerning a long-lived $(^2P^e)He^-$ state: lifetime and energy-level measurements of He^- .... See Entry 106357

Electronic relativistic effects in *K*-shell ionization by proton impact .... See Entry 106559

32.80K Multiphoton processes

106376 Narrowing of two-photon resonance due to elastic collisions. V.A.Ulybin, V.P.Chebotaev (Inst. of Thermophys., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.6, p.311-14 (20 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.6, p.264-6 (20 March 1983). [received: Sept. 1983]
The two-photon absorption line shape is examined in the field of a standing wave with elastic collisions. A sharp decrease is observed in the transit broadening of the two-photon resonance in vibrational-rotational transitions of molecules due to an increase in the interaction time of particles with the

electromagnetic field as a result of elastic collisions. This effect permits obtaining supernarrow optical two-photon absorption resonances with high intensity in a low-pressure gas. (6 refs.)

Multiphoton excitation and frequency tripling in xenon .... See Entry 106326

32.90 OTHER TOPICS IN ATOMIC SPECTRA AND INTERACTIONS WITH PHOTONS

106377 Scattering of 1.1732- and 1.3325-MeV gamma rays through small angles by carbon, aluminum, copper, tin, and lead. P.P.Kane, J.Mahajani, G.Basavaraju, A.K.Priyadarsini (Dept. of Phys., Indian Inst. of Technol., Bombay, India).
Phys. Rev. A (USA), vol.28, no.3, p.1509-16 (Sept. 1983).
With the help of Ge(Li) detectors, elastic and Compton scattering cross sections of copper, tin, and lead were determined in the double-shadow-cone geometry from 4.51° to 12.05° in the case of 1.1732- and 1.3325-MeV γ rays of ^{60}Co. A new method was developed for the accurate measurement of cross sections. The measured elastic scattering cross sections are determined predominantly by Rayleigh scattering from bound atomic electrons. The nuclear Thomson and the Delbruck scattering amplitudes have also been considered in the interpretation of data. The relativistic modified form-factor theory of Rayleigh scattering leads to good agreement with the data for $x<12$ Å^{-1}, where $x=\sin(\theta/2)/\lambda$, and where θ is the scattering angle and λ the photon wavelength. The measured Compton scattering cross sections for $x>4.5$ Å^{-1} are in agreement with those calculated on the basis of tabulated nonrelativistic incoherent scattering functions, although there are deviations at smaller x values. (18 refs.)

106378 Incoherent scattering at low photon energies. V.Visweswara Rao, D.Venkateswara Rao (Dept. of Phys., Indian Inst. of Technol., Kharagpur, India).
Phys. Rev. A (USA), vol.28, no.3, p.1527-30 (Sept. 1983).
Incoherent scattering functions have been experimentally determined for photon energies 84.4, 123.6, 145, and 320 keV in the angular range 30°-130° in the elements Sc, Y, La, Ce, Gd, Dy, W, Pt, and Pb with the use of the aluminum difference technique. The experimental values have been compared with those estimated on the basis of the nonrelativistic Hartree-Fock wave functions. Good agreement is observed between theory and experiment. (14 refs.)

Extractoion of accurate autionisation widths from the emission spectrum of doubly-excited He ....See Entry 106361

33.00 MOLECULAR SPECTRA AND INTERACTIONS WITH PHOTONS

33.10 CALCULATION OF MOLECULAR SPECTRA

106379 Influence of rigid-body motion on the deformation electron density of H_2O. K.Hermansson (Inst. of Chem., Univ. of Uppsala, Uppsala, Sweden).
Chem. Phys. Lett. (Netherlands), vol.99, no.4, p.295-300 (12 Aug. 1983).
The influence of translational and librational motion on the theoretical deformation electron density of a water molecule is investigated. The translational motion dominates the thermal smearing except in the vicinity of the hydrogen atoms at low temperatures. (20 refs.)

106380 Cubic and quartic force constants of some stretching and out-of-plane bending modes of the FH...OH_2 complex: a three-dimensional hypersurface analysis. Y.Bouteiller, M.Allavena, J.M.Leclercq (Centre de Mecanique Ondulatoire Appliquee, CNRS, Paris, France).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.432-6 (19 Aug. 1983).
The potential-energy hypersurface of the FH...OH_2 complex is investigated by following the variations of three coordinates: the r_1(F-H) and r_2(H...O) bond lengths and the out-of-plane β(FHO) angle. The energy values $E(r_1,r_2,\beta)$, calculated at the SCF level are distributed in the four-dimensional space $\{E,r_1,r_2,\beta\}$ and fitted to the fourth order by an analytical surface from which a force field is deduced. The accuracy of the results and their implication for the calculation of vibrational modes are discussed. (22 refs.)

106381 Rotational analysis of the $^2B_1(K'=1)-^2A_1(K''=0)$ sub-band of NO_2 at 464-9 nm in the time-gated excitation spectrum. N.Sugimoto, N.Takeuchi (Nat. Inst. for Environmental Studies, Ibaraki, Japan), S.Takezawa.
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.475-8 (19 Aug. 1983).
The rotational structure of the $^2B_1(K'=1)$ sub-band of NO_2 was, for the first time, analyzed in the time-gated excitation spectrum monitored at the $3\nu_2$ fluorescence band. The band origin, $\nu_0=21504.9$ cm^{-1}, and rotational constant, $\bar{B}'=0.373$ cm^{-1}, were obtained. The observed sub-band was vibrationally identified to be $(\nu_2', K')=(16,1)$ with the linear notation. Also a vibrational assignment of the transitions, the rotational identification of which was reported by Senum and Schwartz (1977) is proposed. (8 refs.)

106382 Vibrational frequencies of the HCCN molecule. A near degeneracy between bent cyanocarbene and linear allene-related geometries. K.S.Kim, H.F.Schaefer,III (Dept. of Chem., Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA), L.Radom, J.A.Pople, J.S.Binkley.
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4148-54 (29 June 1983).
The geometrical structure and vibrational frequencies of the ground triplet electronic state of HCCN have been examined at a wide range of levels of ab initio electronic structure theory. The potential energy surface of HCC bending is very flat for HCCN owing to a competition between linear allene HC=C=N and bent carbene H$\dot{\rm C}$C≡N valence structures. Evidence is presented that both the restricted Hartree-Fock (RHF) and unrestricted Hartree-Fock (UHF) methods treat this potential surface in a somewhat uneven manner. When the effects of electron correlation are included, however, RHF- and UHF-based methods converge to a similar set of structural and energetic predictions. The most reliable levels of theory suggest that HCCN is a quasi-linear molecule, with $\theta_e(\mathrm{HCC})\approx138°$ and a barrier to linearity of only about 2 kcal/mol. (37 refs.)

106383 Two-dimensional analysis of the ring-puckering and PH inversion vibrations of 3-phospholene. M.A.Harthcock, J.Laane (Dept. of Chem., Texas A & M Univ., College Station, TX, USA).
J. Chem. Phys. (USA), vol.79, no.5, p.2103-13 (1 Sept. 1983).
The ring-puckering energy levels for 3-phospholene $CH_2CH=CHCH_2PH$, in both the ground and excited states of the PH inversion vibration have been established from the vibrational spectra of this molecule. The availability of such extensive data made it possible to determine a reliable two-dimensional (with the ring-puckering and the P-H inversion as the two coordinates) potential energy surface. For the calculations, the kinetic energy coefficients g_{44}, g_{55}, and the cross term g_{45} was accurately represented as functions of both coordinates. An initial approximation to the asymmetric two-dimensional potential energy surface was obtained from the one-dimensional ring-puckering function as well as from structural data from microwave spectroscopy. Symmetry constraints established which potential terms were to be utilized. Three separate computer programs were written in order to calculate the vibrational energy levels and to adjust the potential parameters. The most efficient approach utilized a product of two prediagonalized basis sets for the basis functions. Initial attempts to fit the data with a potential surface using terms up through fourth power proved unsatisfactory in fitting data for the inversion excited state. A local solution based on Van Vleck perturbation theory was thus obtained and then expanded, using the symmetry constraints, to the entire solution. The resulting potential surface, which required the use of sixth power terms, gave excellent agreement with the observed spectra. Only five variable parameters were adjusted (for the local solution) in order to fit the 20 observed frequencies. The final potential surface has a central barrier of about 5500 cm^{-1} for the planar configuration. The more stable endo conformation lies 785 cm^{-1} in energy below that of the exo form with similar puckering angle (18°). (22 refs.)

106384 Calculation of the missing mode effect frequencies from Raman intensities. L.Tutt (Dept. of Chem. & Biochem., Univ. of California, Los Angeles, CA, USA), D.Tannor, J.Schindler, E.J.Heller, J.I.Zink.
J. Phys. Chem. (USA), vol.87, no.16, p.3017-19 (4 Aug. 1983).
Regularly spaced vibronic structure in the luminescence spectra of large molecules often does not correspond to any ground-state normal-mode vibration of the molecule. This 'missing mode effect' (MIME) is explained in terms of the time-dependent picture of electronic transitions. Simple equations from which the MIME frequency can be calculated are derived. The parameters which are needed to calculate the MIME frequency are independently determined by using preresonance Raman spectroscopy. Good agreement between the experimental spectrum and the spectrum calculated by using the independently determined parameters is observed. The normal modes contributing to the MIME frequency are identified and discussed. (12 refs.)

106385 Partial-sum rules for and asymmetry between rotational transitions $J\pm\Delta J\leftarrow J$. I.Shimamura (Inst. of Space & Astronautical Sci., Tokyo, Japan).
Phys. Rev. A (USA), vol.28, no.3, p.1357-62 (Sept. 1983).
The authors study a class of spectra $a(J'\leftarrow J)$ of rotational transitions of linear and spherical-top rotators. Examples are the cross sections for photoabsorption, photoionization, and collisions in the sudden approximation. Both the sum $a(J+\Delta J\leftarrow J)+a(J-\Delta J\leftarrow J)$ and the transition-energy-weighted sum $\Delta E(J+\Delta J\leftarrow J)a(J+\Delta J\leftarrow J)+\Delta E(J-\Delta J\leftarrow J)a(J-\Delta J\leftarrow J)$ are nearly indeendent of J at high J, the J-dependent correction terms being of the order of J^{-2} for linear rotators and much smaller for spherical tops. The ratio $a(J+\Delta J\leftarrow J)/a(J-\Delta J\leftarrow J)$ is $1+c\Delta J/J+O(J^{-2})$, where $c=1$ for linear rotators and $c=2$ for spherical tops. The anisotropy parameter $\beta(J'\leftarrow J)$ for the angular distribution of photoelectrons satisfies $\beta(J\pm\Delta J\leftarrow J)=\beta_\infty[1+c_\beta J^{-2}+O(J^{-3})]$, and $\beta(J+\Delta J\leftarrow J)/\beta(J-\Delta J\leftarrow J)=1+O(J^{-3})$ for linear rotators, where β_∞ and c_β are constants independent of J. The β for spherical tops show much weaker dependence on J. (24 refs.)

106386 The $B(^1\Sigma^+)$ and $X(^1\Sigma^+)$ states of HF and DF: RKR curves and Franck-Condon factors. J.M.Alvarino, L.F.Gonzalez, M.L.Hernandez, E.Martinez (Dept. de Quimica Fisica, Univ. del Pais Vasco, Bilbao, Spain).
Spectrosc. Lett. (USA), vol.16, no.7, p.541-53 (1983).
RKR turning points for the $B(^1\Sigma^+)$ and $X(^1\Sigma^+)$ states of DF have been calculated. Franck-Condon factors and r-centroids for the B-X band system of HF and DF have been evaluated and compared with previous experimental results. (23 refs.)

Vibrational spectra and structure. A series of advances. Vol.12 ....See Entry 105049

Ab initio SCF assignment of vibrational spectra of nitrosomethane ....See Entry 106276

$\tilde{X}^1A_1$, $\tilde{a}^3B_1$, and $\tilde{A}^1B_1$ electronic states of silyenes. Structures and vibrational frequencies of SiH_2, SiHF, and SiF_2 ....See Entry 106388

The electronic structure and spectra of UO^+ .... See Entry 106389

Millimeter and submillimeter wave spectrum of oxygen in the $a^1\Delta_g$ state ....See Entry 106395

Λ doubling spectrum of the CH free radical in a RF glow discharge ....See Entry 106396

The rotational Zeeman effect in ArHBr: an interpretation of the rotational Zeeman parameters in rare gas hydrogen halide complexes .. See Entry 106398

Molecular complexes of cyclopropane with hydrogen halides and water studied by matrix-isolation vibrational spectroscopy ....See Entry 106401

Development of a 10 cm^{-1} resolution 6.3 μm H_2O band model ....See Entry 106403

Vibrational infrared spectra of the titanium subchlorides ....See Entry 106404

The rotational spectrum of $(H_2O)_2$ at atmospheric conditions ....See Entry 106405

On the vibrational frequency correlation in liquids: Raman study of aqueous thiocyanate solutions ....See Entry 106407

Influence of the immediate surroundings of solute molecules on their absorption spectra ....See Entry 106415

Infrared laser spectroscopy of free radicals and ions. I. The fundamental band of $NF(X^3\Sigma^-)$ ....See Entry 106417

High resolution infrared studies of site structure and dynamics for matrix isolated molecules ....See Entry 106422

Revised analysis of the structure of the ν_1 band of methane ..See Entry 106425

Rotational Raman spectra of a nearly symmetric rotor ....See Entry 106426

Picosecond transient Raman spectroscopy: the photoisomerization of trans-stilbene ....See Entry 106427

Theoretical interpretation of the resonance Raman spectrum of gaseous chlorine ....See Entry 106428

Rotational R-branch Raman spectroscopy in CO_2 (comment and reply) ....See Entry 106430

Resonance Raman investigation of the π^* antibonding distribution in excited triplet aqueous *p*-benzoquinone ....See Entry 106432

Spectroscopic and theoretical studies of binuclear molybdenum(II) carboxylates ....See Entry 106433

Time-resolved resonance Raman observation of tetrafluoro-*p*-benzosemiquinone anion radical ....See Entry 106434

Raman study of CF_4 in liquid Ar: molecular motions and transition dipole interaction .... See Entry 106435

High vibrational overtones in $SiHCl_3$ and SiH_2Cl_2 .... See Entry 106436

The spectra of $^{74}Ge^{16}O$ and $^{74}Ge^{18}O$ in the vacuum ultraviolet region ....See Entry 106439

Structure and dynamics of molecular rotation of 2-pyridone in toluene and methanol by carbon-13 nuclear magnetic resonance ....See Entry 106453

Infrared optical double resonance spectroscopy of ND_2 ....See Entry 106471

Direct observation of high-lying $^3\Pi_g$ states of the Na_2 molecule by optical-optical double resonance ....See Entry 106474

Laser excitation spectrum and microwave optical double resonance spectrum of the $3_0{}^1$ band in the $\tilde{a}^3A_2$-$\tilde{X}^1A_1$ system of H_2CS: the hyperfine structure of the $\tilde{a}^3A_2$ state ....See Entry 106479

Interstate dynamics in xanthione: a picosecond photon-echo and optical study ....See Entry 106483

Laser-induced fluorescence of the HSiF radical .... See Entry 106484

The photophysics and photochemistry of weakly bound dimers of *s*-tetrazine ....See Entry 106492

Fluorescence excitation spectrum of triptycene in a supersonic jet ....See Entry 106494

On certain new apsects of the process of multiphoton excitation in polyatomic molecules .... See Entry 106508

Non-adiabatic approximation for resonant multiphoton excitation of vibrational-rotational states in strong laser fields ....See Entry 106510

Vibrational spectra of small matrix isolated molecules .... See Entry 106530

Electron scattering from alkali halide molecules .... See Entry 106613

Nuclear dynamics in resonant electron-molecule scattering beyond the local approximation: the 2.3-eV shape resonance in N_2 .... See Entry 106617

Ultrahigh-resolution study of autodetachment in $C_2{}^-$ ....See Entry 106624

Correlation effects in vibrational hole burning ....See Entry 109767

The kinetic temperature and CH_3CCH column density profiles in Sgr B2, Orion, and DR 21 ....See Entry 111173

33.20 MOLECULAR SPECTRA GROUPED BY WAVELENGTH RANGES

(for magneto-optical and electro-optical spectra, see 33.45; for fluorescence and phosphorescence spectra, see 33.50; for photoelectron spectra, see 33.65)

106387 Resolution of an ancient spectroscopic puzzle: the D→X spectrum of I_2. J.Tellinghuisen (Dept. of Chem., Vanderbilt Univ., Nashville, TN, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.373-6 (19 Aug. 1983).
The D→X emission from low-*v* levels of the D state is discerned in the region λ<3280 Å of the emission spectrum of I_2 in Ar. Analysis of 47 bands spanning $v'=0$-3 yields the constants (in cm^{-1}), $T_e=41027.3(5)$, $\omega_e=95.0(3)$, and $\omega_e x_e \approx 0.16$. (28 refs.)

106388 $\tilde{X}^1A_1$, $\tilde{a}^3B_1$, and $\tilde{A}^1B_1$ electronic states of silyenes. Structures and vibrational frequencies of SiH_2, SiHF, and SiF_2. M.E.Colvin, R.S.Grev, H.F.Schaefer,III. (Dept. of Chem., Univ. of California, Berkeley, CA, USA), J.Bicerano.
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.399-405 (19 Aug. 1983).
The spectroscopic characteristics of the three lowest-lying electronic states of SiH_2, SiHF, and SiF_2 have been predicted via a priori quantum-mechanical methods. Where experimental results are available, the theoretical predictions usually agree well. Specially Rao's identification of the $^3B_1$ state of SiF_2 (1970) is confirmed. Also Milligan and Jacox's very tentative assignment of an absorption at 2032 cm^{-1} to ν_1 (SiH_2) (1968) is shown to be reasonable. many spectroscopic features have been predicted for which there are no experimental observations at present. (38 refs.)

106389 The electronic structure and spectra of UO^+. M.Krauss, W.J.Stevens (Molecular Spectroscopy Div., NBS, Washington, DC, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.417-21 (19 Aug. 1983).
Relativistic effective potentials are used to calculate the electronic structure and spectroscopic properties of UO^+. The lowest-energy states are very ionic and the molecular orbitals substantially localized so that the molecule is described by the ionic fragments, U^{3+} (f^3,^4I) and O^{2-} (^1S). The R_e and ω_e of the ground $\Omega=9/2$ state have been determined to be 3.48 bohr and 925 cm^{-1}. The vibrational and electronic states are interleaved with the lowest excited electronic state, $\Omega=7/2$, at 1315 cm^{-1}. The excitation energies of the excited states of UO^+ were calculated using a restricted valence configuration interaction. Strong radiative transitions are predicted in the red part of the visible. (16 refs.)

106390 Absorption and circular dichroism spectra of dimeric systems. Extended dimer model. M.Z.Zgierski (Div. of Chem., Nat. Res. Council of Canada, Ottawa, Ontario, Canada), M.Pawlikowski.
J. Chem. Phys. (USA), vol.79, no.4, p.1616-33 (15 Aug. 1983).
An extended dimer model is formulated. It differs from the simple dimer model in allowing for mixing of monomer electronic states by intermolecular interaction. The exact and approximate mathematics treatments of the model are discussed in detail. The model is applied to studies of absorption and circular dichroism spectra of dimers. It is shown that the transfer of intensity and rotatory power due to interstate mixing leads to readily observable changes in the vibronic structure of the corresponding spectra. The model is used to reinterpret the observed CD spectra of two different 1,1′-bianthryls. (36 refs.)

106391 The photodissociation of nitromethane at 193 nm. L.J.Butler, D.Krajnovich, Y.T.Lee (Dept. of Chem., Univ. of California, Berkeley, CA, USA), G.Ondrey, R.Bersohn.
J. Chem. Phys. (USA), vol.79, no.4, p.1708-22 (15 Aug. 1983).
The dissociation of nitromethane following the excitation of the $\pi^* \leftarrow \pi$ transition at 193 nm has been investigated by two independent and complementary techniques, product emission spectroscopy and molecular beam photofragment translational energy spectroscopy. The primary process is shown to be cleavage of the C-N bond to yield CH_3 and NO_2 radicals. The translational energy distribution for this chemical process indicates that there are two distinct mechanisms by which CH_3 and NO_2 radicals are produced. The dominant mechanism releasing a relatively large fraction of the total available energy to translation probably gives NO_2 radicals in a vibrationally excited $^2B_2$ state. When dissociated, other nitroalkanes exhibit the same emission spectrum as CH_3NO_2, suggesting little transfer of energy from the excited NO_2 group to the alkyl group during dissociation for the dominant mechanism. This conclusion is supported by the apparent loss of the slow NO_2 product in the molecular beam studies to unimolecular dissociation to NO+O, which will occur for NO_2 with 72 kcal/mol or more internal energy. Evidence is presented which suggests that the NO_2 produced via the minor mechanism, which releases a smaller fraction of the available energy to translation, has a large cross section for absorbing an additional photon via a parallel transition and dissociating to NO+O. (41 refs.)

106392 Quantitative interpretation of the absorption and emission spectra of 1,8-diphenyl-1,3,5,7-octatetraene. W.H.Henneker, W.Siebrand, M.Z.Zgierski (Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
J. Chem. Phys. (USA), vol.79, no.5, p.2495-6 (1 Sept. 1983).
Recently Ikeyama and Azumi (1982) (IA) reported carefully corrected absorption and emission spectra of 1,8-diphenyl-1,3,5,7-octatetraene in octane. They interpreted the irregular intensity distributions and lack of mirror-image relationship in terms of two closely spaced states of symmetry $(2)A_g$ and $(1)B_u$ in C_{2h}. They assumed that the forbidden transition between $2A_g$ and the $1A_g$ ground state borrows intensity from the allowed transition between $1B_u$ and $1A_g$ through solvent-induced lowering of the C_{2h} symmetry. The spectra show two a_g CC-stretching progressions with intensity distributions deviating from the displaced harmonic oscillator distributions predicted by the Franck-Condon principle. According to IA, this is due to vibronic coupling between $1B_u$ and $2A_g$ through a_g modes, made possible by the lower symmetry; interference of this coupling with Franck-Condon effects produces the irregular spectra. They support these arguments with perturbation calculations, including both adiabatic and nonadiabatic vibronic coupling. The authors point out that such a two-state vibronic-coupling system can be solved much more accurately by direct diagonalization of the Hamiltonian matrix. This is equivalent to solving the perturbation problem to all orders. The procedure automatically includes both adiabatic and nonadiabatic coupling and yields a much better reproduction of the observed spectra than can be obtained from low-order perturbation treatments. (4 refs.)

106393 Photoelectric detection of absorption spectra in studies of the Shpolskii effect. T.N.Bolotnikova, V.A.Zhukov, L.F.Utkina.
J. Appl. Spectrosc. (USA), vol.37, no.5, p.1286-9 (Nov. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.800-4 (Nov. 1982). [received: Sept. 1983]
The work concerns an evaluation of the possibility of quantitative measurements using the absorption spectra of frozen polycrystalline samples and a comparison of the excitation and absorption spectra obtained under identical conditions for one and the same sample, in order to determine the conditions under which these two spectra are identical. (4 refs.)

106394 Interactions between unbound groups in the molecules $\phi CX_{(1)}X_{(2)}X_{(3)}$. Influence on the secondary transition intensity. D.Denis-Courtois, B.Vidal (Lab. de Spectroscopie de la Reactivite Chimique, Univ. des Sci. et Techniques de Lille, Villeneuve d'Ascq, France).
Spectrochim. Acta Part A (GB), vol.39A, no.8, p.735-50 (1983). In French.
Spectra of the secondary transition of the benzene chromophore, acting as a molecular probe, in molecules $\phi CX_{(1)}X_{(2)}X_{(3)}$ show surprisingly that the coupling involving π_ϕ and an auxochrome, $X_{(1)}$ for example, through the bonds C_α-$X_{(2)}$ and C_α-$X_{(3)}$ has very often almost as much efficiency as a coupling through C_α-H bonds. The authors' spectroscopic results show that neither a group nor a given symmetry of the substituent is to be privileged. Thus the authors develop a model in which no symmetry condition is required. The σ, π coupling is described as a coupling between all the group of substituents on C_α acting as a whole, and π_ϕ, through two 2*p* orbitals belonging to C_α. That coupling scheme is in good agreement with all the intensities of the secondary transition measured at the 00 band of a wide range of molecules. Spectra of species involving one or several at a time of the next bonds have been studied. When two benzene chromophores are involved (C_α-C_ϕ) a through space interaction must also be taken into consideration. (43 refs.)

Vibrational spectra and structure. A series of advances. Vol.12 ....See Entry 105049

Vibrational spectra and conformational analysis of substituted three membered ring compounds .... See Entry 106632

Model compounds for protonation of benz[a]phenazine: spectroscopy of protonated 1,2- and 3,4-benzacridines ....See Entry 109716

33.20B Radiofrequency and microwave spectra

(for NMR spectra, see 33.25; for EPR spectra, see 33.30)

106395 Millimeter and submillimeter wave spectrum of oxygen in the $a^1\Delta_g$ state. G.Cazzoli, C.Degli Esposti, P.G.Favero (Inst. di Spettroscopia Molecolare, CNR, Bologna, Italy).
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.99-101 (26 Aug. 1983).
The measurements of two rotational transitions of oxygen in the $a^1\Delta_g$ electronically excited state in the millimeter and submillimeter wave region allowed a more accurate determination of the molecular parameters of this molecule. The newly determined values in MHz are $B_0=42504.523(4)$, $D_0=0.1526(1)$; $q=7.8(55)\times10^5$. (4 refs.)

106396 Λ doubling spectrum of the CH free radical in a RF glow discharge. M.Bogey, C.Demuynck, J.L.Destombes (Lab. de Spectroscopie Hertzienne, Univ. de Lille, Villeneuve d'Ascq, France).
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.105-9 (26 Aug. 1983).
Λ doubling transitions of CH $X^2\pi$ have been observed in a RF discharge in various gas mixtures. The measured frequencies are fitted together with the astrophysical lines and with recent MODR measurements. A set of molecular parameters is derived, and the hyperfine and Λ doubling structure is carefully analyzed. The frequencies of some transitions of astrophysical interest are predicted with high accuracy. (28 refs.)

106397 The microwave spectrum of the fluoromethyl radical, CH_2F. Y.Endo, C.Yamada, S.Saito, E.Hirota (Inst. for Molecular Sci., Okazaki, Japan).
J. Chem. Phys. (USA), vol.79, no.4, p.1605-11 (15 Aug. 1983).
The microwave spectrum of the fluoromethyl radical, CH_2F, has been observed by using a source-frequency modulation spectrometer with a 1 m long free space absorption cell. The CH_2F radical was generated directly in the cell by the reaction of methyl fluoride with 2450 MHz discharge products of CF_4. The *a*-type *R*-branch transitions, $N=1\leftarrow0$, $2\leftarrow1$, and $3\leftarrow2$ for the ground vibrational state and $N=2\leftarrow1$ and $3\leftarrow2$ for the first excited state of the out-of-lane bending mode (ν_4), have been observed; all of them were found to be split into fine and hyperfine components, and individual lines were measured precisely. The hyperfine structure observed for the ground state is consistent with electronic symmetry of B_1 and with odd parity with respect to the reflection on the 'molecular plane'. A relative intensity

measurement shows that the $\nu_4=1$ state of even parity is located $300(30)cm^{-1}$ above the ground state. These observations suggest that the CH_2F molecule is essentially planar, although the presence of a small hump at the planar configuration cannot be excluded. (27 refs.)

106398 The rotational Zeeman effect in ArHBr: an interpretation of the rotational Zeeman parameters in rare gas hydrogen halide complexes. W.G.Read, E.J.Campbell (Noyes Chem. Lab., Univ. of Illinois, Urbana, IL, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.1669-77 (15 Aug. 1983).
The rotational Zeeman effect in the ArHBr van der Waals molecule has been studied using the method of pulsed Fourier transform microwave spectroscopy carried out in a Fabry-Perot cavity located in the bore of a superconducting magnetic solenoid. The rotational magnetic dipole moment, magnetic susceptibility anisotropy, and bromine bulk shielding constant were determined. The values for $ArH^{79}Br$ are: $g_\perp G=0.00020(5)$, $\chi_\|$-Vc_\perp=-0.13(9)\times 10^{-9}$ MHz/G^2, and $\sigma_{Br}=4000(2000)$ ppm. The equations describing these molecular Zeeman parameters in terms of the properties of the constituent subunits of the complex are derived from the full dynamic molecular Hamiltonian. The rotational *g* value is a sensitive measure of the degree of Coriolis coupling in the complex. The molecular quadrupole moment of ArHBr is calculated. (30 refs.)

The rotational spectrum of $(H_2O)_2$ at atmospheric conditions ....See Entry 106405

33.20E Infrared spectra

106399 Diode-laser spectroscopy of supersonic free jets. Y.Mizugai (Dept. of Phys., Sophia Univ., Tokyo, Japan), H.Kuze, H.Jones, M.Takami.
Appl. Phys. B (Germany), vol.B32, no.1, p.43-7 (Sept. 1983).
A supersonic-free-jet infrared spectrometer has been constructed for investigation of molecular vibrational spectra at low rotational and vibrational temperatures. The sensitivity of measurement in a pulsed jet is increased by employing a phase-sensitive detection method synchronized with the pulsed frequency. The performance of the spectrometer is examined for the absorption lines of the NH_3 ν_2 band. A rotational temperature as low as 16K is attained when seeded in He. Cold-jet spectra are demonstrated for the ν_3 bands of PF_5, $^{34}SF_6$, and $^{182}WF_6$. (17 refs.)

106400 Infrared spectra of hydrogen-bonded salicylic acid and its derivatives: methyl salicylate. M.J.Wojcik (Faculty of Chem., Jagiellonian Univ., Cracow, Poland), C.Paluszkiewicz.
Can. J. Chem. (Canada), vol.61, no.7, p.1449-52 (July 1983).
Infrared spectra of hydrogen-bonded methyl salicylate have been studied in the temperature range 173-293K, in solutions of various concentrations (in CCl_4) and in the gaseous state. The molecules form monomeric intramolecular hydrogen bonds in the solid, liquid and gaseous state. Far-infrared spectra were recorded which give the wavenumber of low-frequency O...O mode used in theoretical reconstruction of the band connected with the O-H stretching vibration. The position and especially the width of this band are determined to a large extent by the influence of the environment. (10 refs.)

106401 Molecular complexes of cyclopropane with hydrogen halides and water studied by matrix-isolation vibrational spectroscopy. A.J.Barnes, S.L.Paulson (Dept. of Chem. & Appl. Chem., Univ. of Salford, Salford, England).
Chem. Phys. Lett. (Netherlands), vol.99, no.4, p.326-30 (12 Aug. 1983).
Infrared spectra of cyclopropane-hydrogen halide and cyclopropane-water complexes show similar perturbations of the cyclopropane modes, suggesting that all have the proton donor 'hydrogen-bonded' to the ring edge. The spectrum of the cyclopropane-water complex is consistent with water forming a bifurcated hydrogen bond to the ring. (10 refs.)

106402 Fourier-transform electronic absorption spectroscopy: the 800 nm near-infrared band system of nitrosyl cyanide (NCNO). J.Pfab (Dept. of Chem., Heriot-Watt Univ., Edinburgh, Scotland).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.465-9 (19 Aug. 1983).
Dispersed and Fourier-transform spectra of NCNO vapour have been measured and some of the vibrational and coarse rotational structure has been analysed. The absorption is due to a $^1A''\leftarrow{}^1A'(n_-\pi^*)$ transition with the origin at 882.2 nm. The main geometry change accompanying the transition consists of an opening up of the CNO angle. (23 refs.)

106403 Development of a 10 cm^{-1} resolution 6.3 μm H_2O band model. L.S.Bernstein (Spectral Sci. Inc., Burlington, MA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.366, p.173-9 (1983). (Modern Utilization of Infrared Technology VIII, San Diego, CA, USA, 26-27 Aug. 1982).
A simple model for developing band model parameters at moderate spectral resolution (~ 10 cm^{-1}) is applied to the 6.3 μm H_2O band. The underlying assumption of the approach is that the shapes of bands of the same symmetry can be superimposed to within ~ 10 cm^{-1}. The band centers of the hot bands for H_2O in the 6.3 μm are known, and the reference bandshapes can be generated from the AFGL HITRAN line atlas. A preliminary set of band model parameters is presented and compared to the NASA parameters. (11 refs.)

106404 Vibrational infrared spectra of the titanium subchlorides. T.C.DeVore, T.N.Gallaher (Dept. of Chem., James Madison Univ., Harrisonburg, VA, USA).
High Temp. Sci. (USA), vol.16, no.2, p.83-8 (April 1983). [received: Sept. 1983]
The infrared spectra of gaseous $TiCl_4$, $TiCl_3$, $TiCl_2$, and, possibly TiCl have been investigated using a microwave discharge through a $TiCl_4$/Ar mixture as the molecular source. The vibrational frequencies found for $TiCl_3$ and $TiCl_2$ are 497 cm^{-1} and 489 cm^{-1}, respectively. In addition, three weak bands were observed at 450 cm^{-1}, 400 cm^{-1}, and 422 cm^{-1}, that have tentatively been assigned as arising from the $X^4\Sigma^-$, the $X'^2\Delta$, and either the $A'^2\Sigma^+$ or the $A'^2\Gamma$ states of TiCl, respectively. (11 refs.)

106405 The rotational spectrum of $(H_2O)_2$ at atmospheric conditions. A.A.Vigasin, G.V.Chlenova.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.7, p.703-8 (July 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
On the basis of published data on the molecular parameters of the water dimer the behaviour of the rotational spectrum in the region 0-100 cm^{-1} is calculated. The characteristics of the temperature alterations of integrated intensity distribution are revealed. From comparison with available experimental data, the molar part of the water dimer under atmospheric conditions is estimated. (19 refs.)

106406 Resonance Raman spectra of the ground and excited states of specifically deuterated tris(2,2′-bipyridine)ruthenium(II). S.McClanahan, T.Hayes, J.Kincaid (Chem. Dept., Univ. of Kentucky, Lexington, KY, USA).
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4486-7 (29 June 1983).
The authors report the resonance Raman (rR) spectra of a specifically deuterated analogue of the title complex in both its ground and lowest electronic excited states. The sensitivity of vibrational frequencies to deuterium substitution permits a more reliable correlation of ground- and excited-state frequencies and provides insight into the nature of the vibrational modes in each state. (9 refs.)

106407 On the vibrational frequency correlation in liquids: Raman study of aqueous thiocyanate solutions. T.Kato (Seibo Womens's Jr. Coll., Kyoto, Japan).
J. Chem. Phys. (USA), vol.79, no.5, p.2139-44 (1 Sept. 1983).
The vibrational frequency correlation functions $\langle\omega(0)\omega(t)\rangle$ are calculated from isotropic Raman spectra for the CN stretching mode of the SCN^- anion in aqueous LiSCN, NaSCN, and KSCN solutions, at concentrations 1-10 M, and at temperatures of 30, 55, and 80° C. The experimental $\langle\omega(0)\omega(t)\rangle$ shows rapid relaxations within a particular environment on a subpicosecond time scale, accompanied by constant positive correlation. It is concluded that the homogeneous dephasing is due to the fast relaxation of $\langle\omega(0)\omega(t)\rangle$, and that the inhomogeneous dephasing comes from the static positive correlation, which should be attributed to a distribution of environments persisting over the time scale of Raman probe. The analysis of $\langle\omega(0)\omega(t)\rangle$ confirms that the inhomogeneous broadening increases with decreasing temperature, with increasing salt concentration, and in the order KSCN<NaSCN<LiSCN. (16 refs.)

106408 FTIR observation of the N_2...HF complex in solid argon. L.Andrews, B.J.Kelsall, R.T.Arlinghaus (Dept. of Chem., Univ. of Virginia, Charlottesville, VA, USA).
J. Chem. Phys. (USA), vol.79, no.5, p.2488-90 (1 Sept. 1983).
During a series of matrix isolation studies of base-HF complexes, spectra of $(HF)_2$ and $(HF)_3$ were observed in solid argon. Matrix samples containing HF were doped with N_2 to check for a possible impurity N_2...HF complex, and strong sharp absorptions at 3881.5 and 262 cm^{-1} were related to N_2 present in the matrix. The linear N_2...HF complex recently characterized by pulsed-nozzle microwave studies, has a weaker N≡N...H-F hydrogen bond than the isoelectronic OC...HF and HCN...HF species. The vibrational spectrum of N_2...HF in solid argon provides complementary spectroscopic information. (19 refs.)

106409 Vibrational analysis of acetate ion molecules and estimation of equilibrium constants for their hydrogen isotopic exchange reactions. M.Kakihana, M.Kotaka, M.Okamoto (Res. Lab. for Nuclear Reactors, Tokyo Inst. of Technol., Tokyo, Japan).
J. Phys. Chem. (USA), vol.87, no.14, p.2526-35 (7 July 1983).
The infrared spectra (4000-300 cm^{-1}) of CH_3COONa and its five isotopic substitutions including D- and ^{13}C-labeled modifications suspended in KBr disks were measured at 80 and 290K. Complete vibrational assignments were established on the basis of correlations of group modes and the ^{13}C shifts of the fundamentals. From a normal coordinate analysis a general valence force field involving 26 force constants has been determined, which reproduces 82 experimental frequencies with a root-mean-squares deviation of 3.3 cm^{-1}. The composition of the normal vibrations from the symmetry coordinates has been given in terms of the potential energy distribution which makes it possible to inspect the relation between the normal modes and the group vibrations. Calculated equilibrium constants of some hydrogen isotopic exchange reactions between the acetate ion molecules are reported. (20 refs.)

106410 Infrared spectra of the *n*-butyl and *n*-pentyl radicals. J.Pacansky, A.Gutierrez (IBM Res. Lab., San Jose, CA, USA).
J. Phys. Chem. (USA), vol.87, no.16, p.3074-9 (4 Aug. 1983).
The *n*-butyl ($CH_3CH_2CH_2\dot{C}H_2$), *n*-butyl-1,1-d_2 ($CH_3CH_2CH_3\dot{C}D_2$), *n*-pentyl ($CH_3CH_2CH_2CH_2\dot{C}H_2$), and *n*-pentyl-1,1-$d_2$ ($CH_3CH_2CH_2CH_2\dot{C}D_2$) radicals have been generated in argon matrices by UV irradiation of the corresponding diacyl peroxides. The infrared spectra of the radicals reveal that the vibrational modes may be separated into two parts: the first consists of a number of modes characteristic for the primary radical center; the second consists of those vibrations of the nonradical portion of the chain which appear to be similar to those found for closed-shell hydrocarbons. (8 refs.)

106411 Infrared spectra of matrix-isolated metal complexes of octaethylporphine. J.R.Kincaid (Chem. Dept., Univ. of Kentucky, Lexington, KY, USA), M.W.Urban, T.Watanabe, K.Nakamoto.
J. Phys. Chem. (USA), vol.87, no.16, p.3096-101 (4 Aug. 1983).
High-resolution infrared spectra of divalent metal (Mn, Fe, Co, Ni, Cu, Zn) complexes of octaethylporphine (OEP) obtained at ~15K in argon matrices or as thin films are reported. The spectra of Ni(OEP) and a number of its isotopically substituted analogues are reported, including those of the meso-deuterated and ^{15}N substituted as well as that of the doubly labeled ^{15}N, meso-deuterated species. A thorough discussion of all observed bands is presented. Justification for selection of fundamental modes is given and sensitivity to metal substitution is discussed in terms of structural and bonding alterations. (23 refs.)

106412 Far infrared absorption in normal H_2 from 77 to 298K. P.Dore, L.Nencini (Istituto di Fisica 'G Marconi', Univ. di Roma, Roma, Italy), G.Birnbaum.
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.30, no.3, p.245-53 (Sept. 1983).
The translational-rotational absorption spectrum of normal H_2 has been measured from 80 to 900 cm^{-1} at seven temperatures from 77.4 to 298K. These results have been accurately fitted by a three-parameter line-shape function, thereby providing a reliable way of predicting the absorption of H_2 anywhere in this frequency and temperature region. (13 refs.)

106413 Influence of nature of solvent on IR and NMR spectra of ethyl cyanoacetate and formaldehyde. R.G.Makitra, T.A.Protsailo, I.E.Boldeskul, Z.Z.Rozhkova.
J. Appl. Spectrosc. (USA), vol.37, no.5, p.1272-7 (Nov. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.784-90 (Nov. 1982). [received: Sept. 1983]
The condensation of cyanoacetic acid ester with formaldehyde, which is a particular case of the Knoevenagel reaction, has recently acquired great practical importance as an initial stage of the industrial preparation of cyanoacrylate adhesives. However, the mechanism of this reaction has been insufficiently investigated, and the spectroscopic identification of the active methylene group of cyanoacetates has therefore become increasingly interesting. The authors used IR and NMR spectroscopy to study the character of the influence of the nature of solvents and also of catalysts of the reaction, i.e. organic bases, on the initial reagents of the condensation reaction, so that it is possible to draw definite conclusions on the proposed mechanism of reaction of cyanoacetates with formaldehyde, and also on the selection of optimal solvents for this reaction. (11 refs.)

106414 Infrared absorption spectroscopy of phosphorescing molecules: naphthalene-d_0. K.Nishikida, Y.Kamura, K.Seki, N.Iwasaki, M.Kinoshita (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
Mol. Phys. (GB), vol.49, no.6, p.1505-7 (20 Aug. 1983).
Infrared absorption spectroscopy has recently been applied successfully to the observation of some vibrations of molecules in their phosphorescent triplet state. Clarke et al. (1973) succeeded in discerning a single new peak at 535 cm^{-1} in phosphorescent naphthalene-d_8. More recently, Mitchell et al. (1979, 1981) have observed several absorption peaks in systems containing acridine and phenazine using an argon ion laser as an excitation source. Baiardo et al. (1982) have also succeeded in observing three new peaks in phosphorescent triphenylene using an FT-IR spectrometer. The authors describe their preliminary results, obtained on naphthalene-d_0 in viscous polyethylene of molecular weight of about 2000. (8 refs.)

106415 Influence of the immediate surroundings of solute molecules on their absorption spectra. N.B.Baranova, L.V.Levshin, M.G.Reva, B.D.Ryzhikov (Dept. of General Phys., Phys. Faculty, Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.5, p.7-11 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.5, p.8-12 (1982).
The reasons for the deformation of the absorption spectra of dye molecules with change in their immediate surroundings by the introduction of other molecules—in particular, surfactant molecules—into their solvate shells is considered. It is shown that these changes may be explained on the basis of the idea of the development of the hypochromic effect in dispersional interactions and of the shift in the system of electronic-vibrational levels under the influence of the field of closely spaced molecules. (12 refs.)

106416 Identification of forbidden transitions in the ν_4 band of $^{14}NH_3$ by intracavity laser-Stark spectroscopy. W.H.Weber (Ford Motor Corp., Dearborn, MI, USA), E.A.Cohen.
Opt. Lett. (USA), vol.8, no.9, p.488-90 (Sept. 1983).
Numerous perturbation-allowed transitions in the 6-μm ν_4 NH_3 band are assigned by laser-Stark spectroscopy. The transitions are forbidden in the sense that they follow the rules $\Delta K=\pm 2$, $a \rightleftharpoons s$, in contrast to the allowed transitions in ν_4, which follow the rules $\Delta K=\pm 1$, $a \rightleftharpoons a$, $s \rightleftharpoons s$. These lines indicate the presence of a significant perturbation, which should be included in the analysis of ν_4 and which, through combination relations with allowed transitions, will provide a basis for precisely determining K-dependent energy intervals in NH_3. (14 refs.)

106417 Infrared laser spectroscopy of free radicals and ions. I. The fundamental band of $NF(X^3\Sigma^-)$. P.B.Davies, W.J.Rothwell (Dept. of Phys. Chem., Univ. of Cambridge, Cambridge, England).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1796, p.205-12 (8 Sept. 1983).
The fundamental absorption band of the NF free radical in its $^3\Sigma^-$ ground state has been measured using a tunable diode laser spectrometer. The positions of fifty-one transitions in both P and R branches were accurately calibrated against reference gas lines. Analysis of the spectrum yields a value for the band centre of 1123.2788(30) cm^{-1} and equilibrium rotational parameters: B_e 1.205679(160) cm^{-1}; α_e 0.014889(160) cm^{-1}; D_e $5.6(8)\times 10^{-6}$ cm^{-1}. (27 refs.)

106418 The emission spectrum of PtO between 3800 Å and 8900 Å. U.Sassenberg, R.Scullman (Inst. of Phys., Univ. of Stockholm, Stockholm, Sweden).
Phys. Scr. (Sweden), vol.28, no.2, p.139-59 (Aug. 1983).
The emission spectrum of PtO has been studied between 3800 Å and 8900 Å. In addition to the earlier reported A-X and D-X transitions several new transitions have been analysed. Most of them have either the X state or another state called the x state as their lower state. The X state has the character of a O^+ state, the x state has the character of a 1 state in Hund's coupling case c which together correspond to a $^3\Sigma^-$ state. The X state together with the x state seem to constitute the ground state of PtO. (11 refs.)

106419 Substituent effects in infrared spectroscopy. IX. Intensity of the carbonyl stretching vibration in 4-substituted camphors. C.Laurence, M.Berthelot (Lab. de Spectrochimie Moleculaire, Univ. de Nantes, Nantes, France), D.G.Morris.
Spectrochim. Acta Part A (GB), vol.39A, no.8, p.699-701 (1983).
For pt.VIII see ibid., vol.38A, p.487 (1982). The frequencies ν(CO) and integrated intensities A(CO) of the carbonyl stretching vibrations have been measured in a series of 4-substituted camphors (1)-(11). Whereas ν(CO) is linearly correlated with the inductive substituent constant. A(CO) is insensitive to substitution (except in 4-NO_2 camphor). This demonstrates unambiguously the insensitivity of carbonyl intensities to σ- and field inductive effects and explains the inductive part of the DSP equation applied to ring substituted aromatic carbonyl compounds by a π-inductive effect. (9 refs.)

106420 Substituent effect in infrared spectroscopy. X. 5-substituted acetyl-2-thiophenes. M.Helbert, M.Berthelot, C.Laurence (Lab. de Spectrochimie Moleculaire, Univ. de Nantes, Nantes, France), D.Spinelli, G.Consiglio, C.Arnone.
Spectrochim. Acta Part A (GB), vol.39A, no.8, p.703-7 (1983). In French.
For pt.IX see ibid., vol.39A, no.8, p.699-701 (1983). The shoulders and/or splittings of the carbonyl band of 5-substituted 2-acetyl thiophenes (1-13) are interpreted as a Fermi resonance by means of the solvent variation method. The unperturbed carbonyl frequencies are calculated by the intensity method and checked by correlation analysis of solvent and substituent effects. The acetyl group is more sensitive to substituent effects in acetylthiophenes than in acetylbenzenes, as shown by infrared spectroscopy and by chemical reactivity. (20 refs.)

106421 Effects of neutral and anionic substituents on the carbonyl stretching bands of substituted methylbenzoates. P.J.Vassileva, I.G.Binev, I.N.Juchnovski (Inst. of Organic Chem., Bulgarian Acad. of Sci., Sofia, Bulgaria).
Spectrochim. Acta Part A (GB), vol.39A, no.8, p.709-12 (1983).
Effects of neutral and anionic substituents on frequencies (ν_{CO}) and integrated intensities (A_{CO}) of the carbonyl stretching bands of substituted methylbenzoates (solvent dimethyl sulphoxide) have been studied in relation to Hammett's equation: satisfactory correlations have been found between ν_{CO} and σ^+ constants, as well as by using the dual-parameter equations to Yukawa, Tsuno and Taft; A_{CO} have been found to increase in cases of strong electron-releasing substituents. It has been found that constants of anionic substituents, determined on the basis of nitrile i.r. frequencies and intensities, reflect satisfactorily the effects of these substituents on ν_{CO} and A_{CO} of methylbenzoates. (13 refs.)

106422 High resolution infrared studies of site structure and dynamics for matrix isolated molecules. B.I.Swanson, L.H.Jones (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
In book: *Vibrational spectra and structure. A series of advances. Vol.12*, J.R.Durig [Ed.], p.1-67. Amsterdam, Netherlands: Elsevier (1983), xvi+497 pp. [0 444 42197 1]
The authors present results on matrix-isolated molecules using an FTIR spectrometer. Vibrational and relaxation studies are made using time-resolved absorption and emission measurements. (92 refs.)

Ab initio SCF assignment of vibrational spectra of nitrosomethane .... See Entry 106276

Electronic structure in the intervalence transfer absorption band of a mixed-valence dimer .... See Entry 106284

The $T_3(\pi,\pi^*)$ state of acridine .... See Entry 106322

Porphyrins. XLIV. Electronic states of Co, Ni, Rh, and Pd complexes .... See Entry 106325

Excitation and dissociation of SF_6 molecules in a two-frequency infrared laser field .... See Entry 106478

Temperature dependence of air and oxygen broadening coefficients of O_3 .... See Entry 106505

On certain new apsects of the process of multiphoton excitation in polyatomic molecules .... See Entry 106508

Vibrational spectra of small matrix isolated molecules .... See Entry 106530

Raman scattering of light by stationary nonlinear polarization waves .... See Entry 106822

Alkylammonium hexachlorostannates(IV), $(R_nNH_{4-n})_2SnCl_6$: crystal structure, infrared spectrum and hydrogen bonding .... See Entry 107660

Reversible, light-induced isomerization of matrix-isolated molecules. Nitrosomethanol .... See Entry 109768

33.20F Raman and Rayleigh spectra

(inc. scattering)

106423 Raman spectra of matrix-isolated group IIIA dimers: Ga_2, In_2, Tl_2. F.W.Froben (Inst. fur Molekulphys., Freien Univ. Berlin, Berlin, Germany), W.Schulze, U.Kloss.
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.500-2 (19 Aug. 1983).
Raman spectra of Ga, In and Tl molecules are measured in Ar and Kr matrices. Resonance progressions allow the authors to assign the ground-state vibrational frequencies and anharmonicities: Ga_2 ($\omega_e''=180$ cm^{-1}, $\omega_e x_e''=1$ cm^{-1}), In_2 ($\omega_e''=118$ cm^{-1}, $\omega_e x_e''=0.8$ cm^{-1}), Tl_2 ($\omega_e''=80$ cm^{-1}, $\omega_e x_e''=0.5$ cm^{-1}) in Ar. The dissociation energies of In_2 and Tl_2 are corrected to 20 kcal/mol. and 10 kcal/mol.±10% respectively. (8 refs.)

106424 Observation of transient resonance Raman spectra of the S_1 state of trans-stilbene. H.Hamaguchi, C.Kato, M.Tasumi (Dept. of Chem., Univ. of Tokyo, Tokyo, Japan).
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.3-7 (26 Aug. 1983).
Transient resonance Raman spectra of trans-stilbene in *n*-hexane have been obtained using two pulsed lasers at 266 and 585 nm. The former was used to pump the molecule to the first excited singlet state (S_1) and the latter to probe spontaneous Raman scattering in resonance with the $S_n \leftarrow S_1$ electronic transition. The dependence of the pump and probe laser power, the temporal behaviour, and the excitation profile of the spectra clearly indicate that they are due to the S_1 state of trans-stilbene. (13 refs.)

106425 Revised analysis of the structure of the ν_1 band of methane. H.Frunder, D.Illig, H.Finsterholzl (Sektion Phys., Ludwig Maximilians Univ., Munich, Germany), H.W.Schrotter, B.Lavorel, G.Roussel, J.C.Hilico, J.P.Champion, G.Pierre, G.Poussigue, E.Pascaud.
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.110-14 (26 Aug. 1983).
The CARS spectrum of the ν_1 band of $^{12}CH_4$ at a pressure of 14 mbar was recorded using CW excitation in the cavity of a ring argon ion laser. The analysis of the intensity profile of the observed spectrum led to the detection of inconsistencies with the hitherto proposed calculated positions of transitions with $J=7$ to $J=10$ and to a relocation of the corresponding lines. (26 refs.)

106426 Rotational Raman spectra of a nearly symmetric rotor. M.Nardone (Istituto di Fisica, Univ. di Camerino, Macerata, Italy), M.A.Ricci.
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.1119-37 (July-Aug. 1983).
Rotational Raman spectra for an accidentally or nearly symmetric rotor are discussed in detail. The spectral-moment theory is used to yield expressions for the polarizability invariants and for the different orientational correlation times involved. A generalization of Gordon's J-diffusion is presented which is able to reproduce also spectra in which the quantization of the rotational states is still present. A further generalization of the model is suggested to account for the molecular anisotropy during the collision process. (31 refs.)

106427 Picosecond transient Raman spectroscopy: the photoisomerization of trans-stilbene. T.L.Gustafson, D.M.Roberts, D.A.Chernoff (Standard Oil Co., Corp Res. Center, Warrensville Heights, OH, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.1559-64 (15 Aug. 1983).
The authors measured picosecond transient resonance Raman spectra of t-stilbene in hexane using a high repetition rate, amplified, synchronously pumped dye laser. They assign four vibrational frequencies to the olefinic moiety. Two of these frequencies, 1238 and 1565 cm^{-1}, have broad, asymmetric bands. They attribute this band shape to a distribution of excited state molecular conformers having different single and double bond strengths. (23 refs.)

106428 Theoretical interpretation of the resonance Raman spectrum of gaseous chlorine. F.Ghandour, M.Jacon (Lab. de Recherches Optiques, Univ. de Reims, Reims, France), E.N.Svendsen, J.Oddershede.
J. Chem. Phys. (USA), vol.79, no.5, p.2150-6 (1 Sept. 1983).
A theoretical calculation of the Raman band profiles of gaseous chlorine excited by a 3638 Å line is performed. The resonance part of the Raman amplitude is calculated within a semiclassical approach and the nonresonant part by an ab initio calculation. The profiles of the overtones are well described by considering only the resonant scattering via the excited electronic state $C^1\Pi(1u)$ and the anomalous value of the fundamental band intensity compared to the first overtone is shown to be due to virtual transitions to higher electronic states (normal Raman effect). (17 refs.)

106429 Effects of pressure on conformer equilibria in liquid n-hexane. P.T.T.Wong, H.H.Mantsch (Div. of Chem., Nat. Res. Council of Canada, Ottawa, Ontario, Canada), R.G.Snyder.
J. Chem. Phys. (USA), vol.79, no.5, p.2369-74 (1 Sept. 1983).
From a study of the dependence of the polarized Raman spectra of liquid n-hexane (30°C) on pressure (0.26-7.38 kbar), the authors have confirmed the findings of Schoen et al. [Nature 270, 412, 1977] that pressure is effec-

tive in perturbing the distribution of conformers. However, their results on the behavior of the gauche forms differ from these authors. They find that increased pressure decreases the concentration of the ttt conformer and increases the concentrations of both the single- and double-gauche forms. Surprisingly, the pressure dependence of the single- and double-gauche conformers is nearly the same. Thus while the volume change for ttt→gtt is found to be about -1.1 ± 0.0 cm^3/mol, that for the single-gauche to double-gauche conversion is about 0.0 ± 0.0 cm^3/mol. These results appear to rule out a simple additivity model for the n-alkanes in which CC bonds respond independently to pressure. Their measurements also suggest that the concentration of the all-trans conformer in liquid n-hexane is significantly higher than the value obtained from the rotational-isomeric-state model with E_g and $E_{gg'}$ equal to the widely used values of 500 and 3000 cal/mol. (16 refs.)

106430 Rotational R-branch Raman spectroscopy in CO_2 (comment and reply). K.Altmann, W.Klocker, G.Strey, H.Finsterholzl, H.W.Schrotter (Sektion Phys., Ludwig Maximilian's Univ., Munchen, Germany), H.P.Godfried, L.F.Silvera.
J. Chem. Phys. (USA), vol.79, no.5, p.2490 (1 Sept. 1983).
Godfried and Silvera's Raman intensity measurements in the R branch of the pure rotational spectrum of vibrationally excited CO_2 molecules in a supersonic molecular beam (ibid., vol.78, no.1, p.121, 1983) are discussed. Altmann et al. point out that these R-branch lines have already been observed, in static samples, by Barrett and Weber (1970) and Wang (1975). They also site earlier work by Altmann, Klockner, and Strey (1976) and by Finsterholzl (1982). Godfried and Silvera reply, stating that they did not claim the first observation of the R-branch lines. They did refer to the work of Barrett and Weber and Wong, although they were not aware of the work of Altmann et al. They did claim to have fully resolved the R-branch transitions for the first time. They point out that their work revealed the existence of overlapping spectra due to national abundance isotopes ^{17}O and ^{18}O in CO_2, and other new information. (10 refs.)

106431 Unusual coordination and metal-ligand geometry of a vanadyl porphyrin in aqueous solution. J.A.Shelnutt, M.M.Dobry (Div. of Chem., Phys. of Organic Materials, Sandia Nat. Labs., Albuquerque, NM, USA).
J. Phys. Chem. (USA), vol.87, no.16, p.3012-15 (4 Aug. 1983).
Vanadyl uroporphyrin I in aqueous alkaline solution has considerably modified absorption and resonance Raman spectra when compared with vanadyl porphyrins in organic solvents or in the crystalline state. Under these latter conditions vanadyl porphyrins are known contain 5-coordinate, out-of-plane vanadium(IV). The unusual spectra of vanadyl uroporphyrin in water can be converted to spectra typical of the 5-coordinate vanadyl porphyrins by formation of π-π complexes or by π-π dimerization. Because π-π complex formation and dimerization block addition of an axial sixth ligand a 6-coordinate, in-plane dihydroxide vanadium(IV) uroporphyrin complex is indicated. This hypothesis is consistent with an analysis of the frequencies of the core-size marker lines of metalloporphyrins indicating expansion of the metal core by 0.03-0.04 Å in $V(OH)_2$UroP. (23 refs.)

106432 Resonance Raman investigation of the π^* antibonding distribution in excited triplet aqueous *p*-benzoquinone. R.Rossetti, S.M.Beck, L.E.Brus (Bell Labs., Murray Hill, NJ, USA).
J. Phys. Chem. (USA), vol.87, no.16, p.3058-61 (4 Aug. 1983).
The time-resolved resonance Raman spectra of triplet *p*-benzoquinone in water have been investigated at 266, 315, 355, and 416 nm. Recent improvements in the apparatus are described. The C=C ring stretch (Wilson's 8a) and the symmetric C=O stretch are tentatively identified, using the isotopic shift for ring deuteration and comparison with the semiquinone radical anion. The symmetric carbonyl stretch at 1496 cm^{-1} is unusually high for an n-π^* excited state. The C=C ring stretch at 1552 cm^{-1} is unusually low for a quinoid type species. These results indicate that there is π^* antibonding density on the ring as well as on the carbonyl groups. Comparison is made with previous $S_0 \rightarrow T_1$ vibronic electronic absorption studies in neon matrices. (18 refs.)

106433 Spectroscopic and theoretical studies of binuclear molybdenum(II) carboxylates. M.C.Manning, G.F.Holland, D.E.Ellis, W.C.Trogler (Dept. of Chem., Northwestern Univ., Evanston, IL, USA).
J. Phys. Chem. (USA), vol.87, no.16, p.3083-8 (4 Aug. 1983).
Electronic absorption spectra of $Mo_2(O_2CCF_3)_4$ and $Mo_2(O_2CH)_4$ have been measured at 10K in inert matrices. Results are compared with previous studies of $Mo_2(O_2CCH_3)_4$. Raman spectra of the three carboxylate complexes have been measured and assigned. Unlike $Mo_2Cl_8{}^{4-}$ or $Re_2Cl_8{}^{2-}$ resonance enhancement of the metal-metal stretch did not occur when the lowest energy absorption band was irradiated; preresonance enhancement of a carboxylate stretching vibration did occur. Certain aspects of the SCF-Xα-DV calculations for $Mo_2(O_2CH)_4$ agree better with previous HF calculations than with SCF-Xα-SW results. The sensitivity of the π-π^* separation to metal-metal distance may explain these differences. Energies of both the singlet and triplet $\delta \rightarrow \delta^*$, $\delta \rightarrow \pi^*$, $\sigma \rightarrow \delta^*$, and $\delta \rightarrow \pi^*$ (OCO) transitions have been calculated and compared with the optical spectra. (41 refs.)

106434 Time-resolved resonance Raman observation of tetrafluoro-*p*-benzosemiquinone anion radical. G.N.R.Tripathi, R.H.Schuler (Dept. of Chem., Univ. of Notre Dame, Notre Dame, IN, USA).
J. Phys. Chem. (USA), vol.87, no.16, p.3101-5 (4 Aug. 1983).
Time-resolved resonance Raman spectroscopy has been used to examine tetrafluoro-*p*-benzosemiquinone radical anion produced in the pulse radiolytic oxidation of tetrafluorohydroquinone in aqueous solution. This radical is much more reactive than *p*-benzosemiquinone and is observed to decay on the millisecond time scale in both Raman and pulse radiolytic experiments. For the Raman experiments excitation was on the red edge of the moderately strong absorption band of this radical at 430 nm. Two resonance-enhanced Raman bands are exhibited at 1556 and 1677 cm^{-1} and are assigned to the in-phase CO and symmetrical CC stretch vibrations. These frequencies are considerably higher than the corresponding values of 1435 and 1620 cm^{-1} observed in this radical's protonated counterpart. The relatively large increase in the CO stretch frequency, in particular, indicates that fluorination induces a substantial increase in the quinoid character of this radical. (12 refs.)

106435 Raman study of CF_4 in liquid Ar: molecular motions and transition dipole interaction. P.Nectoux, M.Drifford, L.Belloni, A.Vinit (Dept. de Phys. Chimie, CENS, Gif-sur-Yvette, France).
Mol. Phys. (GB), vol.49, no.6, p.1375-84 (20 Aug. 1983).
The rotational behaviour of CF_4 dissolved in liquid argon is derived from the band contour analysis of Raman spectra recorded over the concentration range from 10^{-2} mole fraction to 1 mole fraction at 85K. The angular momentum correlation times have been determined with the help of the *J*-diffusion model and used to apply the rough hard sphere model. A study of the transition dipole-transition dipole (TD-TD) interaction is made using the ν_3 mode at 85K for different concentrations. (23 refs.)

Thermometry by CARS in an automobile engine .... See Entry 105324

Raman difference spectroscopy .... See Entry 105387

Some problems on the structure of molecules in the electronic excited states as studied by resonance Raman spectroscopy .... See Entry 106331

The dependence of the *Q*-branch contour of Raman spectra of water vapour on temperature .... See Entry 110555

33.20K Visible spectra

106436 High vibrational overtones in $SiHCl_3$ and SiH_2Cl_2. R.A.Bernheim, F.W.Lampe, J.f.O'Keefe (Dept. of Chem., Pennsylvania State Univ., University Park, PA, USA), J.R.Qualey,III.
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.45-50 (26 Aug. 1983).
Absorption spectra in the 12000-18000 cm^{-1} range has been recorded for gaseous $SiHCl_3$ and SiH_2Cl_2 using intracavity photoacoustic detection and CW dye lasers. The observed transitions correspond to the $\Delta v = 6$, 7, 8 and 9 overtones of the Si-H stretch and are adequately interpreted in terms of a local mode description of the vibration. (31 refs.)

106437 Low excitation energy band of 4-hydroxyazobenzene derivatives. M.R.Mahmoud, S.A.Ibrahim, M.A.Hamed (Chem. Dept., Faculty of Sci., Assiut Univ., Assiut, Egypt).
Spectrochim. Acta Part A (GB), vol.39A, no.8, p.729-33 (1983).
The low excitation energy band appeared in the electronic spectra of some 4-hydroxyazobenzene derivatives is assigned to an electronic transition of the type *n*-π^*. It is concluded that 4-hydroxyazobenzene derivatives exist mainly in the true azo form. On the other hand, the visible spectra of the azo compound; 4-hydroxy-2-carboxyazobenzene is interpreted on the basis that this compound exists in a tautomeric equilibrium of the type azo⇄hydrazone, originating from the carboxyl group at the ortho position to the azo one. (10 refs.)

A theoretical investigation of the radiative properties of the CN red and violet systems .... See Entry 106308

Cross-quadratic terms involving modes of different symmetry in the nuclear potential of metalloporphyrins .... See Entry 106323

Porphyrins. XLIV. Electronic states of Co, Ni, Rh, and Pd complexes .... See Entry 106325

The emission spectrum of PtO between 3800 Å and 8900 Å .... See Entry 106418

Unusual coordination and metal-ligand geometry of a vanadyl porphyrin in aqueous solution .... See Entry 106431

Spectroscopic and theoretical studies of binuclear molybdenum(II) carboxylates .... See Entry 106433

Electric field effects on the absorption spectra of H_2 near the ionization limit .... See Entry 106438

Laser excitation spectrum and microwave optical double resonance spectrum of the $3_0{}^1$ band in the $\tilde{a}^3A_2$-$\tilde{X}^1A_1$ system of H_2CS: the hyperfine structure of the $\tilde{a}^3A_2$ state .... See Entry 106479

Non-linear Stark polarization spectroscopy .... See Entry 106480

Temperature dependence of J-band aggregate of the dye 1,1′-diethyl-2,2′-cyanine bromide studied by steady-state and time-resolved picosecond fluorescence spectroscopy .... See Entry 106488

Homogeneous linewidth and optical dephasing of the $S_1 \leftarrow S_0$ transition of magnesium porphin in an *n*-octane crystal: a study by transient and photochemical hole-burning .... See Entry 106502

Excited state dipole moments of some monosubstituted benzenes from solvent effect on electronic absorption spectra .... See Entry 106630

Spectral properties of flavins in hydrophilic matrices .... See Entry 109777

Photoselection of conformational substrates and the hyposochromic photoproduct of rhodopsin .... See Entry 109780

33.20L Ultraviolet spectra

106438 Electric field effects on the absorption spectra of H_2 near the ionization limit. J.W.Copper, E.B.Saloman, B.E.Cole, Shardanand (NBS, Washington, DC, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1832-4 (Sept. 1983).
The absorption cross section of H_2 has been measured in the region between 77.5 and 82.4 nm and the effects of electric fields up to 20 kV/cm on the cross sections have been investigated. The apparent cross section is found to be increased in the neighborhood of optically allowed transitions to $np\sigma\,^1\Sigma_u{}^+$ and $np\pi\,^1\Pi_u$ states with $n = 4$-7. This increase in absorption is attributed to field mixing with nearby optically forbidden states. (5 refs.)

106439 The spectra of $^{74}Ge^{16}O$ and $^{74}Ge^{18}O$ in the vacuum ultraviolet region. O.Appelblad, S.Fredin, A.Lagerqvist (Inst. of Phys., Univ. of Stockholm, Stockholm, Sweden), F.Alberti.
Phys. Scr. (Sweden), vol.28, no.2, p.160-70 (Aug. 1983).
Five band systems of the absorption spectra of the two isotopic molecules $^{74}Ge^{16}O$ and $^{74}Ge^{18}O$ in the vacuum ultraviolet region have been rotationally and vibrationally analyzed. A number of perturbations have been observed and from one of these, rotational constants for the perturbing state have been derived. Molecular constants of the upper states are given. (14 refs.)

Cross-quadratic terms involving modes of different symmetry in the nuclear potential of metalloporphyrins .... See Entry 106323

Porphyrins. XLIV. Electronic states of Co, Ni, Rh, and Pd complexes .... See Entry 106325

The emission spectrum of PtO between 3800 Å and 8900 Å .... See Entry 106418

Natural and magnetic circular dichroism spectra of selenofenchone. Evidence for a singlet-triplet component of the n→π^* transition of selenoketones .... See Entry 106482

Shift and quenching of fluorescence of tetrahydronaphthols due to hydrogen bonding .... See Entry 106486

Temperature dependence of J-band aggregate of the dye 1,1′-diethyl-2,2′-cyanine bromide studied by steady-state and time-resolved picosecond fluorescence spectroscopy .... See Entry 106488

Homogeneous linewidth and optical dephasing of the $S_1 \leftarrow S_0$ transition of magnesium porphin in an *n*-octane crystal: a study by transient and photochemical hole-burning .... See Entry 106502

Intensity measurements in the (A-X) band system of CO .... See Entry 106507

Resonance-enhanced multiphoton ionization (2+1) of the $\tilde{B}$ and $\tilde{C}'$ states of ammonia .... See Entry 106511

Photoabsorption and photoionization of HD ....See Entry 106516

Excited state dipole moments of some monosubstituted benzenes from solvent effect on electronic absorption spectra ....See Entry 106630

Photoselection of conformational substrates and the hyposochromic photoproduct of rhodopsin ....See Entry 109780

33.20R X-ray spectra

Auger-electron study of correlation effects in $3d^{-1}$ and $4d^{-2}$ states of Cs in atomic Cs and molecular CsI ....See Entry 106375

EXAFS study of Ni-Cl bonding in Ni(11) aqueous solutions at increasing Cl^-/Ni^{2+} ratios ....See Entry 109048

33.25 NUCLEAR MAGNETIC RESONANCE AND RELAXATION; NUCLEAR QUADRUPOLE RESONANCE (NQR)

106440 Dynamic stereochemistry of 2,3,12,13-tetrathia- and -tetraselena[4,4]metacyclophanes. K.R.Dixon, R.H.Mitchell (Dept. of Chem., Univ. of Victoria, Victoria, BC, Canada).
Can. J. Chem. (Canada), vol.61, no.7, p.1598-602 (July 1983).
2,3,12,13-tetrathia- and -tetraselena[4,4]metacyclophanes exhibit temperature dependent ^{1}H NMR spectra in which the methylene resonances change from AB spectra in the low temperature limit to singlets at higher temperatures. Coalescence temperatures are 256 and 208K, respectively, and a complete line-shape analysis yields $\Delta G_{298}{}^{0\neq}$ (thia)=53.2 kJ mol^{-1} and $\Delta G_{298}{}^{0\neq}$ (selena)=46.5 kJ mol^{-1}. The spectra and thermodynamic data are interpreted in terms of a mechanism involving interconversion of *syn* conformers with little or no involvement of the *anti* conformers previously assumed to dominate in this type of molecule. (23 refs.)

106441 ^{13}C NMR of stable imidazoline nitroxides. I.A.Grigor'ev, L.B.Volodarsky (Inst. of Organic Chem., Novosibirsk, USSR), A.Z.Gogolev, R.Z.Sagdeev.
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.19-23 (26 Aug. 1983).
^{13}C NMR spectra of the 15 stable imidazoline nitroxides have been studied. It has been shown that introduction of the N-oxide oxygen atom to the 3 position is most favourable for penetration of the spin density to the C=N group of the imidazoline cycle, and for its effective migration about the conjugated π-system at long distances. (8 refs.)

106442 The interaction of lanthanide shift reagents with cationic sites: a ^{1}H and ^{13}C NMR study of the solution geometry of nicotine N-methiodide. R.L.Bassfield (Philip Morris USA Res. Center, Richmond, VA, USA).
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4168-72 (29 June 1983).
The use of lanthanide shift reagents as proton and carbon-13 NMR shift and relaxation probes has enabled the determination of the solution geometry of the nicotine *N*-methiodide complex. A series of experiments were performed to illustrate the applicability of induced shift and T_1 relaxation data derived from the interaction between Ln(fod)$_3$ and a quaternary ammonium salt. The results indicate that the lanthanide/anion moiety complexes with quaternary salts via the positively charged center and adheres principally to the pseudocontact model. (28 refs.)

106443 Experimental and theoretical studies of ^{13}C-^{13}C coupling constants. I. Conformational and substituent dependencies of long range coupling constants ^{4}J(^{13}C-^{13}C). S.R.Walter (Dept. of Chem., Univ. of Arizona, Tucson, AZ, USA), J.L.Marshall, C.R.McDaniel,Jr., E.D.Canada,Jr., M.Barfield.
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4185-90 (29 June 1983).
The series of ^{13}C-labeled 1- and 2-substituted adamantanes and 2-substituted bornanes were synthesized, and their ^{13}C NMR parameters were accurately measured. Of particular interest are the long range intercarbon coupling constants over four saturated bonds $^4J(^{13}\text{C-C-C-C-}^{13}\text{C})$. Depending on conformational and substituent factors, these coupling constants have magnitudes ranging from 0.1 to 0.73 Hz in the compounds investigated. Because of their relatively small values, the *J*-resolved technique of two-dimensional Fourier transform NMR was important for many of the measurements. In contrast to interproton coupling constants over four saturated bonds, $^4J_{HH'}$, the maximum values of $^4J_{CC'}$ are obtained in those conformations in which the coupled atoms are in closest proximity, rather than in the all-trans arrangements for which the $^4J_{CC'}$ are 0.3-0.6 Hz. Calculated results for the Fermi contact contributions to $^4J_{CC'}$, which were based on the INDO-FPT molecular orbital method, are in exceedingly good agreement with the experimental values. As a consequence, it appears that the computational methods improve as the coupled atoms are further separated, and that the long range coupling constants will be useful for spectral assignments. (44 refs.)

106444 Experimental and theoretical studies of ^{13}C-^{13}C coupling constants. II. Conformational and substituent dependencies of geminal coupling constants ^{2}J(^{13}C-^{13}C). M.Barfield, S.R.Walter (Dept. of Chem., Univ. of Arizona, Tucson, AZ, USA).
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4191-5 (29 June 1983).
For pt.I see ibid., vol.105, no.13, p.4185 (1983). To investigate the importance of conformational and substituent factors on geminal ^{13}C-^{13}C coupling constants $^2J_{CC'}$, use is made of both molecular orbital (MO) and valence-bond (VB) techniques. The MO results qualitatively reproduce certain trends due to hybridization, substituents, and bond angle effects, but even these trends appear to be lost in highly strained systems. By means of a VB bond-order formulation for coupling constants, it is demonstrated that $^2J_{CC'}$ is proportional to differences of geminal and vicinal ^{1}H-^{1}H or ^{13}C-^{1}H coupling constants. In the case of geminal ^{13}C-^{13}C coupling involving a methyl group, the dihedral angle dependence disappears, and the relatively small observed magnitudes indicate that the geminal term is effectively cancelled by the several vicinal terms. Substituents at C2 affect $^2J_{CC'}$ in a manner completely analogous to $^2J_{CH}$ and $^2J_{HH'}$. However, the VB formulation shows that substituents at C1 (or C3) should lead to an angular dependence of the vicinal type. In the case of OH substituents the equation $^2J_{CC'}(\phi')=1.7\cos^2\phi'\text{-}0.9\cos\phi'\text{-}1.9$ provides an excellent correlation of the available experimental data. (34 refs.)

106445 Side-chain vs. main-chain conformational flexibility in aromatic dipeptides. V.Rizzo, H.Jackle (Tech.-Chem. Lab., ETH-Zentrum, Zurich, Switzerland).
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4195-205 (29 June 1983).
The ^{1}H NMR and CD spectra of Ac-Trp-Trp-NHMe, Ac-Phe-Phe-NHMe, and Ac-Tyr-Tyr-NHMe in either 2,2,2-trifluoroethanol (TFE) or tetrahydrofuran (THF) have been recorded down to subzero temperatures. The results indicate a preferentially folded structure in TFE and an extended one in THF solutions as a common feature for the main chain of the three dipeptides, the evidence being strongest for the case of Ac-Trp-Trp-NHMe. An analysis of the conformational space of this latter molecule helps in delineating four low-energy structures for the peptide backbone, which include three extended conformers and one folded conformer (β-turn, type III). For each of these low-energy structures (only two in the case of Ac-Phe-Phe-NHMe and Ac-Tyr-Tyr-NHMe), ensembles of conformers have been generated comprising many different possible geometries of the side chains. Populations of side-chain rotamers, ring-current effects, coupling constants ($J_{C\alpha HNH}$), and CD spectra have been calculated for each ensemble at 200K and then compared with experimental results obtained at the lowest possible temperature. (63 refs.)

106446 Conformational analysis by NMR spectrometry of the highly substituted cyclic tetrapeptides, chlamydocin and Ala^4-chlamydocin. Evidence for a unique amide bond sequence in dimethyl-d$_6$ sulfoxide. M.Kawai, R.D.Jasensky, D.H.Rich (School of Pharmacy, Univ. of Wisconsin, Madison, WI, USA).
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4456-62 (29 June 1983).
The solution conformations of chlamydocin, cyclo(Aib-Phe-D-Pro-L-Aoe), and Ala^4-chlamydocin, cyclo(Aib-Phe-D-Pro-L-Ala), have been investigated by ^{1}H and ^{13}C nuclear magnetic resonance spectroscopy in dimethyl-d_6 sulfoxide. Two conformations of these molecules are present in ratios of approximately 6:4. The conformers interconvert slowly on the NMR time scale, and this slow interconversion is due to a cis-trans isomerization of one amide bond. The 12-membered ring system of conformer I in dimethyl-d_6 sulfoxide is characterized by four transoid amide bonds, with two bis γ-turn intramolecular hydrogen bonds. Conformer II, which is found only in mixed solvents that contain high concentrations of Me$_2$SO, has a cis,trans,trans,trans amide bond sequence. Low-temperature NOE was utilized to determine amide bond geometry in conformer II. Circular dichroism data in different solvents are recorded. Approximate torsional angles of the minor conformer (conformer II) derived from the NMR data and Dreiding models are Aib $\phi+70°$, $\psi+75°$, $\omega-160°$; Phe $\phi+150°$, $\psi-105°$, $\omega+20°$; D-Pro $\phi+85°$, $\psi-140°$, $\omega+165°$; Ala (Aoe) $\phi-105°$, $\psi+80°$, $\omega-160°$, respectively. The cis,trans,trans,trans ring conformation of a cyclic tetrapeptide has not been described previously. (35 refs.)

106447 Isotope effects of benzylic deuterons on chemical shifts of ortho carbons. Correlation with π-bond orders as an indication of a hyperconjugative contribution. L.Ernst (Gesellschaft fur Biotechnol. Forschung, Braunschweig, Germany), H.Hopf, D.Wullbrandt.
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4469-70 (29 June 1983).
The authors investigated the influence of benzylic deuterons on ortho carbon shifts in a series of compounds in which there is a large variation of double-bond character between C_{ipso} and C_{ortho}, but a very similar steric environment of the trideuteromethyl groups. If conjugation or hyperconjugation to some degree influences the sizes of the isotope shifts over three bonds, $^3\Delta$, then one would expect them to depend on the pi-bond order, P_π of the C_{ipso}-C_{ortho} bonds in the same way as regular ortho substituent chemical shifts vary with P_π. For the compounds investigated, the $^3\Delta$ values correlate very strongly with the π-band order. (14 refs.)

106448 Indirect measurement of scalar spin-spin coupling between chemically equivalent hydrogen nuclei. V.Rutar (Dept. of Chem., Univ. of Missouri, Columbia, MO, USA).
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4496-7 (29 June 1983).
Accurate measurements of all scalar (*J*) coupling constants between nuclear spins are very important for studies of molecular conformations. Since coupling between chemically (and magnetically) equivalent hydrogen nuclei does not appear in ^{1}H NMR spectra, a special measuring procedure was developed. It is based on the fact that isotopic labeling removes magnetic equivalence and the *J* coupling shows up in the fine splitting of satellite lines arising from natural abundance ^{13}C spins. The author describes an alternative technique that utilizes correlated motion of ^{13}CH spin pairs. (9 refs.)

106449 NMR spectroscopy of cyclohexane. Gas-phase conformational kinetics. B.D.Ross, N.S.True (Dept. of Chem., Univ. of California, Davis, CA, USA).
J. Am. Chem. Soc. (USA), vol.105, no.15, p.4871-5 (27 July 1983).
Gas-phase ^{1}H NMR spectra of cyclohexane display dynamic line-shape effects which are both temperature and pressure dependent. Gas-phase inversion rates are slower and activation parameters are higher than those observed for liquid-phase samples. At 253K chair-chair inversion rates range from 309 to 1290 s^{-1} for samples containing 1 torr of cyclohexane and from 100 to 2500 torr of SF$_5$. The gas-phase unimolecular activation parameters for the chair to transition-state reaction are $E_{act}(\infty)$, 12.5 (5) kcal/mol; $\Delta H^\ddagger$, 12.1 (5) kcal/mol; $\Delta G\ddagger$, 10.4 (2) kcal/mol; and $\Delta S\ddagger$, 5.7 (5) eu. The bimolecular energy is 11.2 (5) kcal/mol. The large value of $\Delta S\ddagger$ and the difference between the unimolecular and bimolecular activation energies are consistent with proposed freely pseudorotating transition-state models. The pressure dependence of the inversion rate agrees with RRKM calculations assuming a freely pseudorotating transition state, indicating stochastic intramolecular vibrational relaxation in cyclohexane as ca. 11.5 kcal/mol, where there are ca. 1300 vibrational states per cm^{-1}. (49 refs.)

106450 ^{17}O NMR as a tool for studying oxygenated transition-metal derivatives: first direct ^{17}O NMR observations of transition-metal-bonded peroxidic oxygen atoms. Evidence for the absence of oxo-peroxo oxygen exchange in molybdenum(VI) compounds. M.Postel, C.Brevard, H.Arzoumanian, J.G.Riess (Lab. de Chimie Minerale Moleculaire, CNRS, Nice, France).
J. Am. Chem. Soc. (USA), vol.105, no.15, p.4922-6 (27 July 1983).
High-resolution ^{17}O NMR observations of peroxidic oxygen atoms bonded to transition metals are reported for ^{17}O-enriched oxoperoxomolybdenum(VI) derivatives as well as for nonenriched alkylperoxo derivatives of platinum. The chemical shifts of the oxo group are reported. The results are interpreted to evaluate the practicability of ^{17}O NMR as a tool to investigate the oxygen chemistry of the transition elements. In the case of the oxo-peroxo Mo(VI) derivative, direct ^{17}O NMR evidence is given that the oxo and peroxo groups do not exchange. (21 refs.)

106451 Secondary isotope multiplet NMR spectroscopy of partially labeled entities. Carbon-13 SIMPLE NMR of carbohydrates. J.C.Christofides, D.B.Davies (Dept. of Chem., Birkbeck Coll., London, England).
J. Am. Chem. Soc. (USA), vol.105, no.15, p.5099-105 (27 July 1983).
^{13}C NMR measurements have been made in Me$_2$SO-d_6 solutions of some carbohydrates (methyl α-D-gluco- and galactopyranosides, melibiose, maltose, and β-cyclodextrin) in which exchangeable protons have been partially deuterated. Signals from single carbon atoms are observed as a series of multiplets (singlets to octets) with intensity ratios that very quantitatively with OH:OD ratios. Partial deuteration of exchangeable protons in molecules permits direct observation of the different isotopomers measured under conditions of slow exchange and the resonance line separations can be analyzed in terms of the two-bond (β) and three-bond (γ) isotope effects that contribute to the deuterium-induced secondary isotope shift. Signal multiplets and magnitudes of isotope effects are used to assign the spectra of carbohydrates as shown for both α- and β-forms of the α1-$\longrightarrow$6 linked (melibiose) and α1$\longrightarrow$4-linked (maltose) reducing disaccharides. (35 refs.)

106452 Nuclear magnetic resonance and PCILO study of the side-chain conformations in *m*-anisaldehyde and 2,5-dimethyloxybenzaldehyde. M.A.Natiello, R.H.Contreras, J.C.Facelli, D.G.de Kowalewski (Dept. de Fisica, Univ. de Buenos Aires, Buenos Aires, Argentina).
J. Phys. Chem. (USA), vol.87, no.14, p.2603-7 (7 July 1983).
A meta effect on the methoxy-group conformation is studied from both an experimental and a theoretical point of view. Experimental NMR data show that, while in *m*-anisaldehyde (I) both side-chain groups undergo a restricted rotation, in 2,5-dimethoxybenzaldehyde (II) the methoxy group in ring position 5 is held fixed in a cis conformation with respect to the aldehyde group, which in turn, presents a carbonyl cis conformation toward that methoxy group. PCILO calculations follow quite closely, in a qualitative sense, all observed trends. (28 refs.)

106453 Structure and dynamics of molecular rotation of 2-pyridone in toluene and methanol by carbon-13 nuclear magnetic resonance. J.Guillerez, B.Tiffon, B.Anclan, J.Aubard, J.E.Dubois (Inst. de Topologie et de Dynamique des Systemes, Univ.-Paris VII, Paris, France).
J. Phys. Chem. (USA), vol.87, no.16, p.3015-17 (4 Aug. 1983).
The structure and dynamics of molecular rotation of 2(1*H*)-pyridone and 1-methyl-2(1*H*)-pyridone in toluene and methanol have been investigated at 305K by ^{13}C NMR. Both chemical shifts and relaxation times show that 2-pyridone forms stable hydrogen-bonded complexes in methanol, reorientating as a proper unit taking with it two solvent molecules. It follows that the lifetimes of these complexes are greater than the rotational correlation time scale-10^{-11}-10^{12} s. (18 refs.)

106454 Rotation barriers of amides in the gas phase. M.Feigel (Dept. of Chem. & Biology, Univ. of Bremen, Bremen, Germany).
J. Phys. Chem. (USA), vol.87, no.16, p.3054-8 (4 Aug. 1983).
The line shape analysis of the gas-phase ^{1}H NMR spectra of six *N,N*-dialkylamides ($R'CONR_2$: $R=CH_3$, $R'=F$, Cl, CH_3, CF_3; $R=i\text{-Pr}$, $R'=CH_3$; $R=C_2H_5$, $R'=H$) and of *N,N*-dimethylthioacetamide give standard free energies of activation which are at least 1-2.3 kcal/mol smaller than the values in various solvents reported previously. The differences are not correlated with the structure and the barrier heights of the amides. In liquids, dipolar interactions and the internal pressure of the solvent increase the rigidity of the amide bond. (31 refs.)

106455 Nuclear electric hexadecapole coupling constant in antimony trichloride. H.Gotou (Inst. of Phys., Univ. of Tsukuba Sakura, Ibaraki, Japan).
J. Magn. Resonance (USA), vol.54, no.1, p.36-45 (Aug. 1983).
The electric hexadecapole coupling constant of ^{123}Sb (nuclear spin $I={}^{7}/_{2}$) in $SbCl_3$ was determined from the accurate measurement of three nuclear quadrupole resonance frequencies, $\nu_1(\pm{}^{1}/_{2}\text{-}\pm{}^{3}/_{2})$, $\nu_2({}^{3}/_{2}\text{-}\pm{}^{5}/_{2})$, $\nu_3(\pm{}^{5}/_{2}\text{-}\pm{}^{7}/_{2})$ at the same sample temperature. To avoid error produced from the change of the sample temperature, ν_1 and ν_2, or ν_2 and ν_3 were alternately and repeatedly measured as quickly as possible, and the relations between them were determined. To measure the NQR frequency quickly without the disturbance by a marker signal, two marker signals were displayed on both sides of the NQR signal. A method to evaluate the real NQR frequency from a slightly asymmetric lineshape was introduced. As a result, three NQR frequencies were determined at each sample temperature. The values of the hexadecapole coupling constant eMm, quadrupole coupling constant eQq, and asymmetry parameter η, were found as follows: when $\nu_2=67.732$ MHz, $eMm=109.8\pm60.6$ kHz, $eQq=480.5177$ MHz, and $\eta=0.1593909$. (14 refs.)

106456 A simple two-dimensional measurement of the decoupler power during continuous homonuclear irradiation for the correction of Bloch-Siegert shifts. R.V.Hosur (Inst. fur Molekularbiologie und Biophys., Eidgenossische Tech. Hochschule Zurich, Zurich, Switzerland), R.R.Ernst, K.Wuthrich.
J. Magn. Resonance (USA), vol.54, no.1, p.142-5 (Aug. 1983).
Recent applications of two-dimensional (2D) ^{1}H NMR techniques for studies of H_2O solutions of biological macromolecules showed that paraticularly favorable conditions for suppression of the solvent line could be achieved with the use of continuous water irradiation at all times except during the observation period, t_2. Adverse effects with this solvent suppression scheme were experienced since irradiation during the evolution time, t_1, may cause intolerably strong Bloch-Siegert shifts which distort the 2D spectrum in the vicinity of the suppressed solvent line. The authors propose to apply the solvent irradiation during t_1 and to use a mathematical correction for the Bloch-Siegert shifts after the two-dimensional Fourier transformation. They describe a simple experiment for the required accurate measurement of the RF field amplitude during continuous irradiation and illustrate the use of a numerical correction of the Bloch-Siegert shifts in 2D NMR spectra. (7 refs.)

106457 Binomial solvent suppression. D.L.Turner (Dept. of Chem., Southampton Univ., Southampton, England).
J. Magn. Resonance (USA), vol.54, no.1, p.146-8 (Aug. 1983).
The Redfield 2-1-4 pulse has long enjoyed unrivaled popularity amongst chemists interested in observing exchangeable protons of compounds in dilute aqueous solution using Fourier transform NMR. The problem of dynamic range in the presence of an intense H_2O peak is neatly avoided by not exciting the water protons, and to this end the pulse sequence was designed to have as clean a hole in its power spectrum as was compatible with convenience. The measure of its success is that the suppression ratios achieved, ca. 100:1, were probably limited primarily by spectrometer stability and, although cleaner power spectra could be generated, they were little used. The author commends the next row of Pascal's triangle as a still better compromise between efficiency and complexity. (9 refs.)

106458 The 1-1 hard pulse: a simple and effective method of water resonance suppression in FT ^{1}H NMR. G.M.Clore, B.J.Kimber, A.M.Gronenborn (Div. of Molecular Pharmacology, Nat. Inst. for Medical Res., London, England).
J. Magn. Resonance (USA), vol.54, no.1, p.170-3 (Aug. 1983).
In protein and nucleic acid NMR, the study of exchangeable protons can provide a wealth of structural information. In general, however, such protons undergo rapid deuterium exchange so that ^{1}H NMR spectra must be recorded in H_2O rather than D_2O. Because the concentration of solute protons ($\sim$1 m*M*) is so much smaller than that of the water protons ($\sim$110 *M*), methods of solvent suppression must be used to overcome the dynamic range and digitization problems imposed by a limited computer word length. The authors present a novel, very simple, and highly effective time-shared hard pulse method for water resonance suppression, the 1-1 pulse. (8 refs.)

106459 Natural abundance ^{15}N NMR of boron-nitrogen compounds: sign and magnitude of $^{1}J(^{15}N^{11}B)$ in tris(methylamino)borane. B.Wrackmeyer (Inst. fur Anorganische Chem., Univ. Munchen, Munchen, Germany).
J. Magn. Resonance (USA), vol.54, no.1, p.174-6 (Aug. 1983).
The efficient relaxation of the ^{11}B nucleus ($I={}^{3}/_{2}$) by electric quadrupole interactions hampers the determination of indirect nuclear spin-spin coupling constants between boron and other elements $^{1}J(^{11}BX)$. This applies in particular to the situation where a three-coordinate ^{11}B nucleus (large electric field gradient) is linked to other quadrupolar nuclei (e.g., ^{11}B, ^{14}N, ^{17}O) or to nuclei with low natural abundance with $I={}^{1}/_{2}$ (e.g., ^{13}C, ^{15}N). The author has now succeeded in measuring $^{1}J(^{15}N^{11}B)$ in tris(methylamino)borane from the ^{15}N NMR spectrum in natural abundance. A partially collapsed quartet is observed from which $^{1}J(^{15}N^{11}B)\geq45$ Hz can be deduced. The spectrum was recorded using the refocused INEPT pulse sequence. (7 refs.)

106460 The ^{14}N and ^{2}H quadrupole coupling tensors in sodium nitroprusside. D.Gross, N.Pislewski, U.Haeberlen, K.H.Hausser (Max-Planck-Inst. fur Medizinsche Forschung, Heidelberg, Germany).
J. Magn. Resonance (USA), vol.54, no.2, p.236-52 (Sept. 1983).
Measurements by straightforward FT NMR at room temperature in a field of 8.4 T are reported of the principal values and directions of the quadrupole coupling (QC) tensors at all nitrogen sites in sodium nitroprusside (SNP), $Na_2Fe(CN)_5NO.2H_2O$. The assignment of the measured QC tensors to the ^{14}N sites in SNP is discussed. All ^{14}N QC tensors in SNP are nearly axially symmetric. The unique axes of these tensors are parallel to the bond directions of the respective CN and NO ligands within the accuracy of this and the X-ray experiment by which the bond directions were established. The feasibility is discussed of measuring ^{14}N QC tensors in the so-called new state of SNP discovered by Hauser and coworkers (1978). The QC tensors at the hydrogen sites in SNP were measured using deuterated crystals of SNP. These measurements show that the water molecules in SNP undergo a flip process which at room temperature is fast on the time scale of deuteron quadrupole couplings (≈5 μsec) whereas it is slow on this time scale at 77K. The unique directions of the deuteron QC tensors are off the O-D bond directions established by X-ray scattering by as much as 11°. It is argued that the measurement of deuteron QC tensors provides much more accurate information about the orientation of water molecules in hydrates than can be inferred from X-ray scattering data. (14 refs.)

106461 Deuteron quadrupole coupling constants of deuterobromoform and deuteroiodoform determined from direct ^{13}C-^{2}H couplings in ^{2}H NMR spectra. G.C.Lickfield, S.E.Emery, R.V.Gregory, T.C.Chen, A.L.Beyerlein, G.B.Savitsky (Dept. of Chem. & Geology, Clemson Univ., Clemson, SC, USA).
J. Magn. Resonance (USA), vol.54, no.2, p.305-8 (Sept. 1983).
In a recent determination of the deuteron quadrupole coupling constant, Q_D, of $CDCl_3$ from direct ^{13}C-^{2}H couplings in ^{2}H NMR spectra (Lickfield et al., 1983), it was found that the value of Q_D was significantly dependent on the nature of the nematic solvent used to orient the molecule in the magnetic field. The lowering of the Q_D value of $CDCl_3$ in the Phase IV and chemically similar liquid crystals could well be due to hydrogen bonding with the various functional groups of the crystal. Since there is evidence that the order of hydrogen bonding strength in haloforms is $Cl>Br>I$, the authors have determined the Q_D of $CDBr_3$ and CDI_3 in ZLI-1167 and Phase IV in order to further address this problem. A spectroscopic study of the haloforms in the two nematic phases was also attempted in the hope of comparing the extent of hydrogen bonding that these liquid crystals may have on the haloforms. Unfortunately, intense bands in the IR of these liquid crystals overlap with the absorption bands of interest of the haloforms. Therefore, the IR of CH_3OH at 10% molar concentration in both crystals was measured since the OH stretching mode of CH_3OH is free from interference. (16 refs.)

106462 The ^{1}H and ^{13}C chemical shift anisotropies of 2-butyne determined by NMR of the oriented molecule. P.Diehl, F.Moia (Dept. of Phys., Univ. of Basel, Basel, Switzerland).
J. Magn. Resonance (USA), vol.54, no.2, p.312-13 (Sept. 1983).
The authors dissolved 2-butyne in various liquid crystals solvents such as Merck ZLI 1167, EBBA, and a mixture of 52 wt.% of ZLI 1167 with 48 wt.% of ZLI 1132. At this concentration the anisotropy of the diamagnetic susceptibility of the solvent vanishes and the liquid crystal optic axis rotates by 90°, allowing a determination of the shift anisotropy. This method is called NEMIX. (6 refs.)

106463 EPR studies of methylated benzo(*a*)pyrene cation radicals. P.D.Sullivan (Dept. of Chem., Ohio Univ., Athens, OH, USA).
J. Magn. Resonance (USA), vol.54, no.2, p.314-18 (Sept. 1983).
EPR spectra have been obtained from benzo[*a*]pyrene (BP) and all 12 monomethyl derivatives in concentrated H_2SO_4. The 1-, 2-, 3-, 4-, 5-, 8-, 9-, 11-, and 12-methyl BPs were obtained from the NCI Chemical Repository and 6-, 7-, and 10-methyl BPs were synthesized by literature methods. The spectra have enabled the author to estimate and assign splitting constants to all positions in the BP cation radical. (13 refs.)

106464 Study by NMR of organic compounds containing chalcogenes. VIII. ^{13}C NMR of chromannone, chromone, coumarannone-3 and coumarine and their sulphur, selenium and tellurium analogues. M.Baiwir, G.Llabres (Inst. de Phys. B5, Univ. de Liege au Sart Tilman, Liege, Belgium), L.Christiaens, A.Luxen, J.-L.Piette.
Spectrochim. Acta Part A (GB), vol.39A, no.8, p.693-8 (1983).
^{13}C NMR spectra of the title compounds have been fully assigned. The results have been compared with those relative to other chalcogenated compounds, such as anisole, phenyl benzoate, benzofuran, ... and their analogs. In chalcogenochromones and -coumarines, the heteroatom lone pair delocalization spreads to some extent over the heterocyclic part of the molecules, while in chalcogenochromanones and -indoxyles, it only extends to the homocycle. This electronic effect seems also to affect the heavy atom effect exhibited by Te-containing compounds. (33 refs.)

106465 ^{13}C-NMR study of cresyl benzoates. S.P.Srivastava, A.K.Bhatnagar, G.C.Joshi (Indian Inst. of Petroleum, Dehradun, India).
Spectrochim. Acta Part A (GB), vol.39A, no.8, p.713-15 (1983).
The proton-decoupled ^{13}C FT-NMR spectra of para-, meta- and ortho-cresyl benzoates have been recorded and the observed signals have been assigned following the substituent additivity rule. The important features of diagnostic value of these spectra are discussed. (7 refs.)

106466 ^{13}C NMR spectra of β-aminoalcohols derivatives of isophedrine and of their oxazolidines. M.Gelbcke, M.Baudet (Lab. de Chimie Pharmaceutique Organique et de Bromatologie, Univ. Libre de Bruxelles, Bruxelles, Belgium).
Spectrochim. Acta Part A (GB), vol.39A, no.8, p.717-27 (1983).
The carbon-13 NMR spectra of β-aminoalcohols related to nor and pseudonor-isoephedrine ($N\text{-}CH_3$; $N\text{-}C_2H_5$; $N\text{-}iC_3H_7$) and the series of the corresponding oxazolidines from formaldehyde and benzaldehyde were obtained and discussed. The configuration of the 3-alkyl-2,4-diphenyl-5-methyloxazolidines was established. (12 refs.)

106467 Conformational and spectral investigations of thiazolidinone derivatives by ^{1}H and ^{13}C NMR spectroscopy. I.Dogan, S.Icli (Dept. of Chem., Middle East Tech. Univ., Ankara, Turkey).
Spectrosc. Lett. (USA), vol.16, no.7, p.499-511 (1983).
The magnetic non-equivalence of isomeric proton and ^{13}C nuclei has been investigated on rotational isomers of 3-aryl-2,4-thiazolidinediones and 3-aryl-2-arylimino-4-thiazolidinones. The detection of magnetic non-equivalence for proton nuclei was better in quinoline solutions. Free energies of activation have been estimated. The varying hetero atom in the hetero ring is seen to

effect the additive shift parameters and the shielding of distant aryl carbon bonded to hetero ring. (6 refs.)

106468 Semiempirical calculation of ^{13}C NMR screening tensors of organic molecules. W.Meiler, T.Weller, G.Kluge, R.Lochmann, D.Deininger (Sektion Phys., Karl-Marx-Univ. Leipzig, Leipzig, Germany).
Z. Phys. Chem., Leipzig (Germany), vol.264, no.4, p.753-67 (1983). In German.
The ^{13}C-NMR screening tensors for various simple organic molecules have been calculated using CNDO wave functions. Besides the standard parametrization of the CNDO/2 method other parametrizations are applied. The comparison with the experimental data shows that parametrizations scaled for an interpretation of optical spectra are more suitable also for a calculation of NMR screening data than the standard parametrization. Chemical shifts calculated by some of these methods are in qualitative agreement with measured values. (32 refs.)

Investigation of coupled spin networks by two-dimensional multiple-quantum coherence spectroscopy .... See Entry 105350

The validity of Musher's model for the magnetic properties of aromatic molecules .... See Entry 106277

Ab initio one-electron property calculations. V. Miscellaneous heterocycles and related compounds .... See Entry 106294

Influence of nature of solvent on IR and NMR spectra of ethyl cyanoacetate and formaldehyde .... See Entry 106413

Fourier transform heteronuclear magnetic triple resonance in complex spin systems. III. Symmetrical ditertiary phosphine complexes of group VI metal carbonyls .... See Entry 106472

Sign determination of ^{13}C-^{13}C coupling constants by sign-labeled polarization transfer .... See Entry 106475

The crystal and molecular structure of 2,3,12,13-tetrathia[4,4]metacyclophane .... See Entry 107658

^{19}F NMR spectra of hexafluoride groups: UF_6 .... See Entry 108804

NMR-electrolysis combined method (NMREL). Basic principles and some applications .... See Entry 109757

Conformation and dynamics of carcinogenic N-substituted 2-aminofluorene compounds studied by nuclear magnetic resonance spectroscopy .... See Entry 109959

Solvent-peak-suppressed NMR: correction of baseline distortions and use of strong-pulse excitation .... See Entry 109970

33.30 ELECTRON PARAMAGNETIC RESONANCE AND RELAXATION

106469 ESR of the cation radicals from γ-irradiated ketenes in haloalkane and SF_6 matrices. K.Shimokoshi (Dept. of Chem., Tokyo Inst. of Technol., Tokyo, Japan), J.Fujisawa, K.Nakamura, S.Sato, T.Shida.
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.483-6 (19 Aug. 1983).
The cation radicals of ketene and its methyl and ethyl derivatives have been produced in γ-irradiated solid solutions of haloalkanes and SF_6. From the observed isotropic proton hyperfine parameters of these cation radicals and UHF MO (INDO) calculations, the cations are found to be characteristic of ordinary π-radicals. (9 refs.)

106470 Influence of the relative position of nitro groups on intermolecular sodium exchange processes in dinitrobenzene ion pairs, investigated by EPR spectroscopy. M.Branca, A.Gamba (Istituto di Chimica Fisica, Univ. di Sassari, Sassari, Italy), C.Oliva.
J. Magn. Resonance (USA), vol.54, no.2, p.216-25 (Sept. 1983).
The EPR spectra of the anion radicals of nitrobenzene isomers in aprotic solvents with added sodium tetraphenylborate show an intermolecular cation-exchange reaction in which the incoming cation goes to the uncomplexed nitro group. The activation energy barriers $\Delta H\ddagger$ are almost the same for the *m* and *p* isomers, while the activation free energy $\Delta G\ddagger$ is dependent on the relative position of the two nitro groups, probably due to different solvation effects. The transport properties of the systems were also investigated. The spin distribution was computed by the McLachlan method (1960), modified according to McClelland (1961), both for the ion pairs and for the triple ions which are the intermediates of the intermolecular cation exchange. (18 refs.)

EPR evidence on the structure of the copper(II)-bacitracin A complex .... See Entry 109960

33.35 DOUBLE RESONANCES AND OTHER MULTIPLE RESONANCES

106471 Infrared optical double resonance spectroscopy of ND_2. R.E.Muenchausen, G.W.Hills (Dept. of Chem., Univ. of North Carolina, Chapel Hill, NC, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.4, p.335-41 (12 Aug. 1983).
Infrared optical double resonance (IODR) effects have been observed in ND_2. The infrared transitions, $5_{05}\leftarrow 5_{14}$ $(F_1\leftarrow F_1)$ and $2_{12}\leftarrow 2_{21}$ $(F_2\leftarrow F_2)$, in the ν_2 band of ND_2 were efficiently pumped with P(10) of $^{12}C^{18}O_2$ at 1076.57 cm^{-1} and R(26) of $^{12}C^{16}O_2$ at 1082.30 cm^{-1}, respectively. IODR signals were detected by exciting various rovibronic transitions of $\tilde{A}^2A_1\leftarrow\tilde{X}^2B_1$ with a rhodamine 6G dye laser. The P(10) transition of $^{12}C^{18}O_2$ is coincident, within the Doppler width with $5_{05}\leftarrow 5_{14}$ $(F_1\leftarrow F_1)$ of ν_2, ND_2. For this laser line three- and four-level (collisional) IODR signals are observed for both the (000) and (010) vibrational states. The $2_{12}\leftarrow 2_{21}$, $(F_2\leftarrow F_2)$ transition is 120 ± 20 MHz above R(26) of $^{12}C^{16}O_2$. (12 refs.)

106472 Fourier transform heteronuclear magnetic triple resonance in complex spin systems. III. Symmetrical ditertiary phosphine complexes of group VI metal carbonyls. G.T.Andrews, I.J.Colquhoun, W.McFarlane (Chem. Dept., City of London Polytech., London, England).
Polyhedron (GB), vol.2, no.8, p.783-90 (1983).
Magnetic multiple resonance experiments of the types ^{13}C-$\{^{31}P,{}^1H\}$, ^{13}C-$\{^1H\}$ and ^{31}P-$\{^{183}W,{}^1H\}$ have been used to determine the magnitudes and signs of P-C and P-P coupling constants in the symmetrical complexes $LM(CO)_4$ ($L=Ph_2P(CH_2)_nPPh_2$, $Ph_2PN(H)PPh_2$, $(Ph_2P)_2C=CH_2$, cis-$Ph_2PCH=CHPPh_2$; $M=Cr$, Mo, W; $n=1$-4). A knowledge of the signs of the couplings shows that they display a systematic pattern of behaviour according to metal atom and ring size and this may have diagnostic value. ^{13}C, ^{31}P and ^{183}W chemical shifts are also reported. (21 refs.)

106473 ENDOR study of VO^{2+} adsorbed on Y zeolite. H.van Willigen, T.K.Chandrashekar (Dept. of Chem., Univ. of Massachusetts, Boston, MA, USA).
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4232-5 (29 June 1983).
Electron paramagnetic resonance (EPR) has been used extensively in studies of the structure of transition metal ion exchanged zeolites. Use is made of the fact that data on *g* values and metal ion hyperfine splitting constants provide an insight into the structure of the cation binding site. Electron nuclear double resonance (ENDOR) makes it possible to measure the interactions between the unpaired electrons and nuclear spins in the vicinity of the paramagnetic cation. Generally, these interactions remain unresolved in the EPR spectra of these amorphous systems. The ENDOR technique can be used to study cation solvation in the zeolite cavities and changes in cation environment induced by removal of solvent molecules or co-adsorbed molecules. Subtle structural changes that do not register in the EPR spectrum can have a profound effect on the ENDOR spectra. The results suggest that ENDOR can be of great value in studies of transition metal ion adsorption on zeolites as well as other porous surfaces. (21 refs.)

106474 Direct observation of high-lying $^3\Pi_g$ states of the Na_2 molecule by optical-optical double resonance. Li Li, R.W.Field (Dept. of Chem., MIT, Cambridge, MA, USA).
J. Phys. Chem. (USA), vol.87, no.16, p.3020-2 (4 Aug. 1983).
Eight Na_2 vibrational levels belonging to at least two electronic states of $^3\pi_{Og}$ symmetry have been observed near 34000 cm^{-1} by optical-optical double resonance (OODR) fluorescence excitation spectroscopy. A unique feature of this work is that the intermediate levels in this $^3\Pi_{Og}\leftarrow X^1\Sigma_g{}^+$ OODR excitation scheme are singlet-triplet mixed $J=12$-15 levels of the $A^1\Sigma_u{}^+(\nu=22)$-$b^3\pi_{Ou}(\nu=24)$ perturbation complex. (22 refs.)

106475 Sign determination of ^{13}C-^{13}C coupling constants by sign-labeled polarization transfer. O.W.Sorensen, R.R.Ernst (Lab. fur Phys. Chem., Eidgenossische Tech. Hochschule Zurich, Zurich, Switzerland).
J. Magn. Resonance (USA), vol.54, no.1, p.122-33 (Aug. 1983).
A new pulse sequence, which allows the determination of the signs of ^{13}C-^{13}C *J*-coupling constants from natural abundance samples, is presented. The technique uses proton polarization transfer and proton decoupling. The signs of the coupling constants are manifested in the polarities of the resulting proton-decoupled ^{13}C signals. (14 refs.)

106476 Modified selective population transfer experiments. Methods for selective decoupling and suppression of unwanted signals. H.J.Jakobsen, P.J.Kanyha, W.S.Brey (Dept. of Chem., Univ of Florida, Gainesville, FL, USA).
J. Magn. Resonance (USA), vol.54, no.1, p.134-41 (Aug. 1983).
Two pulse sequences, based on the selective population transfer experiment, greatly extend and improve the applications of this polarization transfer method. One of these sequences copes with situations where it is desirable to apply selective decoupling to a group of magnetically equivalent protons which are also used for polarization transfer. The resulting spectrum is both enhanced with all remaining lines in phase and simplified to permit more facile interpretation as is demonstrated for the ^{29}Si NMR spectrum of vinyltrimethylsilane. The second pulse sequence is an improvement of the conventional SPT difference spectroscopy method. Selective π pulses are applied alternatively to the low- and high-frequency satellites in the ^1H spectrum with a concurrent 180° phase shift of the 90° 'read' pulse. This sequence is used for the suppression of strong unwanted signals (e.g., solvent peaks) and does not involve acquisition of these signals in the FIDs. An enhanced coupled or decoupled spectrum for the weak resonances is obtained as is demonstrated by uncovering the signals for the CND_2CN isotopomer from the ^{13}C spectrum of 99% deuterium enriched CD_3CN. (28 refs.)

106477 Mechanism of spin transfer to β protons in π radicals. Analysis of anisotropic hyperfine couplings. M.Brustolon, A.L.Maniero (Istituto di Chimica Fisica, Univ. di Padua, Padua, Italy).
J. Magn. Resonance (USA), vol.54, no.2, p.190-200 (Sept. 1983).
Free radicals produced by γ irradiation in succinic acid and potassium trihydrogen disuccinate are identified and studied by ENDOR. The dipolar tensors of β protons are discussed and compared with several tensors of the same type in the literature. A dependence of the largest principal value on the conformation of the radical is accounted for by a McConnell-Strathdee-Derbyshire calculation (1959, 1962) by taking into account hyperconjugative spin delocalization on the β protons and also spin polarization of π electrons. The relative amounts of spin density on β protons from hyperconjugation and from spin polarization are evaluated as 70 and 30%, respectively. The principal direction corresponding to the largest principal value is calculated for different conformations and is compared with the carbon-hydrogen direction. (31 refs.)

106478 Excitation and dissociation of SF_6 molecules in a two-frequency infrared laser field. S.S.Alimpiev, B.O.Zikrin, B.G.Sartakov, E.M.Khokhlov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. Phys.-JETP (USA), vol.83, no.5, p.943-51 (Nov. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.5, p.1634-49 (Nov. 1982). [received: Sept. 1983]
The spectral and energy characteristics of the excitation and dissociation of SF_6 molecules in a two-frequency infrared laser field are investigated. The quantum efficiency of two-frequency dissociation is found to depend on the frequency of the second field and on the excitation level in the first. The linear-absorption spectra of SF_6 molecules excited by a laser field are obtained. The parameters of these spectra differ significantly from the thermal ones. (16 refs.)

Conformational analysis by NMR spectrometry of the highly substituted cyclic tetrapeptides, chlamydocin and Ala^4-chlamydocin. Evidence for a unique amide bond sequence in dimethyl-d_6 sulfoxide .... See Entry 106446

Nuclear magnetic resonance and PCILO study of the side-chain conformations in *m*-anisaldehyde and 2,5-dimethyloxybenzaldehyde .... See Entry 106452

Conformation of purine mononucleotides by H{H} and P{H} nuclear Overhauser effects .... See Entry 109955

33.35H MODR and PMDR (microwave optical double resonance and phosphorescence microwave double resonance)

106479 Laser excitation spectrum and microwave optical double resonance spectrum of the $3_0{}^1$ band in the $\tilde{a}^3A_2$-$\tilde{X}^1A_1$ system of H_2CS: the hyperfine structure of the $\tilde{a}^3A_2$ state. T.Suzuki, S.Saito, E.Hirota (Inst. for Molecular Sci., Okazaki, Japan).
J. Chem. Phys. (USA), vol.79, no.4, p.1641-57 (15 Aug. 1983).
The dye laser excitation spectrum of the $3_0{}^1$ band in the $\tilde{a}^3A_2\leftarrow\tilde{X}^1A_1$ transition of H_2CS was observed in the region 15280 to 15400 cm^{-1} with Doppler-limited resolution. The observed spectrum was analyzed to yield pre-

cise values for the rotational constants, the centrifugal distortion constants, and the spin-spin and the spin-rotation interaction constants in the upper triplet state and for the band origin. Transitions with $K_a'=4$ and 5 revealed the effect of the *c*-type Coriolis interaction between the $\nu_3'=1$ and $\nu_6'=1$ states, which, when analyzed, allowed determination of the ν_3-ν_6 difference to be 99.341 cm^{-1}. 15 *K*-type doubling transitions and two *a*-type *R* branch transitions in the $\tilde{a}$ state were observed by a microwave or radio-frequency optical double resonance technique, of which two *K*-doubling transitions of $K_a=1$ and two *R* branch transitions (all F_3 components) were resolved into three hyperfine components. From the observed splittings the proton hyperfine coupling constants were determined to be $a_F=27.7(25)$, $T_{bb}+T_{cc}=12.8(44)$, and T_{bb}-$T_{cc}=7.89(19)$ MHz with one standard errors in parentheses. (25 refs.)

Precise Stark-effect measurements in the $^2\Sigma$ ground state of CaCl ....See Entry 106481

33.40 MÖSSBAUER SPECTRA

Measurement of subatomic displacements for Mossbauer spectroscopy ....See Entry 105434

33.45 MAGNETO-OPTICAL AND ELECTRO-OPTICAL SPECTRA; DICHROISM

Absorption and circular dichroism spectra of dimeric systems. Extended dimer model ....See Entry 106390

Side-chain vs. main-chain conformational flexibility in aromatic dipeptides ....See Entry 106445

Electric-field-induced chirality of octahedral $Cr^{3+}6H_2O$ complexes in alum ....See Entry 108926

33.45B Zeeman and Stark effects

106480 Non-linear Stark polarization spectroscopy. M.E.Coles, R.F.Curl,Jr. (Chem. Dept., Rice Univ., Houston, TX, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.494-9 (19 Aug. 1983).
The effects of electric and magnetic fields upon the polarization of a single mode CW dye laser propagating through a low pressure sample of NO_2 have been explored. It is found that with electric field modulation the various Stark sensitive features in the complex NO_2 visible spectrum affect the polarization, producing a spectrum with a much simpler appearance than the normal absorption spectrum. The signal magnitudes are proportional to the square of the laser power. These electric field modulation signals are dominated by the influence of a weak stray laboratory magnetic field. All the phenomena observed are thought to arise from non-linear level crossing. (11 refs.)

106481 Precise Stark-effect measurements in the $^2\Sigma$ ground state of CaCl. W.E.Ernst, S.Kindt, T.Torring (Inst. fur Molekulphys., Freie Univ. Berlin, Berlin, Germany).
Phys. Rev. Lett. (USA), vol.51, no.11, p.979-81 (12 Sept. 1983).
By use of the molecular-beam microwave-optical double-resonance technique the first high-precision Stark-effect measurement of an alkaline-earth monohalide has been performed. Low-field Stark shifts of rotational transitions in the $v=0$, $X^2\Sigma$ state of CaCl exhibited an unexpectedly complicated field dependence which, however, has been shown to be in complete agreement with an exact theoretical calculation. (13 refs.)

The rotational Zeeman effect in ArHBr: an interpretation of the rotational Zeeman parameters in rare gas hydrogen halide complexes ..See Entry 106398

Identification of forbidden transitions in the ν_4 band of $^{14}NH_3$ by intracavity laser-Stark spectroscopy ....See Entry 106416

33.45C Magnetic circular dichroism

106482 Natural and magnetic circular dichroism spectra of selenofenchone. Evidence for a singlet-triplet component of the $n\rightarrow\pi^*$ transition of selenoketones. W.M.D.Wijekoon (Dept. of Chem., Univ. of Nevada, Reno, NV, USA), E.Bunnenberg, R.Records, D.A.Lightner.
J. Phys. Chem. (USA), vol.87, no.16, p.3034-7 (4 Aug. 1983).
Blue (-)-selenofenchone (1) is observed to give a negative long-wavelength Cotton effect (CE), $\Delta\varepsilon_{573}{}^{max}=-0.86$, in addition to a series of CEs down to 190 nm, $\Delta\varepsilon_{270}{}^{max}=-5.21$, $\Delta\varepsilon_{232}{}^{max}+4.90$, in its circular dichroism (CD) spectrum measured in *n*-heptane. The long-wavelength CD (573 nm) and UV (625 nm) λ_{max} of 1 are found surprisingly well separated. Support for the singlet-triplet nature of this electronic transition may be found in a sharp positive magnetic CD band centered near 630 nm in (±)-selenofenchone. The CD and UV data are compared with those of thiofenchone and fenchone. (19 refs.)

Model compounds for protonation of benz[a]phenazine: spectroscopy of protonated 1,2- and 3,4-benzacridines ....See Entry 109716

33.50 FLUORESCENCE, PHOSPHORESCENCE; RADIATIONLESS TRANSITIONS (INTERSYSTEM CROSSING, INTERNAL CONVERSION)

106483 Interstate dynamics in xanthione: a picosecond photon-echo and optical study. L.W.Molenkamp, D.P.Weitekamp, D.A.Wiersma (Dept. of Phys. Chem., Univ. of Groningen, Groningen, Netherlands).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.382-7 (19 Aug. 1983).
Accumulated photon-echo decays have been measured for the $S_1\leftarrow S_0$ origin and several vibronic transitions of dilute xanthione in a xanthone host crystal. The temperature-dependent dephasing is explained as activation of a local phonon mode, while the low-temperature (1.7K) decay determines the intersystem crossing rate to T_1 to be 19.6 ps. An interference in the echo experiment is analyzed and shown to be due to triplet-state absorption. Dispersed phosphorescence measurements with excitation into either S_1 or directly into the $T_1{}^z$ spin sublevel show that the spin-lattice relaxation of this level is rapid compared with its decay to S_0 even at 1.7K. (19 refs.)

106484 Laser-induced fluorescence of the HSiF radical. H.U.Lee, J.P.Deneufville (Materials Dev. Lab., Energy Conversion Devices Inc., North Branch, NJ, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.394-8 (19 Aug. 1983).
HSiF has been detected by laser-induced fluorescence, following the formation of the ground-state radical in the flow reaction of SiH_4 with F_2 at a total pressure of 0.05-0.15 Torr. The authors report the radiative lifetime of the first vibronic state of HSiF ($\tilde{A}^1A''$) as well as a tentative assignment of the prominent bands of the $\tilde{A}^1A''$-$\tilde{X}^1A'$ transition. (15 refs.)

106485 Assignment of the E absorption transitions in C_6D_6 by means of isolated-molecule fluorescence spectra. Y.Takagi, M.Sumitani, D.O'Conner, N.Nakashima, K.Kamogawa, Y.Udagawa, K.Yoshihara (Inst. for Molecular Sci., Okazaki, Japan).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.445-9 (19 Aug. 1983).
Fluorescence spectra following narrow bandwidth excitation of C_6D_6 have been observed and their structure analysed. Excitation of the $E_1{}^0$ absorption band gives rise to fluorescence that cannot originate from a level with ν_8 excited. (15 refs.)

106486 Shift and quenching of fluorescence of tetrahydronaphthols due to hydrogen bonding. K.Chatterjee, S.Laha, S.Chakravorti, T.Ganguly, S.B.Banerjee (Optics Dept., Indian Assoc. for the Cultivation of Sci., Calcutta, India).
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.88-92 (26 Aug. 1983).
Fluorescence intensity of 5,6,7,8-tetrahydronaphthols in cyclohexane is enhanced due to hydrogen bonding with ethanol and dioxane. Triethylamine produces large changes in absorption and fluorescence spectra, and at 300K fluorescence is quenched due to transfer of electronic excitation and short-lived CT complex formation in the fluorescent state. At 77K there is no quenching as the molecular orientation is restricted. Possible reaction schemes are described. (27 refs.)

106487 Internal heavy-atom effect on the T_1 states on monochloroquinolines and monochloronaphthalenes. J.Najbar, W.Jarzeba, Z.H.Urbanek (Inst. of Chem., Jagiellonian Univ., Krakow, Poland).
Chem. Phys. (Netherlands), vol.79, no.2, p.245-53 (1 Sept. 1983).
The triplet lifetimes and luminescence quantum yields were measured for seven monochloroquinolines, 2-methyl-4-chloroquinoline, 2-chloro-4-methylquinoline and two monochloronaphthalenes in ethanol at 77K. The positional dependence of the rate constans for the $T_1\rightarrow S_0$ transitions in the chloroquinolines and chloronaphthalenes were analysed using the Freed-Jortner model of the displaced potential functions for aromatic hydrocarbons. The energy gap dependence of the radiationless transition was found to be very important for the discussion of the internal heavy-atom effect. The relation between theory and experiment is satisfactory when the C-H out-of-plane vibrations are chosen as promoting modes for the relaxation of the triplet state for monochloroquinolines. (31 refs.)

106488 Temperature dependence of J-band aggregate of the dye 1,1′-diethyl-2,2′-cyanine bromide studied by steady-state and time-resolved picosecond fluorescence spectroscopy. Z.X.Yu, P.Y.Lu, R.R.Alfano (Phys. Dept., City Coll. of New York, New York, NY, USA).
Chem. Phys. (Netherlands), vol.79, no.2, p.289-96 (1 Sept. 1983).
Steady-state and time-resolved picosecond fluorescence spectra of the J-band aggregate state of the dye 1,1′-diethyl-2,2′-cyanine bromide were measured at different temperatures. When the temperature was lowered below 210K, two narrow bands centered at 572 and 577 nm appeared in the absorption and fluorescence spectra arising from the formation of the J aggregate. The time-resolved fluorescence study showed that the relaxation decay time of the J-band was ≈20 ps while that of the monomer band was ≈300 ps. (16 refs.)

106489 Kinetics and mechanism of the $CS_2(^3A_2)$ decay. J.A.Duenas Fananas, A.Cabello (Dept. de Quimica-Fisica, Facultad de Quimica, Univ. Complutense, Madrid, Spain).
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.1050-6 (July-Aug. 1983).
From the rate constants for the $CS_2(^3A_2)$ decay obtained by laser-induced fluorescence and using a vibrational cascade model the authors have calculated the average value of the vibrational quantum transferred on each deactivating collision, as well as the second-order rate constants for vibrational and electronic quenching. (12 refs.)

106490 Electron-impact luminescence spectra and neutral fragments: identification of neutral fragments by use of fragment emissions. A.Inoue, S.Yoshida, N.Ebara (Dept. of Chem., Coll. of Arts & Sci., Univ. of Tokyo, Tokyo, Japan).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.209-16 (1 Sept. 1983).
Electron-impact luminescence spectra were measured for cyclohexanol, acetic acid, pyridine, pyrimidine, benzonitrile, aniline, nitrobenzene, *p*-methoxynitrobenzene, 1-chlorobutane, 1-chloropentane, tetrahydrofuran and anisole. The spectra were analyzed and compared with the literature data of mass spectrometry. Fragment emissions of $OH(A^2\Sigma^+$-$X^2II)$, $CN(B^2\Sigma$-$X^2\Sigma)$, $NO(B^2II$-$X^2II)$ and HCl^+ $(A^2\Sigma$-$X^2II)$ can be used for the identification of neutral fragments of OH and H_2O, HCN, NO and HCl, respectively. (31 refs.)

106491 Dimers in jet-cooled *s*-tetrazine vapor: structure and electronic spectra. C.A.Haynam, D.V.Brumbaugh, D.H.Levy (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.1581-91 (15 Aug. 1983).
Dimers with two distinct conformations form as *s*-tetrazine vapor ($C_2N_4H_2$) is cooled in a supersonic jet expansion. Rotationally resolved laser-induced fluorescence excitation spectra of both hydrogen and deuterium substituted dimers have been obtained with single frequency scanning dye lasers. Dimer structures were determined by a combined rotational contour generating program and nonlinear least squares fitting procedure. One dimer conformation is planar with two translationally equivalent monomer units. In this conformation one hydrogen of each ring is in close proximity to the nitrogen lone pair of the other, allowing for stabilization by weak hydrogen bonds. The center-to-center ring separation is 5.6 Å. The other dimer conformation is *T* shaped with symmetrically inequivalent rings giving rise to two electronic transitions with different rotational band types. In this configuration, one hydrogen of the first monomer is in close proximity to the π cloud of the second monomer, and the ring centers are separated by 4.4 Å. The two electronic transitions are due to two close lying electronically excited states where the electronic excitation is localized on one or the other of the two rings. Additional spectral features are attributed to dimer vibrations and larger clusters. (24 refs.)

106492 The photophysics and photochemistry of weakly bound dimers of *s*-tetrazine. L.Young, C.A.Haynam, D.H.Levy (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.1592-604 (15 Aug. 1983).
Energy redistribution within the excited states of the planar and *T*-shaped dimers of *s*-tetrazine was monitored by dispersed emission following selective vibronic excitation. When the dimer contained excess vibrational energy above the electronic origin, three processes were observed: (1) energy transfer from the initially populated ν_{6a} vibration (in-plane stretch) to low frequency dimer vibrations involving motion of one monomer subunit with respect to the other; (2) electronic energy transfer from the high energy ring (∥ polarized) to the low energy ring (⊥ polarized) in the *T*-shaped dimer; and (3) photodissocia-

tion of the *T*-shaped dimer into monomer subunits. Simultaneously observed fluorescence from the initially populated state allows us to estimate the rates at which these processes occur. The observation of photodissociation ($\tau=38$ ps) of the *T*-shaped dimer with an input of 1595 cm^{-1} of excess vibrational energy yields an estimate for the binding energy in the ground state $E_b<1552$ cm^{-1}. (15 refs.)

106493 Site dependence of the 1 ^1A_g to 2 ^1Ag transition of all-trans-1,3,5,7-octatetraene. B.E.Kohler, J.B.Snow (Dept. of Chem., Wesleyan Univ., Middletown, CT, USA).
J. Chem. Phys. (USA), vol.79, no.5, p.2134-8 (1 Sept. 1983).
Highly resolved emission and one-photon fluorescence excitation spectra and fluorescence lifetimes for all-trans-1,3,5,7-octatetraene substituted in a series of *n*-alkane crystals maintained at liquid helium temperatures have been measured. In the *n*-octane host, the 1 ^1A_g to 2 ^1A_g transition is strictly symmetry forbidden: In other hosts, the spectra exhibit both allowed and symmetry forbidden (built on odd symmetry vibrational modes) components of the spectra are sensitive to local perturbations, the energies of the excited 1 ^1A_g and 1 ^1B_u states and the vibrational development of the 1 ^1A_g to 2 ^1A_g transition are nearly the same in all of the hosts studied. The increase in the allowed component of the spectrum with increasing site perturbation correlates with a decrease in the measured fluorescence lifetime. (9 refs.)

106494 Fluorescence excitation spectrum of triptycene in a supersonic jet. R.Bersohn, U.Even, J.Jortner (Dept. of Chem., Tel Aviv Univ., Tel Aviv, Israel).
J. Chem. Phys. (USA), vol.79, no.5, p.2163-7 (1 Sept. 1983).
The laser-induced fluorescence excitation spectrum of triptycene in pulsed supersonic expansions of He reveals the electronic origin of the $S_0 \rightarrow S_1(^1A_1 \rightarrow ^1E')$ transition at 2750.85 Å (36 352 cm^{-1}), followed by 19 vibrational excitations in the energy range 350 cm^{-1} above it. This vibrational structure corresponds to the excitations of four torsional modes of the phenyl rings. Mechanical models for these torsional modes indicate the existence of three doubly degenerate vibrations, exhibiting Jahn-Teller coupling with the $^1E'$ state, together with double excitations of a nondegenerate vibration. At excess vibrational energies of 350-1000 cm^{-1} above the S_1 origin in the laser-induced fluorescence spectrum is extremely weak and devoid of any structure, implying the onset of a new effective intramolecular decay channel which may result in isomerization in the isolated molecule. (21 refs.)

106495 Electronic absorption spectrum of Hg-Ar complex in a supersonic jet. K.Fuke, T.Saito, K.Kaya (Dept. of Chem., Keio Univ., Yokohama, Japan).
J. Chem. Phys. (USA), vol.79, no.5, p.2487-8 (1 Sept. 1983).
The profile of the 253.7 nm resonance line ($^3P_1$) of mercury atom (Hg) perturbed by noble gases has been the subject of numerous investigations for many years. Because of the broadness of the observed absorptions and emissions which up to now were only obtained by an experiment at high temperature, the exact analysis of the electronic structures of Hg-noble gas complexes is still the subject of ambiguities. The authors' preliminary result on the well resolved electronic spectrum of Hg-Ar complex measured in a supersonic jet is presented. The Hg-Ar complex was obtained by the free expansion of heated Hg vapor (340K) seeded in a mixture of 300 Torr Ar and 3 atm He. The electronic spectrum was measured by the fluorescence excitation method monitored in the UV region. (7 refs.)

Ab initio CI study of the photodissociation of nitrosyl chloride (ClNO) .... See Entry 106310

Porphyrins. XLIV. Electronic states of Co, Ni, Rh, and Pd complexes .... See Entry 106325

The T_1 state of *p*-nitroaniline and related molecules: a CNDO/S study .... See Entry 106330

Rotational analysis of the $^2B_1(K'=1)-^2A_1(K''=0)$ sub-band of NO_2 at 464-9 nm in the time-gated excitation spectrum .... See Entry 106381

Infrared absorption spectroscopy of phosphorescing molecules: naphthalene-d_0 .... See Entry 106414

Direct observation of high-lying $^3\Pi_g$ states of the Na_2 molecule by optical-optical double resonance .... See Entry 106474

Experimental study of chlorine donors for the triatomic exciplex Xe_2Cl .... See Entry 106501

NaH: studies of the $X^1\Sigma^+$ state near dissociation and of the radiative lifetimes and collision cross sections of the $A^1\Sigma^+$ state .... See Entry 106504

Time resolved observations of NH_2 and benzyl radicals produced in the infrared multiple photon dissociation of benzylamine .... See Entry 106520

Collision energy dependence of vibration/rotational distribution of BaBr produced in the crossed beam reaction $Ba+CH_3Br$ .... See Entry 106545

Detection of triplet states in a laser dye from linear and circular polarization studies .... See Entry 106752

Time-dependent concentration depolarization: a Monte Carlo study .... See Entry 109000

Model compounds for protonation of benz[a]phenazine: spectroscopy of protonated 1,2- and 3,4-benzacridines .... See Entry 109716

Effect of a polar substituent on olefin triplet lifetime .... See Entry 109766

Spectral properties of flavins in hydrophilic matrices .... See Entry 109777

33.65 PHOTOELECTRON SPECTRA

106496 Angle-resolved photoelectron spectroscopy of the chloro-substituted methanes. P.R.Keller, J.W.Taylor (Dept. of Chem., Univ. of Wisconsin-Madison, Madison, WI, USA), T.A.Carlson, F.A.Grimm.
Chem. Phys. (Netherlands), vol.79, no.2, p.269-76 (1 Sept. 1983).
The angular distribution parameter, β, was determined for the valence orbitals (IP<21.2 eV) of CCl_4, $CHCl_3$, CH_2Cl_2, and CH_3Cl in the 10-30 eV photon energy range using dispersed polarized synchrotron radiation. The energy dependence of β in the photoelectron energy range of 2 to 10 eV for the non-bonding chlorine n(Cl) orbitals of these molecules was found to be similar for all n(Cl) orbitals investigated. The energy dependence of β for the σ orbitals in these molecules was similar to that observed previously for other σ orbitals. The experimental CCl_4 results were compared with theoretical CCl_4 results obtained using the $X\alpha$ multiple scattering formalism. Theory predicts the existence of two strong shape resonances in each of the valence orbitals of CCl_4. The overall agreement between experiment and theory is evaluated along with the experimental evidence concerning the verification of the predicted shape resonances. (13 refs.)

106497 Triply differential photoelectron studies of the four outermost valence orbitals of cyanogen. D.M.P.Holland (Inst. of Phys. Sci. & Technol., Univ. of Maryland, College Park, MD, USA), A.C.Parr, D.L.Ederer, J.B.West, J.L.Dehmer.
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.195-208 (1 Sept. 1983).
Photoelectron measurements, differential in incident wavelength, photoelectron energy and photoelectron ejection angle, have been performed on cyanogen, C_2N_2, from threshold to a photon energy of 24 eV, using synchrotron radiation. The results are presented in the form of photoionization branching ratios and photoelectron angular distributions, including vibrationally resolved results for the outermost orbital, $1\pi_g$. Some evidence for resonant processes is observed and discussed within the framework of recent work on related molecules. However, reliable assignments require further theoretical guidance with regard to the location and identities of possible shape resonances and autoionizing intravalence transitions in the C_2N_2 spectrum. (76 refs.)

106498 The high-resolution photoelectron spectrum of N_2O. The $\tilde{B}(^2\pi_i)$ state. T.Cvitas, L.Klasinc, B.Kovac (Rugjer Boskovic Inst., Zagreb, Yugoslavia), R.McDiarmid.
J. Chem. Phys. (USA), vol.79, no.4, p.1565-8 (15 Aug. 1983).
The complex photoelectron spectrum of the $\tilde{B}$ state of N_2O^+ has been remeasured at high resolution and a novel model proposed to interpret the improved data. In the model, a progression of variable strength Fermi resonances is postulated to occur between pairs of vibrational subbands that differ by ν_3-$2\nu_2$-$(2\nu-1)x_{33}$ rather than between members of the usual overtone progression. The model is seen to accurately describe the experimental data. (25 refs.)

106499 Angle-resolved photoelectron spectroscopy of HCl from a photon energy of 16 to 80 eV. T.A.Carlson, M.O.Krause, A.Fahlman (Chem. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA), P.R.Keller, J.W.Taylor, T.Whitley, F.A.Grimm.
J. Chem. Phys. (USA), vol.79, no.5, p.2157-62 (1 Sept. 1983).
Angle-resolved photoelectron spectroscopy was performed on HCl using synchrotron radiation over a photon energy from 16 to 80 eV. The partial cross sections and angular distribution parameters β were obtained for photoionization of both the 2π and 5σ orbitals. Multiple scattering $X\alpha$ calculations were also carried out for the cross sections and β values. The calculations, together with previously published results on the cross section using a Hartree-Fock model, were compared with experiment and gave reasonable qualitative agreement. Both experimental and theoretical results were examined with particular regard to the nature of the Cooper minimum and the differences between the behavior of the minima for the two orbitals are discussed in detail. (12 refs.)

106500 Calculation of photoelectron spectra of group IV tetrachlorides and carbon tetrahalides by SCF-X_α-SW method. J.K.Zhu, D.Li, J.Li, Y.-K.Pan (Dept. of Chem., Boston Coll., Chestnut Hill, MA, USA).
Theor. Chim. Acta (Germany), vol.63, no.3, p.223-33 (1983).
Photoelectron spectra and one-electron eigenfunctions of group IV tetrachlorides, ACl_4, where A=C, Si, Ge, Sn and carbon tetrahalides, CB_4, where B=F, Cl, Br, I, have been calculated by SCF-X_α-SW method. Excellent agreement is obtained with the observed photoelectron spectra. The radius reduction factors of atomic sphere F_r were adjusted instead of changing individual atomic radii. The comparison of photoelectron spectra and ene-electron eigenfunctions for molecules ACl_4 for different central atoms A and halogen atoms B is discussed. (20 refs.)

An ab initio CI study of the ground and excited states of p-benzoquinone .... See Entry 106314

Relative intensities in X-ray photoelectron spectra. X. Near-threshold structure of photoionization cross-sections of molecular valence shells .... See Entry 106517

ESCA studies on silicon compounds using an internal standard for calibration .... See Entry 109837

33.70 INTENSITIES AND SHAPES OF MOLECULAR SPECTRAL LINES AND BANDS

106501 Experimental study of chlorine donors for the triatomic exciplex Xe_2Cl. G.Marowsky (Max Plank-Inst. fur Biophys. Chem., Gottingen, Germany), F.K.Tittel, W.L.Wilson,Jr., R.Sauerbrey.
AIP Conf. Proc. (USA), no.100, p.334-40 (1983). (Topical Meeting on Excimer Lasers, Incline Village, NV, USA, 10-12 Jan. 1983).
The influence of various chlorine donors, specifically CCl_4, Cl_2 and HCl, on the formation and decay of the trimer Xe_2Cl^* has been studied experimentally for electron beam-excited mixtures of argon, xenon and various halogen donors. Quenching rates of the trimer fluorescence for each donor have been determined. A radiative lifetime for Xe_2Cl^* for 210 ± 25 ns was measured. (15 refs.)

106502 Homogeneous linewidth and optical dephasing of the $S_1 \leftarrow S_0$ transition of magnesium porphin in an *n*-octane crystal: a study by transient and photochemical hole-burning. A.I.M.Dicker, L.W.Johnson, S.Volker, J.H.van der Waals (Gorlaeus and Huygens Lab., Univ. of Leyden, Leyden, Netherlands).
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.8-14 (26 Aug. 1983).
Transient and photochemical hole-burning is used to determine the homogeneous linewidths of the $S_x \leftarrow S_0$ and $S_y \leftarrow S_0$ transitions of a magnesium porphin-pyridine complex in four sites of n-octane ($T=1.2$-$4.2K$). Thermally induced dephasing of $S_x \leftarrow S_0$ is consistent with 'exchange' to low-frequency local modes identified in the spectra. The relaxation time of S_y varies from ≈ 2 to 4 ps from site to site. (31 refs.)

106503 Air broadened NO linewidths in a temperature range of atmospheric interest. J.P.Houdeau, C.Boulet (Dept. de Phys. Atomique et Moleculaire, Univ. de Rennes, Rennes, France), J.Bonamy, A.Khayar, G.Guelachvili.
J. Chem. Phys. (USA), vol.79, no.4, p.1634-40 (15 Aug. 1983).
Self- and N_2-broadened linewidths of NO in the 5.4 μm band have been measured at 163 and 295K using high resolution Fourier transform spectroscopy. These linewidths have been calculated using the formalism of Robert and Bonamy (1979). The calculated values are in good agreement with the experimental one. Therefore, the same formalism can be reasonably used in order to calculate O_2-broadened widths which cannot be easily measured. Air-broadened linewidths calculations have been performed in the temperature range [163-295K]. From the results the J dependence of the exponent $m(J)$ which gives the temperature dependence of the widths, according to the power law $\gamma(T)=\gamma(T_0)(T/T_0)^{-m(J)}$ has been established. (30 refs.)

106504 NaH: studies of the $X^1\Sigma^+$ state near dissociation and of the radiative lifetimes and collision cross sections of the $A^1\Sigma^+$ state. O.Nedelec, M.Giroud (Lab. de Spectrometrie Phys., Univ. Sci. et Medicale de Grenoble, Saint Martin d'Heres, France).
J. Chem. Phys. (USA), vol.79, no.5, p.212-5 (1 Sept. 1983).
With a dye laser pumped by an excimer laser, the NaH $A^1\Sigma^+$ state has been excited up to $\nu'=21$. Its decay to the $X^1\Sigma^+$ ground state has been observed up to $\nu''=19$, a vibrational level close to the dissociation limit, allowing the authors to obtain a precise value of the $X^1\Sigma^+$ dissociation energy: $D_e=15\,785\pm20$ cm^{-1}. For $\nu''>15$, the vibrational spacings and the rotational constants decrease very rapidly, as also observed recently in CsH, due to a sudden change of configuration mixing. The $A\ ^1\Sigma^+$ radiative lifetimes do not vary appreciably from $\nu'=3$ to $\nu'=18$, $\tau=287\pm2$ ns, but increase to 35 ± 2 ns at $\nu'=21$. The quenching and rotational transfer collision cross sections of the $A^1\Sigma^+$ state with H_2 have nearly the same values for a given ν'. They increase from $\nu'=4$ to $\nu'=21$ as do the calculated electric dipole moments and the geometric extent of the levels. (28 refs.)

106505 Temperature dependence of air and oxygen broadening coefficients of O_3. A.Barbe, P.Marche, C.Meunier, P.Jouve (Lab. de Phys. Moleculaire, Faculte des Sci., Reims, France).
J. Phys. (France), vol.44, no.9, p.1015-17 (Sept. 1983). In French.
The authors have recorded the spectra of O_3 broadened by O_2 and dry air in the 5 μm region, at different temperatures from 296K to 171K. From these data, they deduce the values of pressure-broadened linewidths of O_3 at these temperatures. Writing $\alpha_0{}^L(T)=\alpha_0{}^L(T_0).(T_0/T)^n$, they deduce $n=1.3\pm0.2$ for dry air. (8 refs.)

106506 Pressure broadening theory of assymetric-top molecules using the methods of irreducible tensor operators. M.N.Moazzen-Ahmadi, J.A.Roberts (Dept. of Phys., North Texas State Univ., Denton, TX, USA).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.30, no.3, p.229-43 (Sept. 1983).
Contributions to the second-order collision efficiency function used in Anderson (1974) and Murphy-Boggs (1967) pressure-broadening theories due to dipole-dipole, dipole-quadrupole, quadrupole-dipole, and quadrupole-quadrupole interactions are derved by the method of irreducibly spherical tensor operators for molecules of arbitrary symmetry. Results are given explicitly in terms of dipole and quadrupole line strengths. General expressions for dipole line strength in the asymmetric rotor basis, as well as quadrupole moment line strength for the special case of molecules with two independent quadrupole moment components, are derived. (12 refs.)

106507 Intensity measurements in the (A-X) band system of CO. U.D.Prahllad, N.S.Murthy (Dept. of Phys., Univ. of Mysore, Mysore, India).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.250-4 (1983).
Relative integrated intensities of 18 bands of the CO 4th positive ($A^1\mathit{II}$-$X^1\Sigma^+$) band system have been measured by photographic photometry. The variation of the electronic transition moment $R_e(r)$ with the internuclear separation r has been found to be $R_e(r)=\text{constant}\times(0.757r-1)$ in the range 1.456 Å$\leq r\leq$1.575 Å. Smoothed relative band strengths and the effective vibrational temperature of the source are derived. (20 refs.)

The frozen-core approximation with a nonempirical polarisation potential: the sodium isoelectronic sequence ....See Entry 106293

A theoretical investigation of the radiative properties of the CN red and violet systems ....See Entry 106308

The $T_3(\pi,\pi^*)$ state of acridine ....See Entry 106322

Time dependence of absorption lineshapes ....See Entry 106355

The $B(^1\Sigma^+)$ and $X(^1\Sigma^+)$ states of HF and DF: RKR curves and Franck-Condon factors ....See Entry 106386

Resonance Raman spectra of the ground and excited states of specifically deuterated tris(2,2′-bipyridine)ruthenium(II) ....See Entry 106406

On the vibrational frequency correlation in liquids: Raman study of aqueous thiocyanate solutions ....See Entry 106407

Vibrational analysis of acetate ion molecules and estimation of equilibrium constants for their hydrogen isotopic exchange reactions ....See Entry 106409

Far infrared absorption in normal H_2 from 77 to 298K ....See Entry 106412

Revised analysis of the structure of the ν_1 band of methane ..See Entry 106425

Theoretical interpretation of the resonance Raman spectrum of gaseous chlorine ....See Entry 106428

Secondary isotope multiplet NMR spectroscopy of partially labeled entities. Carbon-13 SIMPLE NMR of carbohydrates ....See Entry 106451

A simple two-dimensional measurement of the decoupler power during continuous homonuclear irradiation for the correction of Bloch-Siegert shifts ....See Entry 106456

Laser-induced fluorescence of the HSiF radical ....See Entry 106484

Shift and quenching of fluorescence of tetrahydronaphthols due to hydrogen bonding ....See Entry 106486

Internal heavy-atom effect on the T_1 states on monochloroquinolines and monochloronaphthalenes ....See Entry 106487

Site dependence of the 1 ^1A_g to 2 ^1Ag transition of all-trans-1,3,5,7-octatetraene ....See Entry 106493

Ultrahigh-resolution study of autodetachment in C_2^- ....See Entry 106624

Excited state dipole moments of some monosubstituted benzenes from solvent effect on electronic absorption spectra ....See Entry 106630

Improved constants, Franck-Condon factors and r-centroids including vibration-rotation interaction for the B-X transition of ScO ....See Entry 106631

Broadening of electronic spectra at the critical point of a binary polar mixture ....See Entry 107861

NMR-electrolysis combined method (NMREL). Basic principles and some applications ....See Entry 109757

Spectral properties of flavins in hydrophilic matrices ....See Entry 109777

Photoselection of conformational substrates and the hyposochromic photoproduct of rhodopsin ....See Entry 109780

33.80 PHOTON INTERACTIONS WITH MOLECULES

106508 . On certain new apsects of the process of multiphoton excitation in polyatomic molecules. S.Rashev (Inst. of Solid State Phys., Bulgarian Acad. of Sci., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.5, p.599-601 (1983).
In recent years IR multiphoton excitation (MPE) in polyatomic molecules has aroused much experimental as well as theoretical interest. This enhanced interest is due to its practical implications (isotopically selective multiphoton dissociation (MPD), bond selective laser chemistry etc.) as well as to the possibilities opened up for a deeper insight into the properties of highly excited vibrational levels of the ground electronic state. In order to describe theoretically the population distribution among excited vibronic levels in the quasicontinuum (QC) of a polyatomic molecule, obtained in the course of laser irradiation (in the monomolecular regime), the kinetic equations technique is practically the sole accessible method. The kinetic equations technique is based on certain assumptions about the density of vibronic levels and the IR absorption cross section as functions of excitation energy. After some elaboration the method of description can be reduced to yield a partial differential equation describing the excitation process. (7 refs.)

33.80B Level crossing and optical pumping

106509 XUV excitation of H_2 using the third harmonic or a frequency-double dye laser. C.T.Rettner, E.E.Marinero, R.N.Zare (Dept. of Chem., Stanford Univ., Stanford, CA, USA), A.H.Kung.
AIP Conf. Proc. (USA), no.100, p.345-8 (1983). (Topical Meeting on Excimer Lasers, Incline Village, NV, USA, 10-12 Jan. 1983).
Frequency tripling a doubled dye laser in a pulsed argon source has produced $\sim10^{10}$ photons/pulse, permitting excitation of H_2 between 973 and 1023 Å. (4 refs.)

106510 Non-adiabatic approximation for resonant multiphoton excitation of vibrational-rotational states in strong laser fields. S.-I.Chu, T.-S.Ho, J.V.Tietz (Dept. of Chem., Univ. of Kansas, Lawrence, KS, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.422-6 (19 Aug. 1983).
A method is presented for efficient and accurate treatment of infrared multiphoton absorption (MPA) processes in strong fields. By means of adiabatic separation of the fast vibrational motion from the slow rotational motion, one first solves the quasi-vibrational energy states (QVESs) with molecular orientation fixed. This reduces the computationally often formidable Floquet matrix analysis to a manageable scale. One then introduces non-adiabatic angular couplings of the adiabatic QVESs for proper analysis of resonant MPA. The utility of the method is illustrated by a study of the non-linear MPA quantum dynamics in CO. (10 refs.)

Infrared optical double resonance spectroscopy of ND_2 ....See Entry 106471

Dye stability under excimer-laser pumping. II. Visible and UV dyes ....See Entry 106753

Storage and time reversal of light pulses using photon echoes ....See Entry 106829

Chemiluminescence induced in the laser-promoted reaction of ethanol with oxygen ....See Entry 109715

Luminescence of I_2/Ar mixture flowing out of a quenching setup at atmospheric pressure ....See Entry 109749

33.80E Autoionization, photoionization, and photodetachment

106511 Resonance-enhanced multiphoton ionization (2+1) of the $\tilde{B}$ and $\tilde{C}'$ states of ammonia. R.J.Stanley, O.Echt, A.W.Castleman,Jr. (Dept. of Chem., Pennsylvania State Univ., University Park, PA, USA).
Appl. Phys. B (Germany), vol.B32, no.1, p.35-8 (Sept. 1983).
Resonance-enhanced multiphoton ionization (REMPI) of the $\tilde{B}$ and $\tilde{C}'$ states of NH_3 in a pulsed supersonic molecular beam was observed at 304-340 nm, using the multiphoton-ionization mass-spectrometer system described herein. The observed features are the result of a 2+1 MPI process and correspond quite well with the reported 3+1 MPI of NH_3 in the literature from the ground state of opposite parity. (8 refs.)

106512 Autoionizing Rydberg states of the Li_2 molecule: molecular constants for $Li_2{}^+$. M.W.McGeoch, R.E.Schlier (Avco Everett Res. Lab. Inc., Everett, MA, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.4, p.347-52 (12 Aug. 1983).
Autoionizing Rydberg series of Li_2 have been observed in the two-step optical excitation of a supersonic lithium beam. The series limits are vibrational states of $Li_2{}^+$. In the most probable assignment $IP(Li_2)=41236.4\pm2.5$ cm^{-1} and for $Li_2{}^+$ $\omega_e=263.45\pm1.3$ cm^{-1}; $\omega_e x_e=1.35\pm0.2$ cm^{-1}; $r_e=3.032\pm0.01$ Å; $D_e=10807\pm150$ cm^{-1}. (12 refs.)

106513 Resonance by the complex coordinate method with Hermitean Hamiltonian. N.Moiseyev (Dept. of Chem., Technion-Israel Inst. of Technol., Haifa, Israel).
Chem. Phys. Lett. (Netherlands), vol.99, no.4, p.364-7 (12 Aug. 1983).
Using the complex coordinate method, a new hermitean hamiltonian is formulated, in which the resonance position and width are the 'natural' perturbation strength parameters. If the resonance position is known the resonance width obtained by the presented theory is a lower bound to the exact value. (14 refs.)

106514 State-selective resonant excitation-ionization of H_2 with tunable VUV laser light. H.Rottke, K.H.Welge (Fakultat fur Phys., Univ. Bielefeld, Bielefeld, Germany).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.456-60 (19 Aug. 1983).
State-selective resonant two-phonon ionization of molecular hydrogen with the $B\ ^2\Sigma_u{}^+(\nu'=0,J')\leftarrow X\ ^1\Sigma_g{}^+(\nu''=0,J'')$ transition as resonant step in the wavelength region 1108-1116 Å has been performed with tunable VUV laser light. Two experimental arrangements have been employed, one with a quadrupole mass spectrometer and the other with an ionization cell arrangement. With presently available tunable VUV laser intensities a state-selective detection sensitivity of $\approx10^{-10}$ Torr H_2 can be achieved. (21 refs.)

106515 Ultraviolet laser induced ionization of molecules near surfaces. R.B.Opsal, J.P.Reilly (Dept. of Chem., Indiana Univ., Bloomington, IN, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.461-4 (19 Aug. 1983).
Aromatic molecules are multiphoton ionized in the source region of a time-of-flight mass spectrometer using the output from a KrF excimer laser. Under certain operating conditions unusually sharp mass spectral peaks are observed. It is demonstrated that these result from ionization of molecules initially adsorbed to a metal surface. The implications of this phenomenon are briefly discussed. (14 refs.)

106516 Photoabsorption and photoionization of HD. P.M.Dehmer (Argonne Nat. Lab., Argonne, IL, USA), W.A.Chupka.
J. Chem. Phys. (USA), vol.79, no.4, p.1569-80 (15 Aug. 1983).
Relative photoabsorption and photoionization cross sections have been measured for HD at a temperature of 78K in the wavelength region from 735 to 805 Å. The present wavelength resolution of 0.016 Å represents an improvement of more than two orders of magnitude over that of previous photoionization studies of this molecule. Bands of the $3p\pi\ D\ ^1\Pi_u\leftarrow X^1\Sigma_g{}^+$ system are observed to $\nu'=17$, and ionization efficiencies are reported for a

number of Rydberg states of low principal quantum number. As in the case of H_2, the ionization efficiency is close to unity for Rydberg states that can autoionize with $\Delta\nu=-1$, but drops to zero for states that can autoionize only with a large change in vibrational quantum number and that are significantly predissociated (such as the $3p\pi D^1\Pi_u$ state). The breakdown of (g,u) symmetry in HD and the resulting effects on the absorption spectrum and on the decay paths of the Rydberg states are discussed. (62 refs.)

106517 Relative intensities in X-ray photoelectron spectra. X. Near-threshold structure of photoionization cross-sections of molecular valence shells. M.M.Gofman, V.I.Nefedov (Inst. of General & Inorganic Chem., Acad. of Sci., Moscow, USSR), V.L.Kraizman, R.V.Vedrinski.
J. Electron Spectrosc. & Relat. Phenom. (Netherlands), vol.32, no.1, p.59-72 (Aug. 1983).
For pt.IX see ibid., vol.27, p.109 (1982). A method is described for the calculation of photoionization cross-sections of molecular orbitals using atomic cross-sections. The method is an extension of the additive scheme, and allows description of the resonance structure of the cross-sections, taking into account multiple scattering of photoelectrons by the molecular potential. Calculated photoionization cross-sections for the valence levels of N_2, CO and SF_6 are presented for excitation energies ranging from the ionization threshold to 50 eV. The results are compared with the near-threshold structure in the corresponding X-ray absorption spectra. (33 refs.)

106518 Pade-approximant corrections to general variational expressions of scattering theory: application to 5σ photoionization of carbon monoxide. R.R.Lucchese (Dept. of Chem., Princeton Univ., Princeton, NJ, USA), V.McKoy.
Phys. Rev. A (USA), vol.28, no.3, p.1382-94 (Sept. 1983).
The authors discuss a method for systematically correcting results obtained using variational expressions in scattering theory. The approach taken is to compute a sequence of Pade approximants of the form $[N/N]$ for the error in an initial variational estimate obtained using a basis-set expansion. The relationship between the Pade-approximant approach and the iterative Schwinger method for correcting variational estimates is also examined. The authors discuss a large class of general variational expressions to which the Pade-approximant approach can be applied. The variational expressions considered include those for the wave function, for photoionization transition matrix elements, as well as for scattering matrix (K-matrix) elements. The authors have applied this approach to the 5σ photoionization of CO using the frozen-core Hartree-Fock and fixed-nuclei approximations. The authors find that the Pade-approximant method converges rapidly and reliably. Both total photoionization cross sections and photoelectron angular distributions from threshold to 40 eV are presented and compared to previous experimental and theoretical results. The authors find major quantitative discrepancies between the present results for the total cross section and previous theoretical results. (44 refs.)

Triply differential photoelectron studies of the four outermost valence orbitals of cyanogen .... See Entry 106497

Angle-resolved photoelectron spectroscopy of HCl from a photon energy of 16 to 80 eV .... See Entry 106499

Two-photon-ionization mass spectroscopy of ammonia clusters in a pulsed supersonic nozzle beam .... See Entry 106647

33.80G Diffuse spectra; predissociation, photodissociation

106519 Infrared multiphoton excitation: energy distribution of reacting molecules from overtone excitation studies. S.Ruhman, O.Anner, S.Gershuni, Y.Haas (Dept. of Phys. Chem., Hebrew Univ. of Jerusalem, Jerusalem, Israel).
Chem. Phys. Lett. (Netherlands), vol.99, no.4, p.281-6 (12 Aug. 1983).
A method is offered to estimate quantitatively the energy distribution of molecules reacting after being excited by multiphoton absorption of infrared radiation. The method is based on the comparison of the real time reaction kinetics obtained in the infrared multiphoton experiment with those observed upon excitation of a vibrational overtone. Results obtained for the dissociation of tetramethyldioxetane under low-pressure conditions are used as a demonstration. (16 refs.)

106520 Time resolved observations of NH_2 and benzyl radicals produced in the infrared multiple photon dissociation of benzylamine. H.Reisler, F.B.T.Pessine, C.Wittig (Chem. Dept., Univ. of Southern California, Los Angeles, CA, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.388-93 (19 Aug. 1983).
The average internal energy of benzylamine molecules dissociated via infrared multiple photon excitation is derived from laser induced fluorescence (LIF) measurements of $[NH_2]$ versus time, and is 50-70 kcal mol^{-1} above threshold at fluences of 10-30 J cm^{-2}. The benzyl radical is monitored by LIF and is produced vibrationally 'hot'. Fluorescence lifetimes of bands in its $1^2A_2 \to 1^2B_2$ system are reported. (30 refs.)

106521 Photofragmentation of nitromethane in a molecular beam at 193 nm. N.C.Blais (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.1723-31 (15 Aug. 1983).
The author reports the cross section for dissociation of nitromethane at 193 nm. It is $(1.7\pm1.0)\times10^{-17}$ cm^2 measured relative to that for $H\,^{79}Br$. From this, he infers that the quantum yield for the process is nearly unity. Photofragments of the dissociation were observed at masses 15, 16, and 30 corresponding to CH_3, O, and NO, but only a very small amount of fragments at mass 46 (NO_2) was measured. Time-of-flight spectra were obtained for all fragments except for mass 46. The data is explained by assuming that two sequential absorptions of photons occur. The first photon dissociates CH_3NO_2 to CH_3 and NO_2. The second photon is absorbed by the NO_2 fragment to give NO+O. About 30% of the NO_2 participate in the second absorption and the rate determining step is the primary absorption. The primary absorption fragments are characterized by having a most probable kinetic energy of 7% of the maximum available energy with an average of 19%. The remainder of this energy appears as internal energy of the fragments which can include electronic excitation of NO_2 to the A^2B_2 state or even to further dissociation of NO_2 to NO+O. (29 refs.)

106522 A classical theory of multiple photon dissociation. D.A.Jones, I.C.Percival (Dept. of Appl. Math., Queen Mary Coll., London, England).
J. Phys. B (GB), vol.16, no.16, p.2981-96 (28 Aug. 1983).
The authors consider the absorption of energy from a laser by a molecule that has been excited into the lower quasi-continuum, with particular reference to SF_6 The theory is analytic and purely classical, following the general prescription of E.V. Shuryak. They find stochastic energy absorption, but of a different magnitude from that of Shuryak. The energy diffusion constant is independent of the applied field, in disagreement with experiment. This disagreement is unlikely to be due to quantal effects. They find that if rotation is incorporated into the original model, the picture is completely changed and there is an explicit dependence of diffusion on field strength, but no detailed analysis is available. (45 refs.)

106523 Ultraviolet photodissociation of $Xe_2{}^+$ and $Kr_2{}^+ 1(^1/_2)_u$: detection of rare-gas dimer ions in real time. A.W.McCown, M.N.Ediger, S.M.Stazak, J.G.Eden (Dept. of Electrical Engng., Univ. of Illinois, Urbana, IL, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1440-5 (Sept. 1983).
Momentary depletion of the $Xe_2{}^+$ (or $Kr_2{}^+$) $1(^1/_2)_u$ population is observed by photodissociating the molecule at 351.1, 337.1, or 307.9 nm [on the $1(^1/_2)_u \to 2(^1/_2)_g$ band] and monitoring the temporally resolved emission from the dissociative-recombination fed neutral Xe line at 828.0 nm ($6p[^1/_2]_0 \to 6s[^3/_2]_1$). Near total suppression (>90%) of the Xe ($6p \to 6s$) fluorescence is obtained for laser intensities of 50 MW cm^{-2}. Measurements of the absolute electron density confirm that this effect is due to depletion of the dimer-ion concentration rather than photoionization of the $6p[^1/_2]_0$ state. However, photoionization of the Xe ($6s'$ or $6p$) levels is observed and the cross section is measured to be 2.3×10^{-18} cm^2 at 351 nm. These experiments demonstrate a means for studying the collisional kinetics of rare-gas dimer ions in real time and in the presence of large background gas pressures. (26 refs.)

Ab initio CI study of the photodissociation of nitrosyl chloride (ClNO) .... See Entry 106310

The photodissociation of nitromethane at 193 nm .... See Entry 106391

Excitation and dissociation of SF_6 molecules in a two-frequency infrared laser field .... See Entry 106478

The photophysics and photochemistry of weakly bound dimers of *s*-tetrazine .... See Entry 106492

Resonance by the complex coordinate method with Hermitean Hamiltonian .... See Entry 106513

Photoabsorption and photoionization of HD .... See Entry 106516

Laser isotope separation of tritium from deuterium: CO_2-laser-induced multiphoton dissociation of C_2TF_5 in C_2DF_5 .... See Entry 106625

Deuterium separation and infrared photochemistry in CF_2HCl .... See Entry 109765

33.80K Multiphoton processes

Non-adiabatic approximation for resonant multiphoton excitation of vibrational-rotational states in strong laser fields .... See Entry 106510

Resonance-enhanced multiphoton ionization (2+1) of the $\tilde{B}$ and $\tilde{C}'$ states of ammonia .... See Entry 106511

State-selective resonant excitation-ionization of H_2 with tunable VUV light .... See Entry 106514

Ultraviolet laser induced ionization of molecules near surfaces .... See Entry 106515

Infrared multiphoton excitation: energy distribution of reacting molecules from overtone excitation studies .... See Entry 106519

A classical theory of multiple photon dissociation .... See Entry 106522

Chemiluminescence induced in the laser-promoted reaction of ethanol with oxygen .... See Entry 109715

Deuterium separation and infrared photochemistry in CF_2HCl .... See Entry 109765

34.00 ATOMIC AND MOLECULAR COLLISION PROCESSES AND INTERACTIONS

34.20 INTERATOMIC AND INTERMOLECULAR POTENTIALS AND FORCES

(for molecular solids, see 31.70K)

106524 Comments on energy minimization in subspaces of coordinates and on 'chemical hysteresis'. I.Balint, M.I.Ban (Inst. of General & Phys. Chem., Attila Jozsef Univ., Szeged, Hungary).
Int. J. Quantum Chem. (USA), vol.24, no.2, p.161-7 (Aug. 1983).
Using partial minimization of the potential energy function, the determination of the points of the reaction path does not often lead to unambiguous results. The reason is that the subspace of the coordinate where the minimization takes place cannot be arbitrarily chosen. (6 refs.)

106525 Long-range forces in heavy particle scattering. D.J.Baker, D.R.Flower (Phys. Dept., Univ. of Durham, Durham, England).
J. Phys. B (GB), vol.16, no.17, p.L515-19 (14 Sept. 1983).
The authors examine the applicability of asymptotic series expansions, of the type introduced by Gailitis (1976) to problems in heavy particle scattering. The convergence of the solutions, with respect to the value of the scattering coordinate, is found to be greatly improved in a model problem of the rovibrational excitation of H_2 by H^+. (6 refs.)

106526 Perturbation calculations of the interaction energy between closed-shell Hartree-Fock atoms. The neon dimer. G.Chalasinski (Theoretical Chem. Group, Univ. of Utrecht, Utrecht, Netherlands).
Mol. Phys. (GB), vol.49, no.6, p.1353-73 (20 Aug. 1983).
Interaction energy between two neon atoms described by the Hartree-Fock wavefunctions has been calculated through the second order of the symmetry-adapted perturbation theory. Particular contributions, the first order energy, dispersion, induction, exchange-dispersion and exchange-induction energies, are analysed and the basis set effects are discussed. The calculated values of the interaction energies are close to the experimental energies. (72 refs.)

106527 Repulsive van der Waals and dipole-quadrupole interaction in the excited LiCs molecule. C.Vadia, C.-J.Lorenzen, K.Niemax (Inst. fur Experimentalphys., Univ. Kiel, Kiel, Germany).
Phys. Rev. Lett. (USA), vol.51, no.11, p.988-91 (12 Sept. 1983).
The authors report strong repulsive van der Waals and dipole-quadrupole interactions in the Σ and Π potentials of the LiCs molecule dissociating into Li $2P$ and Cs $6S$ atoms. Theoretical results derived from second-order perturbation theory are verified by investigating experimentally the

wavelength dependence of the quasistatic wings of the Li resonance lines broadened by Cs ground-state atoms. (14 refs.)

106528 Potential energy functions for diatomic molecules. E.I.Toader, A.Dumitrescu (Faculty of Phys., Univ. of Bucharest, Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.6, p.499-506 (1983).
Using the criteria a good diatomic potential function must satisfy and the experimental constants to fit the potential curve, six semiempirical potential-energy functions are reported. The comparison of these potential-energy functions with the potential function for $^1\Sigma_g{}^+H_2$, constructed from the points calculated by Kolos and Wolnievicz (1965), shows that the sixth function of this paper, which has a high degree of versatility, seems also to be a suitable function for other diatomic molecules. (8 refs.)

106529 Force fields for large molecules. H.Matsuura (Dept. of Chem., Faculty of Sci., Hiroshima Univ., Hiroshima, Japan), M.Tasumi.
In book: *Vibrational spectra and structure. A series of advances. Vol.12*, J.R.Durig [Ed.], p.69-143. Amsterdam, Netherlands: Elsevier (1983), xvi+497 pp. [0 444 42197 1]
The authors discuss the general harmonic force field for large molecules and make ab initio calculations of the force constants. (100 refs.)

106530 Vibrational spectra of small matrix isolated molecules. R.L.Redington (Dept. of Chem., Texas Tech. Univ., Lubbock, TX, USA).
In book: *Vibrational spectra and structure. A series of advances. Vol.12*, J.R.Durig [Ed.], p.323-403. Amsterdam, Netherlands: Elsevier (1983), xvi+497 pp. [0 444 42197 1]
Vibrational analysis is performed to obtain a representation for the multidimensional potential energy function governing intramolecular nuclear motion. The matrix isolation sampling method was used for the spectroscopic study of mixtures of isotopic congeners. (276 refs.)

Vibrational spectra and structure. A series of advances. Vol.12 .... See Entry 105049

Algebraic representation for multiple anharmonic oscillators via compact and non-compact unitary groups .... See Entry 105135

Full CI calibration of model Hamiltonian, large basis set studies of the H_2-H_2 van der Waals interaction .... See Entry 106309

Doubly positive diatomic molecules. I. $N_2{}^{2+}$ .... See Entry 106312

Radiative collision-induced electron continuum-continuum scattering .... See Entry 106370

Cubic and quartic force constants of some stretching and out-of-plane bending modes of the FH...OH_2 complex: a three-dimensional hypersurface analysis .... See Entry 106380

Raman study of CF_4 in liquid Ar: molecular motions and transition dipole interaction .... See Entry 106435

Breathing-sphere quantum calculations of integral and differential cross sections for vibrational excitation in ion (atom)-diatom collisions .... See Entry 106543

Semiclassical calculation of energy transfer in polyatomic molecules. X. Energy transfer in Ar+SF_6 at 1 eV .... See Entry 106544

Proton-argon charge transfer cross sections with a realistic electron-target interaction .... See Entry 106568

Theory of low energy ion-ion charge exchange .... See Entry 106581

Two-potential formulation in HHOB .... See Entry 106590

Nuclear dynamics in resonant electron-molecule scattering beyond the local approximation: the 2.3-eV shape resonance in N_2 .... See Entry 106617

A simple perturbational approach for the determination of favourable reaction pathways .... See Entry 109710

34.40 ELASTIC SCATTERING OF ATOMS AND MOLECULES

106531 Zero-angular-momentum resonances in atom-atom collisions. S.Bosanac (R. Boskovic Inst., Zagreb, Yugoslavia).
Phys. Rev. A (USA), vol.28, no.3, p.1344-56 (Sept. 1983).
In elastic atom-atom collisions resonances can be formed even for zero angular momentum, provided that the potential has a barrier. It is shown that their contribution in the cross section is much larger than expected from their energy width. This is due to an unusually large broadening effect in the angular momentum variable which only occurs for zero-angular-momentum resonances. The broadening effect in the partial waves is analyzed, and it is shown how such resonances affect the cross sections. (21 refs.)

106532 Electron loss cross sections for He^+ and He incident on N_2 and O. S.A.Haider, R.P.Singhal (Appl. Phys. Section, Inst. of Technol., Banaras Hindu Univ., Varanasi, India).
Physica B & C (Netherlands), vol.121B+C, no.3, p.437-40 (Aug. 1983).
Electron loss cross sections for He^+ and He incident on molecular nitrogen and atomic oxygen are calculated using the free collision model. Accurate analytical expressions for differential elastic cross sections needed in the free collision model have been used. Good agreement with available experimental data is found at high impact energies when the free collision model is applicable. (13 refs.)

Narrowing of two-photon resonance due to elastic collisions .... See Entry 106376

On the measurement of ion(atom)−ion (atom) charge exchange .... See Entry 106582

34.50 INELASTIC SCATTERING OF ATOMS AND MOLECULES

106533 Collision experiment on highly ionized ions using a vacuum spark source. S.Takagi, S.Ohtani, K.Kadota, J.Fujita (Inst. of Plasma Phys., Nagoya Univ., Nagoya, Japan).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.2-3, p.539-44 (1 Aug. 1983).
Cross sections for one-electron capture by Fe^{6+} in H_2 have been measured at collision energies below 10 eV by using a vacuum spark ion source. It is found that the cross sections are little dependent on the collision energy and their values are around 6×10^{-15} cm^2. This ion source, which has no electrode for ion extraction, can produce multicharged ions from several hundreds of eV to several tens of keV and the maximum charge state of 16 in Fe at the discharge energy of 125 J (capacitor: 10.4 μF, operation voltage: 5 kV). With an ion selection system of 2.7 m time-of-flight and a 127° electrostatic analyzer of 1% resolving power 10^2-10^3 ions/pulse are obtained. Because of the poor reproducibility of the discharge, ions which have captured an electron from the target molecule and ions which have not reacted, are measured simultaneously during one discharge with a microchannel plate which has two collectors at the back. (21 refs.)

106534 Ion energy-loss spectroscopy of Kr^{2+}-He and -Ne collisions. I. Transitions among $^3P_2$, $^3P_1$, $^3P_0$, $^1P_2$ and $^1S_0$ or Kr^{2+}. N.Kobayashi, T.Nakamura, Y.Kaneko (Dept. of Phys., Tokyo Metropolitan Univ., Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2684-91 (Aug. 1983).
Excitation and de-excitation among low-lying states of Kr^{2+}, $^3P_2$, $^3P_1$, $^3P_0$, $^1D_2$ and $^1S_0$, in the collisions with He and Ne are studied in the energy range from 0.5 to 2.7 keV using a high resolution ion energy-loss spectrometer. The primary Kr^{2+} beam is extracted from an electron-impact ion source and the fractional populations of these states are determined as a function of the impact energy for electrons from 80 to 400 eV. The measured fractions are different from those expected from the statistical model. The fractional populations of the metastable states, $^1D_2$ and $^1S_0$, increase monotonously with the increase of the electron energy up to the highest energy studied. The cross sections for the $^3P_2\rightleftarrows{}^3P_1$, $^3P_2\rightleftarrows{}^3P_0$, $^3P_{0,1}\rightleftarrows{}^1D_2$ and $^1D_2\rightleftarrows{}^1S_0$ transitions are evaluated from the intensities of the inelastic and primary peaks observed at angle 0°. (12 refs.)

106535 Relativistic binary-encounter collision and stopping theory: general expressions. A.L.Tofterup (Fysisk Inst., Odense Univ., Odense, Denmark).
J. Phys. B (GB), vol.16, no.16, p.2997-3003 (28 Aug. 1983).
An expression for the energy transfer between two particles moving with relativistic velocities has been given on the basis of a binary-encounter description of elastic scattering. By means of a Lorentz transformation of the differential scattering cross section in the center-of-mass system the differential cross section and the total cross section have been established for relativistic particle velocities. Expressions have been derived that relate stopping power and straggling for a projectile penetrating a medium in internal motion to the stopping parameters of a medium at rest. These expressions contain the velocity distribution of target particles, kinematic factors and the Moller speed. (18 refs.)

106536 Interference effects in photon emission excited in collisions between identical atoms. G.Nienhuis (Fysisch Lab., Rijksuniv. Utrecht, Utrecht, Netherlands).
J. Phys. B (GB), vol.16, no.17, p.L509-15 (14 Sept. 1983).
The author evaluates interference effects arising in the photon emission excited by collisions between identical atoms. The general cause of the interference is the coherent superposition of radiation emitted by either one of the atoms. The author briefly discusses the relevance of these effects in several experimental situations of practical interest. (6 refs.)

106537 Proton affinity of GeH_4 and the shape of $GeH_5{}^+$. S.Kohda-Sudoh (Dept. of Chem., Hirosaki Univ., Hirosaki, Japan), S.Ikuta, O.Nomura, S.Katagiri, M.Imamura.
J. Phys. B (GB), vol.16, no.17, p.L529-31 (14 Sept. 1983).
The structure of $GeH_5{}^+$ is a complex of $GeH_3{}^+ + H_2$ with C_s symmetry. The proton affinity is calculated to be 7.3 eV. The obscure nature of $GeH_5{}^+$ is elucidated by its small dissociation energy 7.6 kcal mol^{-1} into $GeH_3{}^+ + H_2$. (11 refs.)

106538 Charge-changing cross sections for 1-70-keV H^+ and H^0 in collisions with calcium and strontium metal vapors. M.Mayo, J.A.Stone, T.J.Morgan (Phys. Dept., Wesleyan Univ., Middletown, CT, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1315-21 (Sept. 1983).
Absolute electron-transfer cross sections have been measured for H^+ and H^0 in collisions with Ca and Sr metal vapor targets for energies between 1 and 70 keV. The measurements include cross sections for single- and double-electron capture by H^+ and single-electron capture and loss by H^0. The single-electron capture cross section for H^+ incident has been calculated using the binary-encounter approximation, and agrees with experiment to within a factor of 2 for energies between 2 and 70 keV. The electron-detachment cross section for H^- in collisions with Ca and Sr is determined from the present measured data and previously measured charge-state equilibrium fractions. The high- and low-energy structure in the cross sections for single- and double-electron capture by H^+ are discussed in terms of the importance of inner-shell capture at high energies and a molecular picture at low energies, and the cross sections are compared to those for Mg and Ba targets published in a previous paper. The cross section for single-electron capture by H^0 rises at low energies; that for electron detachment from H^- decreases at low energies in agreement with theoretical predictions of Olson and Liu (1979). This situation is discussed as the mechanism responsible for large negative-ion equilibrium yields at low energies for alkaline-earth targets. (28 refs.)

106539 Collisional broadening of nonlinear optical resonances. V.P.Chebotayev, L.S.Vasilenko (Inst. of Thermal Phys., Novosibirsk, USSR).
Prog. Quantum Electron. (GB), vol.8, no.2, p.79-114 (1983).
Discusses the results of experimental studies of collisions by new superhigh resolution spectroscopic methods and considers in detail the influence of velocity changing collisions on the shape of the resonance. (99 refs.)

106540 Angular correlation studies of heavy-particle impact excitation of atoms. K.Blum (Inst. fur Theoretische Phys. I, Univ. Munster, Munster, Germany), H.Kleinpoppen.
Phys. Rep. (Netherlands), vol.96, no.5, p.251-316 (June 1983).
A review is given of recent developments of angular correlation studies of heavy-particle impact excitation of atoms and molecules. After a brief discussion of the basic principles of experimental methods a theory of measurement of angular correlations from heavy-particle atom collisions is outlined in the following way. By applying angular correlation measurements a subensemble from the collision processes is selected which is described by state and scattering parameters. These parameters (scattering amplitudes and their phases, alignment and orientation, state multipoles and coherence parameters) can be connected with the experimental angular correlation data. Results from heavy-particle angular correlations have been discussed in separate sections with ions or atoms as projectiles; subsections are dealing with charge exchange excitation, excitation of autoionizing states direct and simultaneous excitation of target and projectile particles. The angular correlation parameters are very sensitive to the detailed excitation mechanisms and quasi-molecular parameters in heavy-particle atom collisions. The majority of data available so far were obtained from simple projectile-target systems such as one-electron atom systems and rare gas atoms. Attention is drawn to possible spin-orbit effects in the analysis of angular correlations from collisions between very heavy atomic particles. (96 refs.)

Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute .... See Entry 105031

Radiative transition rates of collisionally perturbed atoms in an intense monochromatic field .... See Entry 106358

Radiative collision-induced electron continuum-continuum scattering .... See Entry 106370

Air broadened NO linewidths in a temperature range of atmospheric interest .... See Entry 106503

Long-range forces in heavy particle scattering .... See Entry 106525

Theory of laser-induced chemi-ionization. I. Quantal formulation .... See Entry 106561

Electron capture cross sections for TiH^{4+} .... See Entry 106574

Comment on 'Radiative decay of lithium-like ions following exchange collisions of 3 keV amu^{-1} C^{4+} with H_2' .... See Entry 106575

Velocity dependence of Rydberg $n \rightarrow n'$ charge transfer cross sections .... See Entry 106576

Experimental study of the triatomic hydrogen molecule through the collisional sequence $H_3{}^+ \rightarrow H_3 \rightarrow H_3{}^+$ undergone by fast beams in argon .... See Entry 106577

Confinement of ions for collision studies .... See Entry 107435

Negative ion formation in collision of electron with H_2 and isotopes .... See Entry 109725

34.50E Rotational and vibrational energy transfer

106541 Calculation of differential cross sections for rotational excitation in D_2+CO collisions at 87.2 meV. G.D.Billing, L.L.Poulsen (Dept. of Chem., Panum Inst., Univ. of Copenhagen, Copenhagen, Denmark).
Chem. Phys. Lett. (Netherlands), vol.99, no.4, p.368-71 (12 Aug. 1983).
Differential cross sections for rotational excitation in D_2+CO collisions are calculated at six scattering angles using an electron gas surface and a semi-classical scattering theory in which the translational and the rotational motion of CO are treated classically whereas the D_2 rotation is quantized. (7 refs.)

106542 Collisional redistribution of weak radiation and the factorization approximation. K.Burnett (Dept. of Phys., Univ. of Colorado, Boulder, CO, USA).
Comments At. & Mol. Phys. (GB), vol.13, no.4, p.179-85 (1983).
Describes recent work on the collisional redistribution of weak radiation in dilute gases. This work has dealt with the finite duration of collision effects in the statistical problem of light scattering by atoms undergoing collisions with foreign atoms. It has provided a basis for redistribution functions valid from the line core far into the wing—including the effects of simultaneous radiative and inelastic collisional events—and has also pointed the way to experiments where the details of inelastic collision dynamics can be studied by light scattering. (59 refs.)

106543 Breathing-sphere quantum calculations of integral and differential cross sections for vibrational excitation in ion (atom)-diatom collisions. G.Drolsgagen, J.P.Toennies (Max-Planck Inst. fur Stromungsforschung, Gottingen, Germany).
Chem. Phys. (Netherlands), vol.79, no.2, p.159-77 (1 Sept. 1983).
Pure vibrational excitation cross sections for a large number of ion (atom)-diatom collision systems are calculated using the breathing-sphere approximation. A realisitic spherical potential adapted from the SCF potential calculated and fitted by Lester for $Li^+ + H_2$ is used for all systems. The effect of the collision energy from threshold up to the equivalent of 30 vibrational quanta and the effect of the masses of the incoming atom (1-133 amu) and target molecule (2-160 amu) on the integral inelastic cross sections is studied systematically. In another set of calculations the effect of 10% variations of various potential parameters on the excitation cross sections is examined and discussed in terms of potential range effects and vibrational coupling. Vibrationally inelastic differential cross sections for the system $Li^+ + H_2$ are calculated at total energies of 1.47, 2.0 and 3.65 eV and for $Li^+ + Br_2$ at 0.074, 0.080, and 0.321 eV. Finally the energy dependence of integral cross sections is compared with the predictions of the Schwartz-Slawsky-Herzfeld (SSH) theory. Despite different potentials the qualitative agreement is good except for vibrational excitation of heavy molecules by light atoms. The energy dependence of integral inelastic cross sections and rate constants for this case are derived from the sudden approximation. (52 refs.)

106544 Semiclassical calculation of energy transfer in polyatomic molecules. X. Energy transfer in $Ar+SF_6$ at 1 eV. G.D.Billing (Dept. of Chem., Panum Inst., Copenhagen, Denmark).
Chem. Phys. (Netherlands), vol.79, no.2, p.179-88 (1 Sept. 1983).
Rotational and vibrational energy transfer in $AR+SF_6$ collisions at 1 eV is calculated as a function of scattering angle. Differential cross sections for the two most excited vibrational modes ν_6 and ν_5 are also reported. (12 refs.)

106545 Collision energy dependence of vibration/rotational distribution of BaBr produced in the crossed beam reaction $Ba+CH_3Br$. T.Munakata, Y.Matsumi, T.Kasuya (Inst. of Phys. & Chem. Res., Saitama, Japan).
J. Chem. Phys. (USA), vol.79, no.4, p.1698-707 (15 Aug. 1983).
The energy disposal in the reaction $Ba+CH_3Br \rightarrow BaBr+CH_3$ was studied as a function of collision energy. The collision energy was controlled in the range from 2.9 and 4.9 kcal/mol by variable acceleration of a supersonic CH_3Br beam which intersected a thermal Ba beam. The internal states of the nascent BaBr were probed by means of the laser induced fluorescence (LIF). Systematic simulations of the observed LIF spectra revealed that an increase of collision energy brought about a drastic decrease of vibrational excitation. The vibrational quantum of maximum population shifted from 12 to 1 in accordance with a collision energy increment of only 2 kcal/mol. Surprisal analysis of the vibrational population suggests that the collision energy increment causes a transition between two reaction paths, one of which leads to vibrationally excited BaBr of maximum population at around $\nu''=12$, and the other, to internally cold CH_3 and statistically excited BaBr. (22 refs.)

106546 Mode-selective cooling of vibrational energy during supersonic expansion of pyrimidine: evidence for noncommunicating sets of vibrational manifold. A.K.Jameson (Dept. of Chem., Loyola Univ. of Chicago, Chicago, IL, USA), H.Salgusa, E.C.Lim.
J. Phys. Chem. (USA), vol.87, no.16, p.3007-9 (4 Aug. 1983).
The authors present evidence for mode-selecting cooling of vibrational energy during supersonic expansion of pyrimidine. The $16a_1{}^1$ sequence band is strongly cooled in the expansion while the $16b_1{}^1$ sequence band is cooled very little. Within the context of a unified physical model for intramolecular and intermolecular energy flow, the observation of mode-selective vibrational cooling implies that intramolecular vibrational energy redistribution may be incomplete even for molecules with large excess vibrational energies. (9 refs.)

106547 Cross-section measurement for the energy-transfer collisions $Na(3P)+Na(3P) \rightarrow Na(5S,4D)+Na(3S)$. M.Allegrini (Istituto di Fisica Atomica e Molecolare, CNR, Pisa, Italy), P.Bicchi, L.Moi.
Phys. Rev. A (USA), vol.28, no.3, p.1338-43 (Sept. 1983).
Reports measurements of the cross sections σ_{5S} and σ_{4D} for the electronic-energy-transfer process $Na(3P)+Na(3P) \rightarrow Na(5S,4D)+Na(3S)$. To obtain these cross sections the authors measured the fluorescence intensity for the transitions $5S \rightarrow 3P$, $4D \rightarrow 3P$, and $3P \rightarrow 3S$ in sodium vapor excited with a CW dye laser. The study of this electronic energy transfer is complicated and there is a large disagreement ($\gtrsim 10^4$) among reported measurements. The authors believe they have avoided most of the difficulties of previous experiments. The results are $\sigma_{5S}=(2.0 \pm 0.7) \times 10^{-15}$ cm^2 and $\sigma_{4D}=(3.2 \pm 1.1) \times 10^{-15}$ cm^{-2}, and they are compared with the results of other experiments. (16 refs.)

NaH: studies of the $X^1\Sigma^+$ state near dissociation and of the radiative lifetimes and collision cross sections of the $A^1\Sigma^+$ state .... See Entry 106504

Vibrational relaxation in liquids: quantum states in a classical bath .... See Entry 107503

34.50H Electronic excitation and ionization (inc. beam-foil excitation and ionization)

106548 The secondary ion mass spectrum of glycerol-d_5: evidence for radical cation intermediates. W.V.Ligon,Jr. (Corporate Res. & Dev., General Electric Co., Schenectady, NY, USA).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.189-93 (1 Sept. 1983).
Particle bombardment of liquid glycerol deuterated on carbon has provided evidence for $(MD)^+$ ion formation via a radical cation intermediate. This discovery has important mechanistic implications for the ionization of compounds dissolved in glycerol. (10 refs.)

106549 Excitation of helium ($1^1S \rightarrow 2^1S$) by proton impact at intermediate and high energies. G.P.Gupta (Dept. of Phys., SD Coll., Muzaffarnagar, India), S.Saxena, K.C.Mathur.
Indian J. Phys. Part B, vol.57B, no.2, p.154-60 (April 1983). [received: Sept. 1983]
The differential and integral cross sections for the $1 1S \rightarrow s^1S$ excitation of helium by proton impact are calculated with incident energy ranging from 100-500 KeV, using the two-potential-modified Born (TPMB) approximation. The computed results are compared with the plane-wave results and the various other theoretical calculations. (13 refs.)

106550 Electronic energy transfer between state selected metastable argon atoms and ground state krypton atoms. T.D.Dreiling, N.Sadeghi (Lab. de Spectrometrie Phys., Univ. Sci. et Medicale de Grenoble, Grenoble, France).
J. Phys. (France), vol.44, no.9, p.1007-13 (Sept. 1983).
The excitation transfer reactions from Ar $(^3P_2)$ and Ar $(^3P_0)$ to Kr were studied in the afterglow of a pulsed discharge. The time decay of the metastable concentrations was monitored to obtain total quenching rate constants for removal of Ar (^3P_J) by Kr. In separate experiments, Ar $(^3P_2)$ was optically depopulated in the afterglow by use of a tunable CW dye laser. Comparison of emission intensities from excited Kr levels with and without laser perturbation was used to assign relative rate constants for excitation of Kr levels by Ar $(^3P_2)$ and Ar $(^3P_0)$. The Kr excitation by Ar $(^3P_2)$ was found to be ~40 times more efficient than by Ar $(^3P_0)$. (20 refs.)

106551 Alignment of the M_3 subshell of Au atoms by proton impact. A.M.Borisov, H.Herkow, V.P.Petukhov, E.A.Romanovsky (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
J. Phys. B (GB), vol.16, no.16, p.L495-8 (28 Aug. 1983).
The alignment parameter of the M_3 subshell of gold has been determined by measurement of the polarisation of X-rays following proton impact ionisation in the 0.1-0.5 MeV energy range. Measurements have shown that the experimental dependence of alignment on collision velocity exhibits an oscillation in the 0.16-0.25 relative collision velocity range. (7 refs.)

106552 Differential scattering in collisions of K^+ ions with Ar atoms. S.Kita, M.Izawa, H.Inouye (Res. Inst. for Sci. Measurements, Tohoku Univ., Sendai, Japan).
J. Phys. B (GB), vol.16, no.16, p.L499-504 (28 Aug. 1983).
Total differential cross sections for K^+-Ar collisions have been measured over a wide range of laboratory scattering angles, $5° \lesssim \theta \lesssim 80°$, and at ion energies 100-350 eV. Beyond an angle of about 45°, unexpectedly high cross sections have been found. The cross sections are attributed to Ar^+ ions produced in charge exchange reactions between K^+ ions and Ar atoms and also through autoionisation of doubly excited Ar^{**} atoms formed in the K^+-Ar collisions. Elastic and inelastic differential cross sections have been analysed by a semi-classical treatment assuming three-state potentials The result shows the inelastic collisions with high probability are caused in the region of the closest approach $R_c \lesssim 1.2$ Å, where the repulsive potential $V(R_c) \gtrsim 41$ eV. (17 refs.)

106553 Crossed-beam measurements of absolute rate coefficients in associative ionisation collisions between Na*(np) and Na(3s) for $5 \leq n \leq 15$. J.Boulmer, R.Bonanno, J.Weiner (Dept. of Chem., Univ. of Maryland, College Park, MD, USA).
J. Phys. B (GB), vol.16, no.16, p.3015-24 (28 Aug. 1983).
Associative ionisation in slow collisions between Na*(np) levels and the Na(3s) ground state is studied in a crossed-beam experiment. Excited levels are prepared by laser photoexcitation, and ionic species are analysed by time-of-flight mass separation. Rate coefficients for associative ionisation, measured for principal quantum numbers ranging from $n=5$ to 15, exhibit a pronounced on n with a maximum of approximately 3×10^{-9} cm^3 s^{-1} near $n=11$. Comparisons are made with the theoretical model developed by Duman and Shmatov, and Mihajlov and Janev. (28 refs.)

106554 Energy pooling process in rubidium vapour. L.Barbier, M.Cheret (Service de Phys. des Atomes et des Surfaces, CENS, Gif Sur Yvette, France).
J. Phys. B (GB), vol.16, no.17, p.3213-28 (14 Sept. 1983).
The 'quasi-resonant' energy pooling process in a rubidium vapour $(Rb(5p^2P_{3/2})+Rb(5p^2P_{3/2})+68\ cm^{-1} \rightarrow Rb(5d)+Rb(5s^2S_{1/2}))$ is experimentally investigated. An asymptotic theoretical model is applied to this reaction and gives a cross section (1×10^{-14} cm^2) close to the experimental value (3×10^{-14} cm^2). The results are discussed together with available data for other alkali atoms. (23 refs.)

106555 Ionisation of atoms by ion impact. D.S.F.Crothers, J.F.McCann (Dept. of Appl. Math. & Theoretical Phys., Queen's Univ. Belfast, Belfast, N Ireland).
J. Phys. B (GB), vol.16, no.17, p.3229-42 (14 Sept. 1983).
Total cross sections are calculated for the ionisation of a hydrogen atom by multicharged fully-stripped ions in the 20-1000 keV amu^{-1} impact energy range. Distortion is accounted for in the entrance channel (via the eikonal approximation) and in the exit channel (via the continuum distorted-wave approximation). The transition amplitude is calculated in the post form so that the electronic nonorthogonal kinetic energy is treated as the perturbation. It is concluded that of the currently available models this theory is the most successful and versatile over a considerable range of energies and charges. Specifically for ionisation of a hydrogen atom by 50 keV protons the authors present doubly differential cross sections for electrons ejected in the forward direction and singly differential cross sections as a function of emission

energy. The question of cusps and peaks in the differential cross sections is considered as is the question of charged scaling of the total cross section. (30 refs.)

106556 Ionisation of He atoms by H^+, He^{2+} and Li^{3+} nuclei. V.A.Sidorovich, V.S.Nikolaev (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
J. Phys. B (GB), vol.16, no.17, p.3243-9 (14 Sept. 1983).
The cross sections, σ^{i1} and σ^{i2}, of single and double ionisation of He atoms by H^+, He^{2+}, and Li^{3+} nuclei with energies ranging from 0.01 to 5 MeV amu^{-1} are calculated in the independent-electron approximation. The calculations are made for three versions of the probabilities of one-electron transitions to the continuum. The double ionisation of He by nuclei with energies $E/A \sim 0.1\text{-}Z^2$ meV amu^{-1} is mainly due to the independent interaction of each atomic electron with the bombarding nucleus. The values of σ^{i1} for all nuclei with $E/A \geq 0.2$MeV amu^{-1} and of σ^{i2} for He^{2+} and Li^{3+} nuclei with $E/A=0.2\text{-}0.5$ MeV amu^{-1} calculated in one of the versions are found to agree with the experimental values. The calculated values of σ^{i2} for protons with $E=0.2\text{-}0.7$ MeV and 1.5-4 MeV are respectively higher and lower than the experimental values because the authors calculations were made neglecting the electron correlations. (30 refs.)

106557 Associative ionization in collisions between two Na(3P) atoms. J.Huennekens, A.Gallagher (Joint Inst. for Lab. Astrophys., Univ. of Colorado, Boulder, CO, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1276-87 (Sept. 1983).
The authors measured the rate coefficient [$k=5.6\times10^{-12}$ cm^3/s ($\pm37\%$)] for associative ionization occurring in collisions between two Na($3P$) atoms, by measuring the current resulting from excitation of Na vapor by cw-laser radiation. The major source of uncertainty in measurements of this type is in the determination of the number density and spatial distribution of excited atoms. The authors have measured the excited-atom density by three methods, and have studied the distribution of excited atoms in detail. The rate coefficient at T~650K is compared to other experimental results. (37 refs.)

106558 Total and partial cross sections for electron capture in collisions of hydrogen atoms with fully stripped ions. R.K.Janev, D.S.Belic, B.H.Bransden (Joint Inst. for Lab. Astrophys., Univ. of Colorado, Boulder, CO, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1293-302 (Sept. 1983).
Systematic investigations of charge-transfer reactions $H(1s)+A^{Z+}\rightarrow H^{+}+A^{(Z-1)+}(n,l)(Z^{Z+}$ being a fully stripped ion) within the multichannel Landau-Zener theory with rotational coupling included (MLZRC) are presented. Total cross-section (σ) calculations in the energy region 0.03-80 keV/amu for selected projectiles with charges $5\leq Z\leq 74$ are performed. Oscillations in the Z dependence of σ are observed at low collision energies in the low-Z region. Above this region the Z dependence of σ is linear. The n,l distributions of captured electrons are investigated and results for the partial cross sections σ_n for a number of reactions are presented. The maxima of n distributions appear at $n_m \approx Z^{3/4}$ (in accordance with other theoretical predictions) and have a weak velocity dependence. Validity and limitations of the MLZRC model and the obtained results are discussed. (32 refs.)

106559 Electronic relativistic effects in *K*-shell ionization by proton impact. T.Mukoyama (Inst. for Chem. Res., Kyoto Univ., Kyoto, Japan), L.Sarkadi.
Phys. Rev. A (USA), vol.28, no.3, p.1303-9 (Sept. 1983).
The relativistic plane-wave Born-approximation calculations have been performed for *K*-shell ionization by proton impact. The *K*-shell ionization cross sections have been obtained by the use of relativistic hydrogenic (Dirac) wave functions for target electrons. The ratio of the relativistic cross section to the nonrelativistic one is evaluated and compared with various approximate correction methods for the electronic relativistic effects. Similar comparison is made for the *K*-shell ionization cross sections corrected for binding-energy and Coulomb-deflection effects. These results are also compared with the experimental data. (33 refs.)

106560 Inelastic collisions between selectively excited rubidium 6^2D-state atoms and noble-gas atoms: fine-structure-state mixing. B.G.Zollars, H.A.Schuessler, J.W.Parker, R.H.Hill,Jr. (Dept. of Phys., Texas A&M Univ., College Station, TX, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1329-37 (Sept. 1983).
Inelastic collisional processes in fine-structure-state mixing have been studied by selective stepwise excitation and observation of the resulting fluorescence during collisions of excited rubidium $6^2D_{5/2}$ state atoms with various noble-gas atoms. It is shown that for intermediately excited rubidium atoms the fine-structure-state mixing cross sections are generally increasing from helium to xenon. The cross sections for the process $Rb(6^2D_{5/2})+A(n^1S_0)\rightarrow Rb(6^2D_{3/2})+A(n^1S_0)+\Delta E$ have the values $\sigma_{fs}{}^*=2.4\pm0.9$, 3.1 ± 1.2, 2.6 ± 1.0, 5.8 ± 2.2, and 9.3 ± 5.6 in units of 10^{-14} cm^2, where A denotes in sequence any one of the noble gas atoms He, Ne, Ar, Kr, and Xe, respectively. Transfer cross sections for the transfer of excited $Rb6^2D$-state atoms out of the doublet were also determined and are about an order of magnitude smaller than the fine-structure-mixing cross sections. (45 refs.)

106561 Theory of laser-induced chemi-ionization. I. Quantal formulation. H.P.Saha, J.S.Dahler (Dept. of Chem., Univ. of Minnesota, Minneapolis, MN, USA), S.E.Nielsen.
Phys. Rev. A (USA), vol.28, no.3, p.1487-502 (Sept. 1983).
The quantal theory of field-free associative ionization and Penning ionization, due to O'Malley, Bieniek, and others, is generalized to include the closely analogous laser-induced chemi-ionization processes $A+B+\hbar\omega\rightarrow AB^{+}+e^{-}$, $A+B^{+}+e^{-}$. The principal limitations of the theory are its reliance upon the two-state approximation and its neglect of Born-Oppenheimer terms. Formulas are derived for several scattering cross sections descriptive of the energy spectra and angular distributions of the reaction products. These cross sections vary with the direction of polarization of the laser radiation. The polarization dependences of the heavy-particle ($A+B^{+}$) energy-angle double-differential cross section and of the associated heavy-particle (or photoelectron) energy distribution assume simple cosine-squared forms provided that there is a large number of contributing partial waves. Numerical calculations of these cross sections should be no more difficult to perform than for comparable field-free processes. (12 refs.)

106562 Calculation of proton-impact excitation of the $n=4$ level of atomic hydrogen. B.Barmanry, S.K.Sur, S.C.Mukherjee (Dept. of Theoretical Phys., Indian Assoc. for the Cultivation of Sci., Jadavpur, Calcutta, India).
Phys. Rev. A (USA), vol.28, no.3, p.1813-16 (Sept. 1983).
Differential and integrated cross sections summed over all angular momentum sublevels are calculated for the process $H^{+}+H(n=1)\rightarrow H^{+}+H(n=4)$ in the incident-proton energy range 15-400 keV, employing the Glauber approximation. The integrated cross sections are in very good agreement in curve shape with the available experimental measurement. Results are also presented for the integrated Glauber cross sections for $1s\text{-}4d$ and $1s\text{-}4f$ excitations of hydrogen by proton impact and are compared with available theoretical results. (15 refs.)

106563 Multiple-scattering treatment of the electron-capture to the continuum peak and comparison with experimental results for H^+-He collision. R.O.Barachina, C.R.Garibotti (Inst. Balseiro, Consejo Nacional de Investigaciones Cientificas y Tecnicas, San Carlos de Bariloche, Argentina).
Phys. Rev. A (USA), vol.28, no.3, p.1821-4 (Sept. 1983).
In this work the authors use the first term of a multiple-scattering expansion for the calculation of the distribution of electrons emitted in H^+-He scattering, in a neighborhood of the cusp that corresponds to the electron capture to continuum. The theoretical values that determine the peak shape are compared with recent experimental values at intermediate energies, and the influence of the projectile-target-core interaction in the asymmetry of the peak is discussed. (12 refs.)

106564 Beam-foil study of titanium in the EUV using foils of different materials. S.Bashkin, E.Trabert, P.H.Heckmann, H.von Buttlar, K.Brand (Rhur-Univ. Bochum, Bochum, Germany).
Phys. Scr. (Sweden), vol.28, no.2, p.193-200 (Aug. 1983).
The ultraviolet spectrum (λ8-60 nm) of highly ionized titanium after foil excitation of 15 and 20 MeV fast ions has been recorded. A number of new lines, mainly in sodiumlike Ti XII, are identified. Line intensity ratios and decay curves are measured in selected cases. Using foils of different materials, relative intensities of yrast transitions $n=3\text{-}6$ are evaluated and intercompared with the aid of cascade models. Decay curves of yrast levels are studied for resonance effects in the population mechanism. Little evidence is found for such effects. (39 refs.)

106565 Emission spectra produced from energy transfer reactions of $Ne(^3P_{0.2})$ with N_2O and OCS. M.Tsuji, M.Endoh, H.Obase, Y.Nishimura.
Rep. Res. Inst. Ind. Sci. Kyushu Univ. (Japan), no.74, p.109-113 (1983).
Energy transfer reactions of $Ne(^3P_{0.2})$ with N_2O and OCS have been investigated by UV-visible emission spectroscopy. Penning ionization leading to the $N_2O^+(A^2\Sigma^+)$ state was the only emitting exit channel in the case of N_2O, wherea Penning ionization and excitation transfer were the competitive quenching processes in the case of OCS, producing the $OCS^+(A^2\Pi)$ and $CS(A^1\Pi)$ states, respectively. (12 refs.)

Cross-section measurement for the energy-transfer collisions Na(3*P*)+Na(3*P*)→Na(5*S*,4*D*)+Na(3*S*) .... See Entry 106547

Charge equilibrium of energetic heavy ions in gaseous media (ideal atomic hydrogen gas) .... See Entry 106567

The measurement of inelastic ion-ion and electron-ion collisions .... See Entry 106611

Ionisation processes in He-CO and He-CO-O_2 glow discharges .... See Entry 107463

Mechanism of fragmentation of organic molecules during keV particle bombardment .... See Entry 109722

Negative ion formation in collision of electron with H_2 and isotopes .... See Entry 109725

34.50L Chemical reactions, energy disposal, and angular distribution, as studied by atomic and molecular beams

(see also 31.70F and 82.20K Potential-energy surfaces, 82.40D Beam reactions)

On the measurement of ion(atom)−ion (atom) charge exchange .... See Entry 106582

34.70 CHARGE TRANSFER

(see also 82.30 Charge transfer reactions)

106566 Asymmetry effect in $H^{+}+H^{-}$ neutralization. Application to the $n=3$ pseudocrossing. F.Borondo, A.Macias, A.Riera (Dept. de Quimica Fisica y Quimica Cuantica, Univ. Autonoma de Madrid, Madrid, Spain).
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.63-6 (26 Aug. 1983).
The authors present an extension of previous work on $H^{+}+H^{-}$ neutralization to transitions occurring at the $n=3$ pseudocrossing. Very good agreement with experiment is achieved for energies greater than 500 eV. On the other hand, they conclude that is is difficult to construct a theory explaining the shape of experimental cross sections for energies smaller than 300 eV. (11 refs.)

106567 Charge equilibrium of energetic heavy ions in gaseous media (ideal atomic hydrogen gas). S.Karashima (Dept. of Electrical Engng., Sci. Univ. of Tokyo, Tokyo, Japan), T.Watanabe.
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.6, p.895-902 (June 1983).
The charge distribution and its mean values for incident heavy ions are investigated theoretically, the incident heavy ions being treated as they impact and penetrate in an ideal atomic hydrogen gas. The charge on the ions is determined by the equilibrium between electron loss from the ions and electron capture from hydrogen to the ions. Assuming a local balance for electron loss and capture, the charge distribution, the average equilibrium charge, the distribution width, and the asymmetry parameter (skewness) are obtained as functions of the incident velocity. In the estimation of the loss and capture cross sections, some simplification has been made. The scaling law on the above quantities with respect to the atomic number of the incident particles is derived. Practical calculations have been carried out for C, Ne, Ar, Kr, I, and U ions in atomic hydrogen. (13 refs.)

106568 Proton-argon charge transfer cross sections with a realistic electron-target interaction. A.K.Sharma, M.K.Srivastava (Dept. of Phys., Univ. of Roorkee, Roorkee, India).
Indian J. Phys. Part B, vol.57B, no.2, p.119-24 (April 1983). [received: Sept. 1983]
Total cross sections for *K*-shell to *K*-shell charge transfer for protons on argon are calculated in the Brinkman-Kramers and the Coulomb-projected Born approximations by using the Herman-Skillman potential for the active electron-target interaction in place of the usual Coulomb potential. This modification is found to lead to an improvement in the results. (12 refs.)

106569 $1s\rightarrow2s$ capture in proton-hydrogen charge transfer scattering. B.K.Rao, U.C.Satapathy, D.N.Tripathy (Inst. of Phys., Sachivalaya Marg, Orissa, India).
Indian J. Phys. Part B, vol.57B, no.2, p.195-201 (April 1983). [received: Sept. 1983]
The simple nonperturbative approach previously developed by the authors for the problem of charge transfer in proton-hydrogen collisions has been applied to calculate the cross section for the $1s\rightarrow2s$ capture process in that case. The results are close to the cross sections obtained in a recent experiment over a

wide range of energies. They are also comparable with the results from other theories. (11 refs.)

106570 Charge transfer in H^+-H^- collisions. M.Ghosh (Dept. of Theoretical Phys., Indian Assoc. for the Cultivation of Sci., Calcutta, India).
Indian J. Phys. Part B, vol.57B, no.2, p.202-8 (April 1983). [received: Sept. 1983]
The Coulomb-Born approximation (CB) is applied to calculate the charge transfer cross section in H^+-H^- collisions in the intermediate and high energy region (50 to 1000 keV). The present computed values for the total cross sections are compared with the existing theoretical and observed values. The curve to the total cross section obtained in the CB shows a trend similar in nature with the other existing theoretical curves. (8 refs.)

106571 Electron transfer at crystallographically known long distances (25 Å) in [Zn^{II},Fe^{III}] hybrid hemoglobin. J.L.McGourty, N.V.Blough (Dept. of Chem., Northwestern Univ., Evanston, IL, USA), B.M.Hoffman.
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4470-2 (29 June 1983).
The authors describe the first example of long-range electron transfer between chromophores that are rigidly held at a fixed and crystallographically known distance and orientation. They employ mixed-metal, [M,Fe], hybrid hemoglobins that have both chains of one type, either α or β, substituted with a closed shell zinc(II) protoporphyrin (ZnP), whereas the two chains of the other type contain a ferriheme (Fe^{III}P): [Zn^{II},Fe^{III}]. (16 refs.)

106572 Relative electron affinities of substituted nitrobenezenes in the gas phase. E.K.Fukuda, R.T.McIver,Jr. (Dept. of Chem., Univ. of California, Irvine, CA, USA).
J. Phys. Chem. (USA), vol.87, no.16, p.2993-5 (4 Aug. 1983).
Using pulsed ion cyclotron resonance mass spectrometry, the authors have determined the relative electron affinities of 12 substituted nitrobenzenes in the gas phase by measuring equilibrium constants for electron transfer reactions of the the $C_6H_5NO_2^- + X\text{-}C_6H_4NO_2 = X\text{-}C_6H_4NO_2^- + C_6H_5NO_2$, where X is a substituent group. An excellent correlation is found between the relative electron affinities of the substituted nitrobenzenes and the relative gas-phase acidities of substituted anilines and phenols. (18 refs.)

106573 Single electron capture by Ar^{2+} and Ar^{3+} ions impacting helium. E.Y.Kamber (Dept. of Phys. & Astron., Univ. Coll., London, England), J.B.Hasted.
J. Phys. B (GB), vol.16, no.16, p.3025-35 (28 Aug. 1983).
Energy-loss spectra and different elastic and inelastic scattering functions for 540 eV single electron capture collisions of Ar^{2+} and 1250 eV Ar^{3+} ions with helium are reported and interpreted in terms of the avoided crossings of potential energy curves. Calculations are made of the proportions of long-lived excited states of these ions present in the beam, which is produced in an oscillating electron ion source. (9 refs.)

106574 Electron capture cross sections for TiH^{4+}. H.Sato, M.Kimura, A.E.Wetmore, R.E.Olson (Phys. Dept., Univ. of Missouri-Rolla, Rolla, MO, USA).
J. Phys. B (GB), vol.16, no.16, p.3037-44 (28 Aug. 1983).
Electron capture cross sections have been computed for $Ti^{4+} + H \rightarrow Ti^{3+} + H^+$ and $Ti^{3+} + H^+ \rightarrow Ti^{4+} + H$, where the reactants were in their ground states. The energy range investigated was 0.1 to 10 keV amu^{-1}. The impact parameter perturbed-stationary-state method incorporating electron translation factors were used to calculate the cross sections. The molecular wavefunctions were generated using the pseudo-potential method. At 1 keV amu^{-1} ($v_{rel} = 4.4 \times 10^7$ cm s^{-1}), representative electron capture cross sections for the $Ti^{4+} + H$ and $Ti^{3+} + H^+$ reactions are 2×10^{-15} cm^2 and 1×10^{-17} cm^2, respectively. An appreciable energy dependence was observed for both cross sections. (10 refs.)

106575 Comment on 'Radiative decay of lithium-like ions following exchange collisions of 3 keV amu^{-1} C^{4+} with H_2'. H.Winter (Inst. fur Allgemeine Phys., Tech. Univ. Wien, Wien, Austria).
J. Phys. B (GB), vol.16, no.17, p.L521-3 (14 Sept. 1983).
It is shown that *n,l*-state selective electron capture cross sections derived from observation of VUV emission lines for C^{4+}-H_2 collisions by Bliman et al. (1983) are incorrect because of inadequate evaluation of experimental results. The corrected data are compared with the author's own measurements and remaining discrepancies are explained. (10 refs.)

106576 Velocity dependence of Rydberg $n \rightarrow n'$ charge transfer cross sections. K.B.MacAdam, R.G.Rolfes (Dept. of Phys. & Astron., Univ. of Kentucky, Lexington, KY, USA).
J. Phys. B (GB), vol.16, no.17, p.3251-62 (14 Sept. 1983).
Measurements of the distribution of final n' states that are populated in charge transfer collisions of Ar^+ and Na^+ ions with Na in the 25s state are reported. Collision energies range from 580 to 2000 eV corresponding to projectile speeds v_1 from 0.572 to 1.400 times the RMS electronic orbital speed v_i in the initial state ($\tilde{v} = v_1/v_i$). The data are presented on a common relative scale of cross sections to indicate velocity or energy dependence. The cross section summed over all final states n' is of the form $\sigma^{1/2} = A\text{-}B$ in $\tilde{v}$ and agrees qualitatively with the velocity dependences of a Brinkman-Kramers (BK) calculation and of scaled experimental data for $p + H(1s) \rightarrow H$ (all states)$+p$. The data disagree with classical trajectory Monte-Carlo calculations for $\tilde{v} < 1$. Relative cross sections for $n \rightarrow n'$ are also presented for $n' = 20$ and 40. The peak positions and widths of the final-state distributions are compared with the predictions of the BK approximation. There is satisfactory agreement for low and intermediate final n', but the measured distributions show less than the predicted population of high final states. (51 refs.)

106577 Experimental study of the triatomic hydrogen molecule through the collisional sequence $H_3{}^+ \rightarrow H_3 \rightarrow H_3{}^+$ undergone by fast beams in argon. M.J.Gaillard, A.G.de Pinho, J.C.Poizat, J.Remillieux, R.Saoudi (Inst. Nat. de Phys. Nucleaire, Univ. Claude Bernard Lyon-1, Villeurbanne, France).
Phys. Rev. A (USA), vol.28, no.3, p.1267-75 (Sept. 1983).
The neutralizatioan-ionization method using two gas targets was employed to study the sequence $H_3{}^+ \rightarrow H_3 \rightarrow H_3{}^+$. The existence of long-lived states of the neutral molecule H_3 ($\tau \gtrsim 3 \times 10^{-7}$ s) is demonstrated, any ambiguity due to the presence of HD molecules being definitively removed. Dissociation cross sections of the molecular ion in argon have been measured and the dissociation cross section of the neutral molecule, the electron-capture, and the electron-loss cross sections have been estimated. The capture cross section for $H_3{}^+$ is extremely small (~1 b at 1 MeV) and decreases very rapidly with the velocity of the incident ion beam. It is suggested that these measured cross sections concern the formation of H_3 Rydberg states in a narrow band of *n* and *l* values. (24 refs.)

106578 Electron capture by slow Fe^{q+} ions from hydrogen atoms and molecules. R.A.Phaneuf (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1310-14 (Sept. 1983).
Total electron-capture cross sections have been measured for collisions for Fe^{q+} ions ($3 \leq q \leq 14$) with H and H_2 energies in the 10-95 eV/amu range. The cross sections increase approximately linearly with increasing ionic charge *q*, and for atomic hydrogen, can be represented by the empirical formula: $\sigma = q \times 10^{-15}$ cm^2 with an RMS deviation of ±26%. For Fe^{5+} and Fe^{6+}, for which higher-energy data exist, the cross sections are found to be essentially energy independent over the range $17 < E < 2000$ eV/amu. The cross sections for an atomic H target average 26% larger than for H_2. Agreement with generalized theoretical models is within a factor of 2 or better. (19 refs.)

106579 General classical scaling of electron-loss cross sections in collisions of atoms with highly charged ions. R.K.Janev (Plasma Phys. Lab., Princeton Univ., Princeton, NJ, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1810-12 (Sept. 1983).
With the use of the classical concepts for electron capture and ionization, a general scaling relationship for the electron-loss section in collisions of atoms with highly charged ions is derived. The validity of the obtained formula is determined by the combined validity regions of the classical approximations for electron capture and ionization and covers a broad range of parameters in which most of present-day experiments are carried out. An analogous scaling formula for the $H^*(n) + H^+$ electron-loss collisions is also derived. (10 refs.)

106580 Orbiting charge-transfer cross section between He^+ ions and cesium atoms at near-thermal ion-atom energies. H.A.Schuessler, C.H.Holder,Jr., Chun-Sing O (Dept. of Phys., Texas A&M Univ., College Station, TX, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1817-20 (Sept. 1983).
The energy dependence of the total charge-transfer cross section for the collision of helium ions with cesium atoms at epithermal energies (0.1 to 1 eV) has been measured. It was observed that the cross section increases with $E^{-1/2}$. This can be attributed to orbiting collisions. The charge-transfer cross section is expressed as the product of the classical orbiting cross section and a quantum-mechanical charge-transfer probability which is shown to be energy independent. (15 refs.)

106581 Theory of low energy ion-ion charge exchange. A.Salin (Lab. d'Astrophys., Univ. de Bordeaux I, Talence, France).
Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute, Baddeck, NS, Canada, 13-26 Sept. 1981 (New York, USA: Plenum 1983), p.325-72
In the semi-classical theory one treats the motion of the nuclei classically whereas the motion of the electrons is treated by quantum mechanics. This does not mean necessarily that the classical motion of the nuclei can be considered as independent of that of the electrons. It is, on the contrary, quite clear that the potential experienced by the nuclei depends on the state of the electrons. Hence the trajectory described by the nuclei depends on the evolution of the electronic state while the evolution of the electronic state can be calculated once the trajectory of the nuclei is known. The author restricts himself to the simple situation where the trajectories of the nuclei can be obtained from a known potential $V_0(R)$ depending only on the relative distance between them. This potential, by definition, will be independent of the reaction channel, hence the name 'common trajectory' given to this approach (Gaussorgue et al., 1975). It is obvious that in ion-ion collisions at low energies the Coulomb repulsion between the two ions plays an important role so that its effect has to be included in V_0. The author shows the relation between the semiclassical theory and the quantum distorted wave theory. This relation has also the advantage to illustrate the basic ideas collision theory. (35 refs.)

106582 On the measurement of ion(atom)−ion (atom) charge exchange. F.Brouillard, W.Claeys (Inst. de Phys., Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium).
Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute, Baddeck, NS, Canada, 13-26 Sept. 1981 (New York, USA: Plenum 1983), p.415-59
The authors derive some useful kinematic relations for the measurement of cross sections by means of intersecting beams. These include the formulation of center-of-mass energy of the collidants, laboratory-energies and angles of the products formed in elastic or inelastic processes. Kinematics provides a simple way to reach extremely low collision energies with energetic beams (merged beams) or reversely to convert tiny CM-inelastic losses or gains into observable laboratory effects. As a preliminary step, the concept of cross section is briefly reviewed. (23 refs.)

Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute .... See Entry 105031

Orbital SCF energies in the double proton transfer of the adenine-thymine base pair .... See Entry 106279

Electronic structure in the intervalence transfer absorption band of a mixed-valence dimer .... See Entry 106284

Spectroscopic observations of the radiative charge transfer and association of helium ions with neon atoms at thermal energy .... See Entry 106336

Collision experiment on highly ionized ions using a vacuum spark source .... See Entry 106533

Differential scattering in collisions of K^+ ions with Ar atoms .... See Entry 106552

Total and partial cross sections for electron capture in collisions of hydrogen atoms with fully stripped ions .... See Entry 106558

Multiple-scattering treatment of the electron-capture to the continuum peak and comparison with experimental results for H^+-He collision .... See Entry 106563

The measurement of inelastic ion-ion and electron-ion collisions .... See Entry 106611

Studies of ion-ion recombination using flowing afterglow plasmas .... See Entry 107337

34.80 ELECTRON SCATTERING

106583 Energy relaxation of electrons in helium. B.Shizgal (Dept. of Chem., Univ. of British Columbia, Vancouver, British Columbia, Canada).
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.41-4 (26 Aug. 1983).
The energy relaxation of electrons in helium is examined with a discrete ordinate method of solution of the Lorentz-Fokker-Planck equation. A realistic theoretical e-He momentum-transfer cross section is employed. The time evolution of the energy is obtained in the form of a small number of exponential terms each characterized by an eigenvalue of the Lorentz-Fokker-Planck operator. (10 refs.)

106584 Electron detachment from negative ions in sulphur hexafluoride. D.Hansen, H.Jungblut, W.F.Schmidt (Hahn-Meitner-Inst. fur Kernforschung Berlin, Bereich Strahlenchemie, Berlin, Germany).
J. Phys. D (GB), vol.16, no.9, p.1623-34 (14 Sept. 1983).
A novel method for the investigation of electron detachment from negative ions has been developed. It allows the study of the influence of the age of the ions on the detachment process. Measurements were performed on sulphur hexafluoride at 73.3 and 110 mbar. The reduced detachment coefficient δ/n

was obtained for a narrow range of E/n values around 3.8×10^{-15} V cm^2. A significant influence of the age of the ions on δ/n was found, which is interpreted as being due to excited states of SF_6^-. (23 refs.)

106585 Bremsstrahlung of electrons in an atomic potential: the classical character of the spectrum; scaling laws. V.I.Kogan, A.B.Kukushkin (I.V. Kurchatov Inst. of Atomic Energy, Moscow, USSR).
JETP Lett. (USA), vol.37, no.6, p.322-6 (20 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.6, p.272-5 (20 March 1983). [received: Sept. 1983]
A simple classical theory is developed for the bremsstrahlung of kilovolt electrons in a Thomas-Fermi potential, permitting the universalization of the voluminous body of numerical quantum results for this problem, which, in turn, have been confirmed by recent experiments. (8 refs.)

106586 Experimental studies of electron-ion recombination. J.B.A.Mitchell, J.W.McGowan (Dept. of Phys., Univ. of Western Ontario, London, Ontario, Canada).
Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute, Baddeck, NS, Canada, 13-26 Sept. 1981 (New York, USA: Plenum 1983), p.279-324
Electron-ion recombination is one of the most fundamental concepts in atomic and molecular physics and plays a major role in the chemistries of the upper atmosphere, interstellar space, combustion and thermonuclear fusion. Indeed, it has been from studies of these fields that much of the knowledge concerning the mechanisms of recombination has come. These studies have been backed up by a considerable theoretical and experimental effort in an attempt to gain a quantitative understanding of recombination as well as to elucidate the fine details underlying the electron capture and stabilization process for different ion species. In turn great advances have been made in these areas as a result of the improved understanding of the physics of recombination. (146 refs.)

Description of equipment for measuring differential cross sections in ion-neutral particle collisions at low energies ....See Entry 106633

34.80B Elastic scattering of electrons by atoms and molecules

106587 The structure of the scattering matrix. M.J.Seaton (Dept. of Phys. & Astron., Univ. Coll. London, London, England).
Comments At. & Mol. Phys. (GB), vol.13, no.4, p.171-8 (1983).
The scattering matrix has structures due to: (i) near-threshold effects; (ii) closed channels; (iii) use of wavefunction expansions which include both continuum functions and functions of bound-state type. In this comment the structure due to (iii) is derived without making use of the formalism of projection operators. (6 refs.)

106588 Determination of spin exchange scattering amplitude for 2*S*-2*S* transition. S.Sarkar, M.Chakrabarti (Dept. of Theoretical Phys., Indian Assoc. for the Cultivation of Sci., Calcutta, India).
Indian J. Phys. Part B, vol.57B, no.2, p.149-53 (April 1983). [received: Sept. 1983]
Using the method of Corinaldesi and Trainor (1952) the authors perform the calculation for spin exchange scattering amplitude in the particular case of the 2*S*-2*S* transition in an electron atom collision. (3 refs.)

106589 Elastic scattering of electrons by hydrogen molecules. K.N.Joshipura (M.B. Patel Sci. Coll., Anand, India), H.S.Desai.
Indian J. Phys. Part B, vol.57B, no.2, p.161-5 (April 1983). [received: Sept. 1983]
Differential and total elastic cross-sections, total collisional cross-sections and momentum-transfer cross-sections, for elastic scattering of 100 eV-1000 eV electrons by hydrogen molecules are calculated, in the high energy higher order Born approximations of Yates (1979). The results are compared with theoretical and experimental data and sample results are shown. (14 refs.)

106590 Two-potential formulation in HHOB. C.N.Chandra Prabha, H.S.Desai (Dept. of Phys., Faculty of Sci., MS Univ. of Baroda, Baroda, India).
Indian J. Phys. Part B, vol.57B, no.2, p.190-4 (April 1983). [received: Sept. 1983]
The two-potential HHOB approximation is formulated parallel to the two-potential eikonal approximation. The theory developed for any target atom is applied to the special case of elastic $\bar{e}$-H atom scattering to calculate the differential scattering cross sections at the sample energy 200 eV. The results agree well with the recent measured and theoretical values. A significant imporvement over the basic HHOB approximation is obtained. (11 refs.)

106591 Angular distribution of electrons elastically scattered from O_2 at 40-500 eV: a two-potential coherent approach. A.Jain (Dept. of Appl. Math. & Theoretical Phys., Queen's Univ. of Belfast, Belfast, N Ireland).
Phys. Rev. A (USA), vol.28, no.3, p.1829-31 (Sept. 1983).
A coherent two-potential approach (in which multiple scattering is allowed) is used to calculate the integrated and momentum-transfer cross sections and differential cross sections for electron-O_2 elastic scattering in the energy range 40-500 eV. Above 100 eV, the present theory is in excellent agreement with experiment. However, below 100 eV, there are discrepancies at intermediate angles in the differential cross sections. (9 refs.)

106592 Calculation of elastic electron scattering cross sections for argon and krypton at low energies. H.P.Berg (Inst. fur Theoretische Phys., Tech. Univ. Clausthal, Clausthal-Zellerfeld, Germany).
Physica B & C (Netherlands), vol.122B+C, no.1, p.129-38 (Sept. 1983).
Theoretical results are presented of angular distributions for electrons over a range of 40°-110° elastically scattered from argon and krypton at energies between 10 eV and 50 eV, obtained by using the X_α-approximation including exchange terms in the scattering potential. The calculations give a rather reliable prediction in the whole energy range, in contrast to the calculations of McCarthy et al. (1977) and of Walker (1971) in particular at scattering energies below 25 eV. The theoretical data are in good agreement with the experiments, especially the measurements of Qing et al. (1967) and Meyr. (26 refs.)

106593 Scattering of electrons by atoms and photodetachment of negative ions in a homogeneous electric field. I.I.Fabrikant (Phys. Inst., Latvian Acad. of Sci., Latvian SSR).
Sov. Phys.-JETP (USA), vol.83, no.5, p.967-72 (Nov. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.5, p.1675-84 (Nov. 1982). [received: Sept. 1983]
Scattering of electrons by a force center in a homogeneous electric field is considered. The oscillatory energy dependence of the cross section, due to interference effects accompanying scattering, is investigated. The feasibility of experimental observation of the effects is analyzed. A multichannel theory of electron scattering by atoms and a multichannel theory of photodetachment of negative ions in an electric field are developed. It is shown that the phase shifts of electron scattering by atoms can be determined with high resolution by measuring the cross sections for the photodetachment of the corresponding negative ions in an electric field. (13 refs.)

34.80D Atomic excitation and ionization by electron impact

106594 The 1*s*-2*s* and 1*s*-2*p* excitation of helium ions by electron impact. M.Basu, P.S.Mazumder, A.S.Ghosh (Dept. of Theoretical Phys., Indian Assoc. for the Cultivation of Sci., Calcutta, India).
Can. J. Phys. (Canada), vol.61, no.9, p.1297-300 (Sept. 1983).
The electron impact excitation of He^+ to the $n=2$ level is studied using two variants of the polarized orbital method, one due to Daskhan et al. (1981) and the other due to Temkin and Lamkin (1961). The present results for 1*s*-2*p* total excitation cross sections are in fair agreement with the measured values. For the 1*s*-2*s* excitation, our values fail to reproduce the more elaborate theoretical prediction by Morgan near the threshold energies. (22 refs.)

106595 Ionization of the hydrogen atom by electron impact with the use of the polarized-orbital method. P.S.Mazumder, M.Basu, A.S.Ghosh (Dept. of Theoretical Phys., Indian Assoc. for the Cultivation of Sci., Calcutta, India).
Indian J. Phys. Part B, vol.57B, no.2, p.95-108 (April 1983). [received: Sept. 1983]
The triple differential cross section (TDCS) for the ionization of atomic hydrogen by electron impact has been calculated by employing the polarized orbital distorted wave method. The authors have also calculated the TDCS using the polarized plane-wave method including the effect of exchange, which has been approximately evaluated by Pathak and Srivastava (1980). The present results at 100 and 250 eV are in reasonable agreement with the measured values and existing theoretical predictions. (6 refs.)

106596 Electron impact double excitation in heliumlike ions 07. B.Padhy, R.Srivastava, D.K.Rai (Dept. of Phys., Banaras Hindu Univ., Varanasi, India).
Indian J. Phys. Part B, vol.57B, no.2, p.109-18 (April 1983). [received: Sept. 1983]
Calculation of cross sections for the electron impact double excitation of heliumlike ions in the framework of Coulomb-Born-Oppenheimer approximation is presented. Closed form expression for both the differential and the total cross sections have been obtained without the use of partial wave analysis. The total cross section for excitation of Li^+ from the ground state to each of the excited states $2s^2\ {}^1Sg$, $2s2p1$, ${}^3p_u$, $2p^2\ {}^1Sg$, ${}^3Pg$ and ${}^1Dg$ is computed. (22 refs.)

106597 Fast evaluation of the relativistic ionisation form factor: momentum space representation. D.Trautmann, G.Baur, F.Rosel (Inst. fur Phys., Univ. Basel, Basel, Switzerland).
J. Phys. B (GB), vol.16, no.16, p.3005-13 (28 Aug. 1983).
The authors present a new and powerful method for the evaluation of the relativistic ionisation form factor in momentum space. Limiting cases and generalisations are discussed. (20 refs.)

106598 A measurement of the cross section for electron impact ionisation of Al^+. R.G.Montague, M.F.A.Harrison (Culham Lab., UKAEA, Abingdon, England).
J. Phys. B (GB), vol.16, no.16, p.3045-51 (28 Aug. 1983).
The crossed ion and electron beams technique has been used to make an absolute measurement of the cross section for the ionisation process $e+Al^+\rightarrow2e+Al^{2+}$ at electron energies ranging from below threshold up to 750 eV. The compounded random and systematic errors are estimated to be about ±5% at energies in excess of about 25 eV. The cross section for the ground-state ion is determined from the measured data using a small correction that allows for the presence of about 9% of metastable ions in the Al^+ beam. Comparison of the present data with the predictions of Lotz shows that the latter work appreciably overestimates the ground-state cross section at energies above 35 eV. The scaled Born prediction of McGuire is in closer agreement but it also exceeds the measured cross section above 35 eV. The shape of the Coulomb-Born-exchange cross section of Moores is in fair agreement but the magnitude is lower than the present data. (13 refs.)

106599 Electron excitation of Ca XVII. P.L.Dufton (Dept. of Pure & Appl. Phys., Queen's Univ. of Belfast, Belfast, N Ireland).
J. Phys. B (GB), vol.16, no.16, p.3053-63 (28 Aug. 1983).
Electron-excitation collision strengths have been calculated for transitions between the ten lowest levels of Ca XVII ($2s^2\ {}^1S_0$, $2s2p\ {}^3P_{0,1,2}$, $2s2p\ {}^1P_1$, $2p^2\ {}^3P_{0,1,2,}$ $2p^2\ {}^1D_2$, $2p^2\ {}^1S_0$). At high impact energies, where all the channels are open, the calculation was carried out in the *LS*-coupling approximation by means of the *R*-matrix method. Transitions between the fine structure levels were then determined by application of a unitary transformation to the *LS*-coupled *K*-matrices. At low impact energies, where some of the channels may be closed, an extension of the *R*-matrix method was employed to take account of relativistic effects directly in the scattering equations. In general, results are in good agreement with recent distorted-wave calculations. Electron-excitation rates are given for a range of electron temperatures. (25 refs.)

106600 Threshold behaviour for ionisation by electrons and positrons. S.Geltman (Max-Planck-Inst. for Quantenoptik, Garching, Germany).
J. Phys. B (GB), vol.16, no.17, p.L525-8 (14 Sept. 1983).
The threshold laws for atomic ionisation by electron and positron impact are derived in the Coulomb-projected Born approximation, and compared with other theories. There is a very large difference between the resulting threshold forms for electron and positron impact. (9 refs.)

106601 Electron impact excitation of the $n=2$ level in He^+ and H at low energies. N.R.Badnell (Dept. of Appl. Math. & Theoretical Phys., Cambridge Univ., Cambridge, England).
J. Phys. B (GB), vol.16, no.17, p.3263-78 (14 Sept. 1983).
Two Coulomb-exchange distorted-wave (CEDW) approximations are developed and applied to the electron impact excitation of the 1s→2s and 1s→2p transitions in He^+ and H at low energies. In the first approximation, CEDW1, partial waves are distorted by various direct multiple potentials. In the second approximation, CEDW2, particular partial waves are additionally distorted by an exchange monopole potential. Results for cross sections presented here are compared with those of the three-state close-coupling and Coulomb-Born-Oppenheimer approximations, and with experiment. Despite the unfavourable degeneracy of the 2s and 2p states in hydrogenic atoms, the CEDW2 approximation gives satisfactory agreement with the three-state close-coupling approximation for the 1s→2s transition and fairly good agreement for the 1s→2p transition together with a significant reduction in computing time. Thus the author's distorted-wave approach can be useful at low energies for singly-ionised and neutral atoms and is sufficiently promising to justify further development for application to more complex systems, where the authors no longer have the degeneracy of states that we do with hydrogenic atoms. (32 refs.)

106602 Electron transport parameters and excitation rates in argon. C.M.Ferreira, J.Loureiro (Centro de Electrodinamica, Univ. Technica de Lisboa, Lisboa, Portugal).
J. Phys. D (GB), vol.16, no.9, p.1611-21 (14 Sept. 1983).
A self-consistent set of electron impact cross-section and of excitation and ionisation rates was obtained for argon by making some adjustments in the experimental cross-section data available from the literature and requiring that calculated and measured electron transport quantities be in agreement. The calculations were made by numerically solving the Boltzmann transport equation. Values of the ratio of the electric field to the gas number density of interest in this work are in the range from 10 to 100 Td (Townsend). The resulting final set of cross-sections obtained here is not unique but represents one of the best possible combinations which can be sought for on the basis of presently available data. Therefore, the present results are relevant for the modelling of discharges in argon and in various visible and UV laser mixtures containing high concentrations of argon atoms. (54 refs.)

106603 Novel short-pulse photoionization electron source: Li $(1s2s2p)^4P^\circ$ deexcitation measurements in a plasma. J.C.Wang, R.G.Caro, S.E.Harris (Edward L. Ginzton Lab., Stanford Univ., Stanford, CA, USA).
Phys. Rev. Lett. (USA), vol.51, no.9, p.767-70 (29 Aug. 1983).
As a result of photoionization of rare-gas atoms by X-rays emitted from a laser-produced plasma, high densities ($>10^{16}$ cm^{-3}) of hot (~45-eV) electrons are produced in a pulse of ~600 ps duration. Following excitation by means of this electron source, the deexcitation rate constant from the Li $(1s2s2p)^4P^\circ$ level is measured to be 3×10^{-7} cm^3 s^{-1} at an electron density of ~10^{15} cm^{-3}. (8 refs.)

106604 Ionization: test of a continuum optical model for electron scattering. I.E.McCarthy, A.T.Stelbovics (Inst. for Atomic Studies, Flinders Univ. of South Australia, Bedford Park, Australia).
Phys. Rev. A (USA), vol.28, no.3, p.1322-8 (Sept. 1983).
An optical potential for taking account of the continuum in a coupled-channels calculation of electron scattering from atoms and ions must reproduce the total ionization cross section. This is tested here for a range of atoms and ions, using a momentum-space formulation based on the orthogonalized Born-Oppenheimer approximation to the ionization amplitude. The theory is quite acceptable as a fast calculation of total ionization cross sections, particularly at higher energies where distorted-wave methods are cumbersome. It compares quite satisfactorily with distorted-wave calculations for ions at lower energies near the maximum of the cross-section curve. (24 refs.)

106605 Double electron excitation in heliumlike ions. B.Padhy, R.Srivastava, D.K.Rai (Dept. of Phys., Banaras Hindu Univ., Varanasi, India).
Phys. Rev. A (USA), vol.28, no.3, p.1825-8 (Sept. 1983).
A Coulomb-Born-Oppenheimer approach to the calculation of cross sections for electron-impact excitation of the doubly excited $2p^{2\,3}P$ state in heliumlike ions is presented. It is shown that closed-form expressions can be obtained for both differential and total cross sections. The analysis is applied to calculate the total cross section for the process $e^- + \mathrm{Li}^+(1s^{2\,1}S) \rightarrow \mathrm{e}^- + \mathrm{Li}^+(2p^{2\,3}\mathrm{P})$. (17 refs.)

106606 Theoretical triply differential cross section of electron-impact ionization of atoms. Keh-Ning Huang (Argonne Nat. Lab., Argonne, IL, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1869-72 (Sept. 1983).
The triply differential cross section of the electron-impact ionization of atoms is given in a parametrized form, suitable for theoretical computations or for semiempirical fittings. Application of the present formulation is demonstrated. Merits of coplanar measurements are discussed. It is also shown that the coplanar up-down asymmetry of the ejected electron is linear in the scattering angle, or the momentum transfer, of the incident electron for small momentum transfers. (5 refs.)

106607 Nucleus excitation due to annihilation of positron by bound atomic electrons. V.P.Aleshin.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1146-52 (Aug. 1983). In Russian.
Nucleus excitation is considered occurring due to energy released in annihilation of an incident positron and an electron from that in the nucleus atomic shell. Using the reciprocity theorem, the cross-section of the annihilation excitation is expressed through the coefficient of the monoenergetic pair conversion. The line shape is investigated and analytical expressions for the cross-section are given in some limiting cases. The comparison to the current theoretical approches is made and calculations of the cross-section for the annihilation excitation of ^{115,113}In, ^{111}Cd and ^{176}Lu are fulfilled. For these nuclei the calculated cross-section is approximately 10^{-2} of that found in the experiment except for ^{111}Cd where the theoretical value is only 5 times as low as the experimental one. (20 refs.)

106608 Theory of electron-atom collisions. Yong-Ki Kim (Argonne Nat. Lab., Argonne, IL, USA).
Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute, Baddeck, NS, Canada, 13-26 Sept. 1981 (New York, USA: Plenum 1983), p.101-65
The collision of electrons with atoms (including ions as special cases) is not only of interest to atomic physics itself but also has important applications in other fields such as astrophysics, plasma physics, and radiation physics. Although the main emphasis of this conference is on the interaction with ions, this paper covers interactions with both neutral atoms and ions. (76 refs.)

106609 Electron impact excitation of ions. D.H.Crandall (Phys. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute, Baddeck, NS, Canada, 13-26 Sept. 1981 (New York, USA: Plenum 1983), p.201-38
The author reviews electron-ion beams experiments primarily. The techniques, difficulties, and present trends in this area will be discussed. Measured cross sections are compared with theoretical results and the current level of agreement assessed. (76 refs.)

106610 Electron-impact ionization of ions. E.Salzborn (Inst. fur Kernphys., Justus-Liebig-Univ. Giessen, Giessen, Germany).
Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute, Baddeck, NS, Canada, 13-26 Sept. 1981 (New York, USA: Plenum 1983), p.239-77
Electron-impact ionization of atoms and ions is one of the fundamental collision processes in all types of plasmas—in astrophysical objects as well as in laboratory discharges. Many of the plasma properties, for example the radiation emitted, depend on the state of ionization of ions in these plasmas. In order to interpret spectroscopic observations and to find theoretical models for the formation and evolution of the plasma, cross sections for electron-impact processes are needed. The author gives a survey of the characteristic features of electron-ion ionisation processes with an emphasis on recent experimental progress. (110 refs.)

106611 The measurement of inelastic ion-ion and electron-ion collisions. K.T.Dolder (School of Phys., Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England).
Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute, Baddeck, NS, Canada, 13-26 Sept. 1981 (New York, USA: Plenum 1983), p.373-413
Dense gases or plasmas obey the laws of equilibrium thermodynamics and their properties can be discussed without recourse to atomic physics. Temperatures, for example, can be deduced from measurements of radiated energy simply by applying Stefan's law. But laboratory plasmas, stellar and planetary atmospheres are of greatest practical interest and they are rarely, if ever, in full thermodynamic equilibrium. Therefore details of all relevant atomic processes are required to construct theoretical models and deduce plasma properties from observations. (70 refs.)

Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute ....See Entry 105031

On the excitation of the lowest autoionisation state in alkali atoms ....See Entry 106362

The structure of the scattering matrix ....See Entry 106587

34.80G Molecular excitation, ionization, and dissociation by electron impact

106612 Theoretical study of electron impact mass spectrometry. I. Ab initio MO study of the fragmentation of *n*-butane. T.Takeuchi, M.Yamamoto (Dept. of Chem., Nara Women's Univ., Nara, Japan), K.Nishimoto, H.Tanaka, K.Hirota.
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.139-48 (1 Sept. 1983).
The fragmentation mechanism of *n*-butane by low-energy electron bombardment has been studied by means of the ab initio MO method. Optimized geometries of possible *n*-butane cation conformers, reaction intermediates and fragments have been calculated using the energy gradient technique. The results suggest that the fragmentation to C_1+C_3 is more favorable than that to C_2+C_2, when the electron impact energy is at most only a few eV above the ionization threshold. The base peak at m/z 43 has been calculated to be due to the 2-propyl cation. In the course of fragmentation to C_1+C_3 proton tunneling is expected. (10 refs.)

106613 Electron scattering from alkali halide molecules. V.M.Chhaya (Dept. of Phys., MNV Sci. Coll., Rajkot, India), H.S.Desai.
Indian J. Phys. Part B, vol.57B, no.2, p.177-83 (April 1983). [received: Sept. 1983]
The low energy electron scattering from molecules belonging to alkali halide matrix is studied. The modified Born-Eikonal series method is employed to calculate rotational excitation cross sections. The curves are plotted for the incident electron energy versus total cross section for each column of alkali halide matrix. The conclusion is drawn regarding dependence of the total cross section with the electron-negativity difference of the molecules. (12 refs.)

106614 Electron energy-loss spectroscopy of carbon monoxide. II. The energy region 11 to 20 eV. B.Wallbank, S.Daviel, J.Comer, P.Hickes (Phys. Dept., Univ. of Manchester, Manchester, England).
J. Phys. B (GB), vol.16, no.16, p.3065-76 (28 Aug. 1983).
For pt.I see ibid., vol.15, no.12, p.1929-37 (1982). An electron impact spectrometer incorporating a position-sensitive multidetector has been used to study the excited electronic states carbon monoxide in the energy region 11 to 20 eV. A series of peaks previously assigned to one vibrational progression have been resolved into two progressions, one of which has been assigned to a transition to a previously unobserved state. At high impact energy and small scattering angle the spectra observed are in good agreement with previous photoabsorption data. At high scattering angle members of Rydberg series resulting from spin-forbidden transitions have been observed in the energy region below the first ionisation potential. At higher excitation energies several new spectral features have been observed, some of which have been assigned to Rydberg series. (23 refs.)

106615 Rotational excitation of CH_4 and H_2O by slow electron impact. A.Jain, D.G.Thompson (Dept. of Appl. Math., Queen's Univ. of Belfast, Belfast, N Ireland).
J. Phys. B (GB), vol.16, no.16, p.3077-98 (28 Aug. 1983).
Cross sections for rotationally elastic and inelastic scattering of slow electrons by spherical (CH_4) and asymmetric top (H_2O) molecules are calculated in the adiabatic-nuclei-rotation (ANR) approximation. The elastic scattering amplitude is derived in the molecule-fixed frame and the corresponding K matrix is obtained by solving a set of coupled differential equations; in which the total interaction potential includes an ab initio molecular core potential from the ground state near Hartree-Fock wavefunctions, an exchange term in the free-electron-gas-exchange (FEGE) model plus the orthogonalisation procedure and the distortion of the target through a recently proposed non-parametric polarisation potential of Jain and Thompson (1982). Symmetry properties and the selection rules for the asymmetric rotor in general are discussed. In order to avoid convergence problems for the molecule with a permanent dipole moment, an alternative two-stage hybrid S-matrix theory of Collins and Norcross (1978) along with the closure formula of Crawford and Dalgarno (1971) is adopted to obtain converged cross sections (in which proper use of the unitarised Born approximation is made). Results are compared with recent available measurement and calculations; there is a qualitative agreement for CH_4 with recent calculations performed in a different model. In the case of H_2O, some difficulties are discussed in comparing directly the authors' data with recent experimental cross sections. (51 refs.)

106616 Measurement of the branching ratio for the dissociative recombination of $H_2{}^+ + e$. J.B.A.Mitchell, J.L.Forand, C.T.Ng, D.P.Levac, R.Mitchell, P.M.Mul, W.Claeys, A.Sen, J.Wm.McGowan (Dept. of Phys., Univ. of Western Ontario, London, Ontario, Canada).
Phys. Rev. Lett. (USA), vol.51, no.10, p.885-8 (5 Sept. 1983).
The dissociative recombination of $H_3{}^+$ with electrons can have two exit channels, namely $e+H_3{}^+ \rightarrow H+H+H$ (channel I), and $e+H_3{}^+ \rightarrow H_2+H$ (channel II). A new technique has been developed which has been used to determine the relative contributions of channels I and II to the overall recombination process. Over the energy range from 0.01 to 0.05 eV it has been found that channel I dominates. (24 refs.)

106617 Nuclear dynamics in resonant electron-molecule scattering beyond the local approximation: the 2.3-eV shape resonance in N_2. M.Berman, H.Estrada, L.S.Cederbaum, W.Domcke (Inst. fur Phys. Chem., Univ. Heidelberg, Heidelberg, Germany).
Phys. Rev. A (USA), vol.28, no.3, p.1363-81 (Sept. 1983).
Resonant electron scattering from the N_2 molecule is treated within the framework of Feshbach's projection-operator formalism. The problem of

nuclear motion in the complex, nonlocal, and energy-dependent potential of the resonant state is solved with the use of basis-set expansion methods. The width function $\Gamma(E,R)$ of the 2.3-eV shape resonance is taken from previous ab initio calculations [A.U. Hazi, T.N. Rescigno, and M. Kurilla, Phys. Rev. A 23, 1089 (1981)]. The potential-energy curve $V_1(R)$ of the discrete electronic state giving rise to the resonance is adjusted to obtain quantitative agreement with experiment for the $\nu=0\rightarrow1$ vibrational excitation channel. Calculated cross sections are reported for many vibrational excitation channels including scattering from vibrationally excited target molecules and are compared with experiment. The results are in good agreement with experiment as far as experimental data are available. The information on the 2.3-eV shape resonance in N_2 obtained in this way (potential-energy curve, width function, complex pole of the S matrix, phase shift, etc.) is discussed and compared to the results of other ab initio and empirical calculations. Particular emphasis is laid on the assessment of the accuracy of the local complex potential approximation (boomerang model). It is shown that the local approximation is excellent for the 2.3-eV resonance in N_2 as far as the calculation of vibrationally inelastic cross sections is concerned. The local complex potential emerging from the present study differs significantly from the potential obtained empirically by Dube and Herzenberg [Phys. Rev. A 20, 194 (1979)], although the calculated cross sections are virtually identical for a large number of channels. The authors discuss the precision with which a local complex potential can be defined. (73 refs.)

106618 Dissociative recombination of an electron and a molecular ion. S.A.Akhmanov,Jr., K.S.Klopovskii, A.P.Osipov (Nuclear Phys. Res. Inst., Moscow State Univ., Moscow, USSR).
Sov. Phys.-JETP (USA), vol.83, no.5, p.936-42 (Nov. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.5, p.1623-33 (Nov. 1982). [received: Sept. 1983]
It is shown that the multichannel problem of the recombination of an electron and a molecular ion can be rigorously reduced to the determination of an optical potential for the elastic scattering of an electron by a molecular ion. A method, based on the formalism of many-particle theory, is proposed and makes it possible to construct the optical potential. As a result, formulas are derived for the resonance part of the dissociative-recombination cross section with allowance for strong channel coupling. These formulas are used to calculate the cross section for dissociative recombination of an electron and a molecular-oxygen ion in various vibrational states. All the quantities in the formula for the cross section are determined by the present method, and are not adjustable parameters. The results are in satisfactory agreement with the experimental data. (20 refs.)

106619 Study of electron attachment in air during prolonged interaction with an electron beam. Yu.P.Vagin, N.N.Morozov, B.M.Stepanov (All-Union Sci.-Res. Inst. of Optophys. Measurements, Moscow, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.28, no.2, p.254-5 (Feb. 1983). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.53, no.2, p.406-8 (Feb. 1983). [received: Sept. 1983]
Intense sources of ionizing radiation such as high-current accelerators, pulsed reactors, etc., are widely used today in experimental physics. Intense irradiation can produce a variety of new effects in the exposed materials (e.g. air). These effects may be so large that they must be allowed for when experiments are conducted in the ionization region of intense sources. For radiation of low intensity (e.g., when an ionizing chamber is used to record exposure doses), it is usually assumed that the electrochemical properties of air are not changed by the radiation. This assumption is no longer valid when intense radiation fluxes are employed and the radiation doses are large (a few megarads). Under these conditions, various chemically active compounds (such as NO_2, NO, O_3, etc.) are produced in air which greatly alter the rates of various collisional processes; their influence is particularly great on one of the principal processes resulting in deionization of air, i.e. attachment of electrons to neutral molecules. The authors report experimental findings on the dependence of the lifetime of electrons in air on the radiation dose and on the factors determining the kinetics of attachment under their experimental conditions. (5 refs.)

106620 Potential energy curves for dissociative recombination. S.L.Guberman (Boston Coll., Newton, MA, USA).
Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute, Baddeck, NS, Canada, 13-26 Sept. 1981 (New York, USA: Plenum 1983), p.167-200
The direct dissociative recombination (DR) of a diatomic molecular ion, AB^+, with an electron is described by $AB^+ + e^- \rightarrow AB^* \rightarrow A+B$ where AB^* is a repulsive state of the neutral molecule which dissociates directly to A and B. The dissociation prevents the emission of an electron by AB^* and accounts for the high rate of electron recombination with molecular ions compared to atomic ions. The author presents a discussion of ab initio calculations of potential energy curves for the AB^* and AB^+ states. Results for recent large scale calculations for O_2 are presented along with additional results for H_2 and He_2. (84 refs.)

Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute ....See Entry 105031

Electron-impact luminescence spectra and neutral fragments: identification of neutral fragments by use of fragment emissions .... See Entry 106490

The measurement of inelastic ion-ion and electron-ion collisions ....See Entry 106611

34.90 OTHER TOPICS IN ATOMIC AND MOLECULAR COLLISION PROCESSES AND INTERACTIONS

106621 Atomic and molecular physics near ionization thresholds in high fields. J.P.Connerade (Blackett Lab., Imperial Coll., London, England), J.C.Gay, S.Liberman.
Comments At. & Mol. Phys. (GB), vol.13, no.4, p.189-203 (1983).
The study of atoms (and potential molecules) in high fields has become an area of renewed interest among atomic physicists since the discovery of quasi-Landau resonances in 1969. The problem is not merely one of refining one's understanding of atomic interactions to more elaborate and varied external perturbations, rather, it is of fundamental nature and requires a novel approach. A colloquium on the theme Atomic and Molecular Physics near Ionization Thresholds in High Fields (CNRS International Colloquia No.334) was held at Aussois (France) in June 1982 and attracted 80 participants from Laboratories in Europe and the USA. This comment is a brief survey of selected themes, obviously influenced by the activities of the authors. A full record of the colloquium appears in the Proceedings. (14 refs.)

106622 Merged electron-ion beam experiments. V. Dissociative recombination of OH^+, H_2O^+, H_3O^+ and D_3O^+. P.M.Mul, J.W.McGowan, P.Defrance, J.B.A.Mitchell (Dept. of Phys., Univ. of Western Ontario, London, Ontario, Canada).
J. Phys. B (GB), vol.16, no.16, p.3099-107 (28 Aug. 1983).
For pt.IV see ibid., vol.14, no.8, p.1353-671 (1981). Absolute cross sections for dissociative recombination of OH^+, H_2O^+, H_3O^+ and D_3O^+ have been measured using a merged electron-ion beam apparatus through an energy interval from 0.01 to 1 eV. The recombination cross section for the diatomic OH^+ is small, one of the smallest measured by the authors for a diatomic ion. The cross sections for the polyatomics H_2O^+, H_3O^+ and D_3O^+ are large and nearly identical. Like most other polyatomic ions they exhibit nearly an $E_{cm}{}^{-1}$ energy dependence below approximately 0.1 eV. At higher energies the slope of the cross section versus electron energy is much steeper with an energy dependence near $E_{cm}{}^{-2}$. Cross sections for D_3O^+ are less than those for H_3O^+ indicating the presence of a small isotope effect. (32 refs.)

106623 Recoil-induced excitation of atoms by neutron scattering. T.W.Ruijgrok, B.R.A.Nijboer (Inst. for Theoretical Phys., Univ. of Utrecht, Utrecht, Netherlands), M.R.Hoare.
Physica A (Netherlands), vol.120A, no.1-2, p.537-44 (1983).
When a medium energy neutron hits a free atom there is a finite probability that as a consequence of the recoil the atom becomes excited or ionised. For the simple case of a hydrogen atom exact calculations are reported of the transition probabilities for various initial and finite states as a function of the momentum transfer. (3 refs.)

106624 Ultrahigh-resolution study of autodetachment in $C_2{}^-$. U.Hefter, R.D.Mead, P.A.Schulz, W.C.Lineberger (Dept. of Chem., Univ. of Colorado, Boulder, CO, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1531-8 (Sept. 1983).
The authors describe a new coaxial laser-ion-beam photodetachment spectrometer designed to measure high-resolution photodetachment spectra of negative ions, and the measurement of $C_2{}^-$ autodetachment rates with it. The apparatus resolution of 10 MHz is sufficient to resolve linewidth and line shape of autodetaching resonances in $C_2{}^-$. Autodetachment rates of the $B^2\Sigma_u{}^+$ state have been measured for a variety of rotational levels with $\nu'=6$, 7, 8, and 9. The observed rates vary between 10^7 and 10^{10} s^{-1}, depending on vibrational and rotational state. Autodetachment of high vibrational levels ($\nu'=19$) of the $A^2\Pi_u$ state has been seen to be slower than 10^8 s^{-1}. The physical processes giving rise to these results are discussed in some detail. (33 refs.)

35.00 PROPERTIES OF ATOMS AND MOLECULES; INSTRUMENTS AND TECHNIQUES

35.10 ATOMS

35.10B Atomic masses, mass spectra, abundances, and isotopes

(inc. isotope separation; for mass spectrometry, see also 07.75; for radioisotope separation see 28.42H or 82.55)

106625 Laser isotope separation of tritium from deuterium: CO_2-laser-induced multiphoton dissociation of C_2TF_5 in C_2DF_5. Y.Makide, S.Kato, T.Tominaga (Dept. of Chem., Univ. of Tokyo, Tokyo, Japan), K.Takeuchi.
Appl. Phys. B (Germany), vol.B32, no.1, p.33-4 (Sept. 1983).
Isotope separation of tritium from deuterium in heavy water was attempted by CO_2-laser-induced, highly-selective multiphoton dissociation of C_2TF_5 present in C_2DF_5. Single-step T/D separation factors exceeding 3000, 1000, and 500 were attained, respectively, for the first time with CO_2 laser 10P(34) 931.0 cm^{-1} at 10, 20, and 30 Torr pentafluoroethane pressures at $-78°C$ (i.e. equivalent to 15, 30, and 45 Torr at room temperature). (6 refs.)

Numerical analysis of hydrogen isotope separation characteristics in improved dual temperature exchange reaction system between water and hydrogen gas ....See Entry 106160

Lithium isotope separation by displacement chromatography using cryptand resin ....See Entry 106161

Kinetics of the interaction of a liquid diffusing into another one as studied by reflection spectroscopy (ATR) .... See Entry 109736

Deuterium separation and infrared photochemistry in CF_2HCl ....See Entry 109765

An activation method to determine the isotopic ratio of $^6Li/^7Li$ in lithium compounds ....See Entry 109824

35.10D Electric and magnetic moments, polarizability

106626 The mean static dipole polarisability of scandium. R.Glass, G.S.Chandler (Dept. of Phys. & Inorganic Chem., Univ. of Western Australia, Nedlands, Australia).
J. Phys. B (GB), vol.16, no.16, p.2931-6 (28 Aug. 1983).
The mean static dipole polarisability of scandium is calculated. Perturbation theory was used so that the polarisability is expressed in terms of the second-order energy correction. The ground-state and necessary first-order correction to the wavefunction were determined variationally as a superposition of configurations. The importance of the various polarising orbitals and the length of the configuration expansion are examined. (11 refs.)

Many-body calculations of atomic properties. I. g_j factors ....See Entry 106289

Finite-field SCF calculations of the dipole polarisabilities of heavy atoms using relativistic effective potentials .... See Entry 106291

35.10F Relativistic corrections, fine- and hyperfine-structure constants

106627 Fine and hyperfine structure parameters in a space of constant curvature. N.Bessis, G.Bessis (Lab. de Spectroscopie Theorique, Univ. Claude Bernard, Lyon I, Villeurbanne, France).
J. Phys. A (GB), vol.16, no.13, p.L467-70 (11 Sept. 1983).
Analytical expressions of the atomic fine and hyperfine structure parameters in a space of constant curvature have been obtained by use of a ladder

operator technique. It is found that the additional curvature contributions to the classical (flat) expressions increase with *n*. (5 refs.)

$\alpha(Z\alpha)^2E_F$ binding corrections to hyperfine splitting in hydrogenic atoms .... See Entry 106320

Extension of the measurements of the np $^2P_{1/2,3/2}$ and nd $^2D_{3/2,5/2}$ Rydberg series in neutral indium .... See Entry 106328

Synchronized quantum beat spectroscopy and its application to the measurement of pressure shifts of the hyperfine splitting in $3^2S_{1/2}$ of sodium atoms .... See Entry 106350

Collision broadening and shift of excited *s* states in thallium .... See Entry 106353

Extractoion of accurate autionisation widths from the emission spectrum of doubly-excited He .... See Entry 106361

Recalibration of the Auger spectra of boron .... See Entry 106374

Auger-electron study of correlation effects in $3d^{-1}$ and $4d^{-2}$ states of Cs in atomic Cs and molecular CsI .... See Entry 106375

Inelastic collisions between selectively excited rubidium 6^2D-state atoms and noble-gas atoms: fine-structure-state mixing .... See Entry 106560

35.10H Ionization potentials, electron affinities

Energy levels of silicon, Si I through Si XIV .... See Entry 105044

Calculation of the ionization energy of a donor atom near a semiconductor surface .... See Entry 108488

35.20 MOLECULES

(see also 61.55, 61.60, and 61.65 Specific structures of metals and alloys, of other inorganic materials, and of organic materials, respectively)

Vibrational spectra and structure. A series of advances. Vol.12 .... See Entry 105049

35.20B General molecular conformation and symmetry; stereochemistry

Strategic design of organic conductors. Structure of a prototypical molecule .... See Entry 106258

Are the silacyclopentadienyl anion and the silacyclopropenyl cation aromatic? .... See Entry 106286

Comments on the cis, trans, and cyclic dimers of NO .... See Entry 106287

Ab initio SCF-LCAO-MO study of conformational stability and internal rotation in n-butane, ethyl methyl ether and ethyl methyl sulphide .... See Entry 106296

Chemical applications of topology and group theory. XIII. Chirality and framework groups .... See Entry 106300

Theoretical study of the structure and reactivity of the pentazole anion .... See Entry 106301

Equilibrium geometries of transition metal complexes. A comparison of approximate molecular orbital theory and experiment .... See Entry 106303

Structures and rearrangements of closo-boron hydrides .... See Entry 106304

Vibrational frequencies of the HCCN molecule. A near degeneracy between bent cyanocarbene and linear allene-related geometries .... See Entry 106382

$\tilde{X}^1A_1$, $\tilde{a}^3B_1$, and $\tilde{A}^1B_1$ electronic states of silyenes. Structures and vibrational frequencies of SiH_2, SiHF, and SiF_2 .... See Entry 106388

Effects of pressure on conformer equilibria in liquid n-hexane .... See Entry 106429

Unusual coordination and metal-ligand geometry of a vanadyl porphyrin in aqueous solution .... See Entry 106431

The interaction of lanthanide shift reagents with cationic sites: a ^1H and ^{13}C NMR study of the solution geometry of nicotine N-methiodide .... See Entry 106442

Experimental and theoretical studies of ^{13}C-^{13}C coupling constants. I. Conformational and substituent dependencies of long range coupling constants $^4J(^{13}C$-$^{13}C)$ .... See Entry 106443

Side-chain vs. main-chain conformational flexibility in aromatic dipeptides .... See Entry 106445

Conformational analysis by NMR spectrometry of the highly substituted cyclic tetrapeptides, chlamydocin and Ala^4-chlamydocin. Evidence for a unique amide bond sequence in dimethyl-d_6 sulfoxide .... See Entry 106446

Nuclear magnetic resonance and PCILO study of the side-chain conformations in *m*-anisaldehyde and 2,5-dimethyloxybenzaldehyde .... See Entry 106452

Structure and dynamics of molecular rotation of 2-pyridone in toluene and methanol by carbon-13 nuclear magnetic resonance .... See Entry 106453

Dimers in jet-cooled *s*-tetrazine vapor: structure and electronic spectra .... See Entry 106491

Structure and bonding of the first η^2-coordinated P_4 ligand: molecular structure of trans-$[Rh(P_4)(PPh_3)_2Cl].2CH_2Cl_2$ at 185K .... See Entry 106628

Symmetry in N-H...N bonding, the structure of β-iminoamines and their salts .... See Entry 107654

The structure and conformation of cis-2-phenylcyclobutanecarboxylic acid and cis-3-(p-fluorophenyl)cyclobutanecarboxylic acid .... See Entry 107655

The crystal and molecular structures of 1,2,7,9-tetrathia-3,6,8,10-tetra-azacyclohept(e)indene, a novel tricyclic carbon-sulphur-nitrogen ring system .... See Entry 107657

The crystal and molecular structure of 2,3,12,13-tetrathia[4,4]metacyclophane .... See Entry 107658

Improving the resolution of electron density maps of proteins by refining the model structure. I. Numerical experiments .... See Entry 107664

The structure of perdeuteronaphthalene $C_{10}D_8$ at 12K by neutron diffraction .... See Entry 107665

Single-crystal EPR of the ^{17}O-enriched dioxygen adduct of vitamin B_{12r}: reversible oxygen bonding, electronic and geometric structure, and molecular dynamics .... See Entry 108757

Chemical properties of the gas-phase benzvalene radical cation .... See Entry 109727

Conformation of purine mononucleotides by H{H} and P{H} nuclear Overhauser effects .... See Entry 109955

Conformation and dynamics of carcinogenic N-substituted 2-aminofluorene compounds studied by nuclear magnetic resonance spectroscopy .... See Entry 109959

EPR evidence on the structure of the copper(II)-bacitracin A complex .... See Entry 109960

35.20D Interatomic distances and angles

Interruption of conjugation in polyenes bound to transition-metal fragments .... See Entry 106285

A new version of the variational cellular method for polyatomic systems .... See Entry 106292

Equilibrium geometries of transition metal complexes. A comparison of approximate molecular orbital theory and experiment .... See Entry 106303

Cubic and quartic force constants of some stretching and out-of-plane bending modes of the $FH...OH_2$ complex: a three-dimensional hypersurface analysis .... See Entry 106380

Proton affinity of GeH_4 and the shape of GeH_5^+ .... See Entry 106537

35.20G Bond strengths, dissociation energies, hydrogen bonding, etc

106628 Structure and bonding of the first η^2-coordinated P_4 ligand: molecular structure of trans-$[Rh(P_4)(PPh_3)_2Cl].2CH_2Cl_2$ at 185K. W.E.Lindsell, K.J.McCullough (Dept. of Chem., Heriot-Watt Univ., Edinburgh, Scotland), A.J.Welch.

J. Am. Chem. Soc. (USA), vol.105, no.13, p.4487-9 (29 June 1983).

Although the complex $Rh(P_4)(PPh_3)_2Cl$ (**1**) and related derivatives of Rh and Ir were synthesized several years ago, the precise nature of the novel M-P_4 interaction was not established. In the more recently characterized complexes $M[N-(CH_2CH_2PPh_2)_3]P_4$ (**2**, M=Ni; **3**, M=Pd) the P_4 tetrahedron is η^1-coordinated to the metal. For complex **1**, however, the alternative η^2-or η^3-coordination modes are also feasible. Indeed, a very recent NMR study of **1** suggested η^2-coordination for the P_4 unit. It was clearly of considerable importance to characterize **1** by X-ray diffraction, to corroborate the conclusions of the NMR experiment and also to furnish accurate structural parameters for the coordinated P_4 moiety (errors in P-P lengths in the structural study of **2** being rather large). Recrystallization from dichloromethane at 195K has afforded suitable crystals as a solvate ($Rh:CH_2Cl_2=$**1**:2), which on rapid transference to a diffractometer equipped with a low-temperature attachment enabled an accurate structural study to be undertaken. (19 refs.)

Ab initio studies on hydrogen-bonded chains. III. The linear, infinite chain of hydrogen cyanide molecules .... See Entry 106278

Coordination 2 of phosphorus: quantum chemical study of P=N and P=C systems .... See Entry 106307

Ab initio CI study of the photodissociation of nitrosyl chloride (ClNO) .... See Entry 106310

Doubly positive diatomic molecules. I. N_2^{2+} .... See Entry 106312

Ab initio studies on ONH_3, ONF_3 and OCF_3^-, using polarization functions and configuration interaction methods .... See Entry 106315

Infrared spectra of hydrogen-bonded salicylic acid and its derivatives: methyl salicylate .... See Entry 106400

Molecular complexes of cyclopropane with hydrogen halides and water studied by matrix-isolation vibrational spectroscopy .... See Entry 106401

Raman spectra of matrix-isolated group IIIA dimers: Ga_2, In_2, Tl_2 .... See Entry 106423

Shift and quenching of fluorescence of tetrahydronaphthols due to hydrogen bonding .... See Entry 106486

NaH: studies of the $X^1\Sigma^+$ state near dissociation and of the radiative lifetimes and collision cross sections of the $A^1\Sigma^+$ state .... See Entry 106504

Autoionizing Rydberg states of the Li_2 molecule: molecular constants for Li_2^+ .... See Entry 106512

A classical theory of multiple photon dissociation .... See Entry 106522

Proton affinity of GeH_4 and the shape of GeH_5^+ .... See Entry 106537

Alkylammonium hexachlorostannates(IV), $(R_nNH_{4-n})_2SnCl_6$: crystal structure, infrared spectrum and hydrogen bonding .... See Entry 107660

Single-crystal EPR of the ^{17}O-enriched dioxygen adduct of vitamin B_{12r}: reversible oxygen bonding, electronic and geometric structure, and molecular dynamics .... See Entry 108757

EXAFS study of Ni-Cl bonding in Ni(11) aqueous solutions at increasing Cl^-/Ni^{2+} ratios .... See Entry 109048

Search for a simplified procedure for the evaluation of the Gibbs free energy of hydrogen-bond formation .... See Entry 109791

35.20J Barrier heights (internal rotation, inversion); rotational isomerism, conformational dynamics

Comments on the cis, trans, and cyclic dimers of NO .... See Entry 106287

Ab initio SCF-LCAO-MO study of conformational stability and internal rotation in n-butane, ethyl methyl ether and ethyl methyl sulphide .... See Entry 106296

Coordination 2 of phosphorus: quantum chemical study of P=N and P=C systems .... See Entry 106307

Effects of pressure on conformer equilibria in liquid n-hexane .... See Entry 106429

Dynamic stereochemistry of 2,3,12,13-tetrathia- and -tetraselena[4,4]metacyclophanes .... See Entry 106440

NMR spectroscopy of cyclohexane. Gas-phase conformational kinetics .... See Entry 106449

Rotation barriers of amides in the gas phase .... See Entry 106454

Conformational and spectral investigations of thiazolidinone derivatives by ^1H and ^{13}C NMR spectroscopy .... See Entry 106467

The crystal and molecular structure of 2,3,12,13-tetrathia[4,4]metacyclophane .... See Entry 107658

On nuclear magnetic relaxation due to slow molecular reorientation and fast internal rotation interference .... See Entry 108821

Secondary amines: a low-temperature dielectric relaxation study .... See Entry 108865

Conformation of purine mononucleotides by H{H} and P{H} nuclear Overhauser effects .... See Entry 109955

Conformation and dynamics of carcinogenic N-substituted 2-aminofluorene compounds studied by nuclear magnetic resonance spectroscopy .... See Entry 109959

35.20M Electric and magnetic moments (and derivatives), polarizability, and magnetic susceptibility

106629 Static dipole moment of two coupled systems (molecules). J.M.Vigoureux (Lab. de Phys. Moleculaire, Univ. de Besancon La Bouloie, Besancon, France).
J. Chem. Phys. (USA), vol.79, no.5, p.2363-8 (1 Sept. 1983).
The author presents the expression for the dipole moment of a pair of nonidentical systems in terms of the frequency dependent polarizabilities and hyperpolarizabilities. The author's calculations are quite general and include the two particular cases of the near-zone (London) and of the far-zone (Casimir) limits. The author first considers the case of two dissimilar centrosymmetric systems and then, the more particular one of two spherical ones. (11 refs.)

106630 Excited state dipole moments of some monosubstituted benzenes from solvent effect on electronic absorption spectra. L.S.Prabhumirashi, D.K.Narayanan Kutty, A.S.Bhide (Chem. Dept., Poona Univ., Pune, India).
Spectrochim. Acta Part A (GB), vol.39A, no.8, p.663-8 (1983).
The excited state dipole moments of a number of monosubstituted benzenes in their ^1L_a and ^1L_b states are estimated from solvent induced shifts in the corresponding electronic absorption bands by following a recently indicated modified procedure. Some regular trends, apparent from the results, are discussed. The present results are in good agreement with those available in literature which are based on other experimental methods such as optical Stark effect, microwave Stark effect, etc. The proposed method is however found to be suitable for a wider variety of molecules and their electronic transitions accessible in the near u.v.-vis. region. (16 refs.)

The validity of Musher's model for the magnetic properties of aromatic molecules .... See Entry 106277

Ab initio studies on hydrogen-bonded chains. III. The linear, infinite chain of hydrogen cyanide molecules .... See Entry 106278

Dynamic polarizability of an exactly solvable model of diatomic molecule .... See Entry 106280

Ab initio one-electron property calculations. V. Miscellaneous heterocycles and related compounds .... See Entry 106294

Corrections to the orbital magnetic properties for diatomic molecules .... See Entry 106295

Electromagnetic properties of BH ($^1\Sigma^+$) using CASSCF wavefunctions .... See Entry 106311

Ab initio studies on ONH_3, ONF_3 and OCF_3^-, using polarization functions and configuration interaction methods .... See Entry 106315

The rotational Zeeman effect in ArHBr: an interpretation of the rotational Zeeman parameters in rare gas hydrogen halide complexes .. See Entry 106398

Non-linear Stark polarization spectroscopy .... See Entry 106480

NaH: studies of the $X^1\Sigma^+$ state near dissociation and of the radiative lifetimes and collision cross sections of the $A^1\Sigma^+$ state .... See Entry 106504

35.20P Rotation, vibration, and vibration-rotation constants

106631 Improved constants, Franck-Condon factors and r-centroids including vibration-rotation interaction for the B-X transition of ScO. C.B.Suarez (Dept. of Phys., Univ. of La Plata and Consejo Nacional de Investigaciones Cientificas y Tecnicas, La Plata, Argentina).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.295-8 (1983).
The authors report Franck-Condon factors, *r*-centroids and a new set of constants for the B-X transition of ScO (blue system) that correlate with observed band intensities and band origins. The vibration-rotation effect turns out to be of importance for some bands. A numerical calculation of centrifugal distortion constants agrees with experimental data. (14 refs.)

106632 Vibrational spectra and conformational analysis of substituted three membered ring compounds. C.J.Wurrey (Dept. of Chem., Univ. of Missouri, Kansas City, MO, USA), J.E.DeWitt, V.F.Kalasinsky.
In book: *Vibrational spectra and structure. A series of advances. Vol.12*, J.R.Durig [Ed.], p.205-322. Amsterdam, Netherlands: Elsevier (1983), xvi+497 pp. [0 444 42197 1]
Since all physical and chemical properties of a substance ultimately are derived from its molecular structure, the determination of the structural features of molecules has intrigued scientists for many years. One specific aspect of molecular structure involves the orientation about a particular bond (or about several bonds) of one portion of the molecule with respect to the rest of the molecule—in other words, the molecular conformation about that bond (or those bonds). The authors study the vibrational spectra and conformation of substituted three membered ring compounds. (158 refs.)

Generator coordinate method based on coherent states. II. Calculation of vibrational states by the double circular orbit method .... See Entry 106262

Quantum vs. classical calculation of nonlinear spectra-reduced dynamics and intramolecular entropy .... See Entry 106270

Ab initio SCF assignment of vibrational spectra of nitrosomethane .... See Entry 106276

Ab initio studies on hydrogen-bonded chains. III. The linear, infinite chain of hydrogen cyanide molecules .... See Entry 106278

Comments on the cis, trans, and cyclic dimers of NO .... See Entry 106287

Doubly positive diatomic molecules. I. N_2^{2+} .... See Entry 106312

Cubic and quartic force constants of some stretching and out-of-plane bending modes of the FH...OH_2 complex: a three-dimensional hypersurface analysis .... See Entry 106380

Vibrational frequencies of the HCCN molecule. A near degeneracy between bent cyanocarbene and linear allene-related geometries .... See Entry 106382

Infrared spectra of hydrogen-bonded salicylic acid and its derivatives: methyl salicylate .... See Entry 106400

Fourier-transform electronic absorption spectroscopy: the 800 nm near-infrared band system of nitrosyl cyanide (NCNO) .... See Entry 106402

Vibrational analysis of acetate ion molecules and estimation of equilibrium constants for their hydrogen isotopic exchange reactions .... See Entry 106409

Substituent effects in infrared spectroscopy. IX. Intensity of the carbonyl stretching vibration in 4-substituted camphors .... See Entry 106419

Substituent effect in infrared spectroscopy. X. 5-substituted acetyl-2-thiophenes .... See Entry 106420

Effects of neutral and anionic substituents on the carbonyl stretching bands of substituted methylbenzoates .... See Entry 106421

The high-resolution photoelectron spectrum of N_2O. The $\tilde{B}(^2\pi_i)$ state .... See Entry 106498

NaH: studies of the $X^1\Sigma^+$ state near dissociation and of the radiative lifetimes and collision cross sections of the $A^1\Sigma^+$ state .... See Entry 106504

Autoionizing Rydberg states of the Li_2 molecule: molecular constants for Li_2^+ .... See Entry 106512

Force fields for large molecules .... See Entry 106529

Vibrational spectra of small matrix isolated molecules .... See Entry 106530

Mode-selective cooling of vibrational energy during supersonic expansion of pyrimidine: evidence for noncommunicating sets of vibrational manifold .... See Entry 106546

Alkylammonium hexachlorostannates(IV), $(R_nNH_{4-n})_2SnCl_6$: crystal structure, infrared spectrum and hydrogen bonding .... See Entry 107660

35.20S Hyperfine and fine-structure constants

Λ doubling spectrum of the CH free radical in a RF glow discharge .... See Entry 106396

The microwave spectrum of the fluoromethyl radical, CH_2F .. See Entry 106397

Mechanism of spin transfer to β protons in π radicals. Analysis of anisotropic hyperfine couplings .... See Entry 106477

Laser excitation spectrum and microwave optical double resonance spectrum of the 3_0^1 band in the $\tilde{a}^3A_2$-$\tilde{X}^1A_1$ system of H_2CS: the hyperfine structure of the $\tilde{a}^3A_2$ state .... See Entry 106479

35.20V Ionization potentials, electron affinities, molecular core binding energy

Lone-pair and core ionization potentials of planar ammonia and phosphine. The use of core and valence ionization potentials to quantify the bonding and antibonding character of molecular orbitals of compounds of nitrogen and phosphorus .... See Entry 106288

A new version of the variational cellular method for polyatomic systems .... See Entry 106292

The frozen-core approximation with a nonempirical polarisation potential: the sodium isoelectronic sequence .... See Entry 106293

Structures and rearrangements of closo-boron hydrides .... See Entry 106304

Coordination 2 of phosphorus: quantum chemical study of P=N and P=C systems .... See Entry 106307

Calculation of photoelectron spectra of group IV tetrachlorides and carbon tetrahalides by SCF-X_α-SW method .... See Entry 106500

Autoionizing Rydberg states of the Li_2 molecule: molecular constants for Li_2^+ .... See Entry 106512

Relative electron affinities of substituted nitrobenezenes in the gas phase .... See Entry 106572

Search for a simplified procedure for the evaluation of the Gibbs free energy of hydrogen-bond formation .... See Entry 109791

ESCA studies on silicon compounds using an internal standard for calibration .... See Entry 109837

35.20X Mass spectra

Gas-phase thermochemical information from triple quadrupole mass spectrometers: relative proton affinities of amines .... See Entry 106333

Electron-impact luminescence spectra and neutral fragments: identification of neutral fragments by use of fragment emissions .... See Entry 106490

State-selective resonant excitation-ionization of H_2 with tunable VUV laser light .... See Entry 106514

Ultraviolet laser induced ionization of molecules near surfaces .... See Entry 106515

Photofragmentation of nitromethane in a molecular beam at 193 nm .... See Entry 106521

The secondary ion mass spectrum of glycerol-d_5: evidence for radical cation intermediates .... See Entry 106548

Relative electron affinities of substituted nitrobenezenes in the gas phase .... See Entry 106572

Theoretical study of electron impact mass spectrometry. I. Ab initio MO study of the fragmentation of *n*-butane .... See Entry 106612

Two-photon-ionization mass spectroscopy of ammonia clusters in a pulsed supersonic nozzle beam .... See Entry 106647

Gas-phase solvation of NO_2^- and NO_3^- by ethyl nitrate ...... See Entry 109720

Metastable doubly-charged ions of methane studied by means of a triple-sector mass spectrometer .... See Entry 109721

Energy and time dependence of the decay processes of toluene molecular cations .... See Entry 109726

Chemical properties of the gas-phase benzvalene radical cation .... See Entry 109727

Pulse-rate effects in the photochemistry of gas-phase bromobenzene ions. A study of ion relaxation mechanisms .... See Entry 109770

35.80 ATOMIC AND MOLECULAR MEASUREMENTS AND TECHNIQUES

106633 Description of equipment for measuring differential cross sections in ion-neutral particle collisions at low energies. G.Zarate Mejia, D.Galvis Sanchez (Dept. de Fisica, Univ. Nacional de Colombia, Bogota, Colombia), V.Herman.
Rev. Colomb. Fis. (Colombia), vol.15, no.1, p.95-106 (1981). In Spanish. [received: Aug. 1983]
Following a short mention of the usefulness of measuring differential cross-sections in scattering experiments is a description of an equipment built with that purpose at the Physics Department of Universidad Nacional de Colombia in Bogota. A sample of results obtained is shown and some possible steps for its improvement are proposed. (19 refs.)

106634 Direct kinetic study of CH($A^2\Delta$). C.Nokes, G.Gilbert, R.J.Donovan (Dept. of Chem., Univ. of Edinburgh, Edinburgh, Scotland).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.491-3 (19 Aug. 1983).
Time-resolved kinetic studies of CH($A^2\Delta$), following formation by ultraviolet multiphoton excitation of $(CH_3)_2CO$ and CH_2I_2, are reported. Absolute rate constants (300K) for removal of CH($A^2\Delta$) by H_2, O_2 and CH_4 are determined at $(8.5\pm0.4)\times10^{-12}$, $(1.10\pm0.04)\times10^{-11}$ and $(2.0\pm0.1)\times10^{-11}$ cm^3 molecule^{-1} s^{-1}, respectively. In each case the rate constant for removal of CH($A^2\Delta$) is less than that for the ground electronic state, CH(X ^{2}II). (10 refs.)

106635 NonMaxwellian velocity distributions in the transition region of supersonic expansions of the noble gases He, Ne and Ar. H.C.W.Beijerinck, G.H.Kaashoek, J.P.M.Beijers, M.J.Verheijen (Phys. Dept., Eindhoven Univ. of Technol., Eindhoven, Netherlands).
Physica B & C (Netherlands), vol.121B+C, no.3, p.425-36 (Aug. 1983).
Small deviations of a Maxwell-Boltzmann velocity distribution are conveniently described by a function $B(\nu)[1+\Sigma_{n1}{}^{N}=3\gamma_n H_n(\nu)]$, with $B(\nu)$ the undisturbed distribution function and $H_n(\nu)$ the Hermite polynomials. The upper limit N is determined by the accuracy required. A selection of e.g. only odd or even terms is determined by the symmetry of the problem. Measurements for He and Ne of the velocity distribution perpendicular to the streamlines of the expansion, as described by a virtual source, result in a kurtosis parameter $\gamma_{\perp,4}=1.15\times10^{-2}$ of the central virtual source, independent of the source conditions. This value is in fair agreement with an a priori estimate $\gamma_{\perp,4}=0.7\times10^{-2}$ from a simple transition region model and full calculations by Klots (1982) within the framework of the thermal conduction model. The radii R_1 and R_2 and the relative populations c_1 and c_2 of the narrow and the wide virtual source, respectively, are in good agreement with the results obtained with undisturbed free jets in a cryo-expansion chamber. This indicates that free jets of the gases He and Ne (with their small Van der Waals constants) are hardly influenced by the finite pumping speed of 1000 1/s in the expansion chamber. For Ar the authors obtain 33% larger values for R_1, showing the influence of scattering by residual gas. (19 refs.)

Diode-laser spectroscopy of supersonic free jets .... See Entry 106399

High vibrational overtones in $SiHCl_3$ and SiH_2Cl_2 .... See Entry 106436

36.00 STUDIES OF SPECIAL ATOMS AND MOLECULES

36.10 EXOTIC ATOMS AND MOLECULES (CONTAINING MESONS, MUONS, AND OTHER ABNORMAL PARTICLES)

106636 Coulomb-nuclear interference in hadronic atoms. J.Thaler (Inst. fur Theoretische Phys., Univ. Graz, Graz, Austria).
J. Phys. G (GB), vol.9, no.9, p.1009-24 (Sept. 1983).
A rapidly converging expansion method for the Coulomb T operator is applied to relate S-wave strong interaction shifts and widths in the ground state of mesic atoms to the pure hadronic scattering length in the corresponding scattering system. The result improves the accuracy of the Deser formula and, in combination with other methods, allows a determination of Coulomb corrections to S-wave scattering lengths in a model-independent way. In detail, the author discusses various corrections in the ground state of kaonic hydrogen, where a discrepancy between bound-state and scattering data exists which is not yet understood. Further applications are given for heavier pionic atoms and atomic protonium. (31 refs.)

106637 Pionic 3d→2p X-ray measurements in ^{50,52,54}Cr, ^{45}Sc, ^{51}V, ^{55}Mn and Fe. R.Kunselman (Phys. Dept., Univ. of Wyoming, Laramie, WY, USA), R.J.Powers, M.V.Hoehn, E.B.Shera.
Nucl. Phys. A (Netherlands), vol.A405, no.3, p.627-47 (5 Sept. 1983).
Reports the measurement of the strong interaction shifts and widths of the pionic 3d→2p transitions in separated isotopes of ^{50,52,54}Cr and natural Sc, V, Mn, and Fe. Using these new data in combination with earlier low-Z pionic data ($6\leq Z\leq20$) the authors have studied the phenomenological pion-nuclear potential. Employing nuclear structure information from measured charge densities and Hartree-Fock calculations, they have fitted the pion-nuclear potential parameters to the pionic-atom data. They have explored the sensitivity of these data to the value of the Lorentz-Lorenz parameter ξ. The addition of an isovector dependence to the s- and p-wave two-nucleon terms is shown to be unnecessary at the present level of experimental accuracy. They have used the deduced optical potentials to determine the neutron radii of the nuclei $20\leq Z\leq26$ and find reasonable agreement with Hartree-Fock predictions and with the results of the hadronic probes for $20\leq Z\leq23$ but poor agreement for $24\leq Z\leq26$. (68 refs.)

106638 Additional radiative-recoil corrections to muonium and positronium hyperfine splitting. J.R.Sapirstein, E.A.Terray, D.R.Yennie (Newman Lab. of Nuclear Studies, Cornell Univ., Ithaca, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.11, p.982-4 (12 Sept. 1983).
A compact expression for one-loop radiative corrections to lepton lines in positronium and muonium hyperfine splitting is presented. It is valid for hyperfine-splitting contributions of order $\alpha^2 E_F$, including the effects of recoil to all orders. For muonium, known nonrecoil parts of this contribution are easily evaluated analytically, as is a previously calculated radiative-recoil contribution of order $\alpha^2 E_F(m_e/m_\mu)\ln(m_\mu/m_e)$. Nonlogarithmic radiative-recoil corrections obtained by numerical evaluation of this expression yield new contributions of 2.64 ± 0.07 kHz for muonium and -11.12 ± 0.02 MHz positronium. (8 refs.)

106639 Some aspects of muonium atom chemistry. A.Cecal, C.Hatnean (Inst. Politehnic, Iasi, Rumania).
Stud. & Cercet. Fiz. (Rumania), vol.35, no.6, p.567-76 (1983). In Rumanian.
Consists of a theoretical study on the formation and deceleration of penetrons, penetron strains and penetron atoms, followed by several examples of chemical transformations induced by these unstable atoms when interacting with atoms and molecules of substances in different states of aggregation. (23 refs.)

106640 Lifetime of the mesic molecule $dt\mu$. L.N.Bogdanova, V.E.Markushin, V.S.Melezhik, L.I.Ponomarev (JINR, Dubna, USSR).
Sov. Phys.-JETP (USA), vol.83, no.5, p.931-5 (Nov. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.5, p.1615-22 (Nov. 1982). [received: Sept. 1983]
A lifetime of $\tau\approx10^{-11}$ sec is calculated for the mesic molecule $dt\mu$ produced resonantly in the excited rotational-vibrational state $J=\nu=1$. (22 refs.)

Study of isotope shifts, isotone shifts and nuclear compressibility from the analysis of muonic X-ray transitions .... See Entry 105736

Spectroscopy of superheavy quasimolecules and quasiatoms ... See Entry 105933

Energies of three-particle systems with Coulomb interactions .... See Entry 106274

Prediction and interpretation of collinear reactive scattering resonances by the diagonal corrected vibrational adiabatic hyperspherical model .... See Entry 109718

36.20 MACROMOLECULES AND POLYMER MOLECULES

(for biological macromolecules, see also 87.15; for polymer reactions and polymerization, see 82.35)

106641 The freely jointed chain in expanded form. A.J.Galli, W.H.Brumage (Dept. of Phys., Louisiana Tech. Univ., Ruston, LA, USA).
J. Chem. Phys. (USA), vol.79, no.5, p.2411-18 (1 Sept. 1983).
The distribution function for an exact treatment of an n-link freely jointed chain is obtained in expanded form to order $1/n^3$. Comparisons are made with modified Gaussian distribution functions of the same order. (6 refs.)

106642 A Monte Carlo off-lattice method: the slithering snake in a continuum. C.Brender, M.Lax (Dept. of Chem., Bar Ilan Univ., Ramat-Gan, Israel).
J. Chem. Phys. (USA), vol.79, no.5, p.2423-5 (1 Sept. 1983).
An off-lattice Monte Carlo simulation of a polymer chain using the slithering snake method is introduced. The mean square end-to-end distance is calculated and compared with previous studies. Results indicate that small angular deviations from the tetrahedral lattice models produce large conformational change in the polymer chain. (10 refs.)

106643 Effects from bead size and hydrodynamic interactions on the translational and rotational coefficients of macromolecular bead models. J.Garcia de la Torre, V.Rodes (Dept. de Quimica Fisica, Univ. de Murcia, Murcia, Spain).
J. Chem. Phys. (USA), vol.79, no.5, p.2454-60 (1 Sept. 1983).
In the work, the authors analyze a deficiency of the currently used form of the Kirkwood-Riseman (KR) theory for macromolecular bead models in regard to the finite size of the beads and illustrate the importance of a more complete description of hydrodynamic interactions. They consider several exact or very accurate theories for two-bead models and compare their results with different KR-based methods. One of them is the substitution technique in which the beads are substituted by a cubic array of smaller spheres. Its disadvantage is an increase in computer requirements. A novel result of their work is very simple correction for the KR rotational coefficients intended to correct, in part, the failure originated by size effects. The comparison of the various approaches has been made for two specific cases, the rigid dumbbell and prolate ellipsoids, for which rigorous results are available. The authors show that the performance of the substitution technique is excellent, and that their correction improves in many cases the KR results for rotation. (21 refs.)

106644 Renormalization group theory of transport properties of polymer solutions. II. Rotatory friction coefficient vs. intrinsic viscosity. Y.Oono, M.Kohmoto (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
J. Chem. Phys. (USA), vol.79, no.5, p.2478-81 (1 Sept. 1983).
For pt.I see ibid., vol.78, no.1, p.520 (1983). The rotatory friction coefficient f_r is calculated with the aid of the renormalization group theory. The present calculation shows that the ratio of f_r to the intrinsic viscosity $[\eta]$ depends on the excluded volume and the draining effects. The calculated ratio $f_r/[\eta]$ is about ~5%-7% less than the conventional value which is obtained by using the preaveraging approximation of the Oseen tensor. The conventional value is independent of the excluded volume and draining effects. (9 refs.)

106645 Application of two-dimensional relayed coherence transfer experiments to ^{1}H NMR studies of macromolecules. G.King, P.E.Wright (Dept. of Inorganic Chem., Univ. of Sydney, Sydney, NSW, Australia).
J. Magn. Resonance (USA), vol.54, no.2, p.328-32 (Sept. 1983).
Relayed coherence transfer (RCT) spectroscopy has recently been proposed as a method for establishing connectivity between two remote nuclei within a given spin system (Aue et al., 1976). In its simplest 2D variant, the mixing pulse of the COSY pulse sequence is replaced by a $90°-\tau-180°-\tau-90°$ pulse train. This can induce two consecutive coherence transfer processes, resulting in magnetization transfer between nuclei A and X of an AMX spin system, for example. RCT experiments were performed with full quadrature detection using N-type peak selection. The value of τ was set in the range 30 to 40 msec to optimize relayed magnetization transfer involving coupling constants of 6-8 Hz. (16 refs.)

106646 The behaviour of polyelectrolyte solutions in elongational flow; the determination of conformational relaxation times (with an appendix of an anomalous adsorption effect). M.J.Miles, K.Tanaka, A.Keller (H.H. Wills Phys. Lab., Univ. of Bristol, Bristol, England).
Polymer (GB), vol.24, no.9, p.1081-8 (Sept. 1983).
The elongational flow method for determining conformational relaxation times of macromolecules (τ) in solution, based on the determination of the critical strain rate to induce the coil→stretch transition has been described previously for neutral polystyrene (PS) solution. It is applied to a polyelectrolyte, the Na^+ salt of polystyrene sulphonate (NaPSS), which is available in monodisperse form in several molecular weights. In highly dilute solutions in the absence of added salt, τ is up to three orders of magnitude larger than for neutral PS indicating a more expanded and/or more permeable chain conformation. The existence of a critical strain rate plus the observed quadratic molecular-weight (M) dependence suggest a free-draining coil at these low salt concentrations. On adding salt, a drastic and sharp decrease in τ, followed by a more gentle decrease on addition of further salt, is interpreted as

a transition to a more collapsed non-free-draining coil behaviour, which is then retained. On raising and subsequently lowering of pH, τ increases and decreases in a reversible manner with a small hysteresis corresponding to the overall increase in salt concentration. Exchanging Na^+ or Ca^{++} decreases τ drastically, from which a stiffer and more compact molecular conformation, assigned to intramolecular ionic bridging, is inferred. However, the same dependence on ionic strength of added salt is otherwise observed. For divalent salt forms, τ increases with polymer concentration until gelation occurs, indicating intermolecular ionic bridging. (20 refs.)

Ab initio studies on hydrogen-bonded chains. III. The linear, infinite chain of hydrogen cyanide molecules .... See Entry 106278

A simple two-dimensional measurement of the decoupler power during continuous homonuclear irradiation for the correction of Bloch-Siegert shifts .... See Entry 106456

The 1-1 hard pulse: a simple and effective method of water resonance suppression in FT ^{1}H NMR .... See Entry 106458

Crystalline conformation and structure of lichenan and barley β-glucan .... See Entry 107659

Polymer conformation and viscometric behaviour. I. Conformational transition in poly(benzyl methacrylate) in dilute solutions .... See Entry 108005

Interpreting light scattering patterns by means of optical diffraction .... See Entry 108238

Low-angle laser light scattering from polystyrene solutions: intensity measurements and photon correlation spectroscopy .... See Entry 108967

Photoselection of conformational substrates and the hyposochromic photoproduct of rhodopsin .... See Entry 109780

Determination of the absolute handedness of knots and catenanes of DNA .... See Entry 109961

Quasi-elastic light scattering studies on T7 DNA in the presence of a sinusoidal electric field .... See Entry 109967

Determination of twist and handedness of a 39-base pair segment of DNA in solution .... See Entry 110268

36.40 ATOMIC AND MOLECULAR CLUSTERS

106647 Two-photon-ionization mass spectroscopy of ammonia clusters in a pulsed supersonic nozzle beam. H.Shinohara (Inst. for Molecular Sci., Okazaki, Japan).
J. Chem. Phys. (USA), vol.79, no.4, p.1732-40 (15 Aug. 1983).
Two-photon-ionization (TPI) with an ArF excimer laser at 193 nm, when combined with a mass spectrometer, is found to be a very sensitive method for the detection of ammonia clusters. Ammonia cluster distributions in the pulsed beam expansion have been measured via TPI by varying the delay time between the pulsed beam and the laser firing. The relative intensity of the clusters as observed by the TPI is a sensitive function of the delay time. Furthermore, seeding effects on the ammonia cluster distribution with He, Ne, Ar, and Kr carrier gases are examined. The distribution shifts toward high mass region with increasing mass of the seeding gases. Finally, an effective competition between the one-photon predissociation and two-photon ionization at the $\tilde{A}^1A''_2$ state of the ammonia monomer (which is insignificant in the clusters) is found and discussed in terms of a simple rate-equation treatment valid in this system. (35 refs.)

40.00 CLASSICAL AREAS OF PHENOMENOLOGY

(inc. applications)

41.00 ELECTRICITY AND MAGNETISM; FIELDS AND CHARGED PARTICLES

(see also 03.50 Maxwell theory: general mathematical aspects)

41.10 CLASSICAL ELECTROMAGNETISM

106648 On the optimum direction of magnetic force in magnetic separation experiments. D.Zoler, A.Segal, G.Calugaru (Dept. of Phys., Polytech. Inst. of Jassy, Jassy, Rumania).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.5, p.591-4 (1983).
At present there is great interest in improving the magnetic separation methods, so as to fractionate nonferrous materials from the residue of incinerated urban refuse. Important progress has been made along this line by making use of the levitation property of magnetic fluids. The authors discuss a new separation procedure in which the magnetic force is at an oblique angle γ from the horizontal. The resultant vector summation of this force and the gravitational force forms an angle σ with the horizontal. This angle depends on particle density as well as on the density of the magnetic fluid. They obtain the expression for the angle σ and also the relation for the magnetic force. They estimated the optimum numerical values of γ for eleven nonferrous elements: Mg, Be, Al, Zn, Cu, Co, Mo, Ag, Pb, Hg, W, and for the following values of the parameter a: $(4,5,6,7,8)\times10^{-4}m^3/kg$. (6 refs.)

41.10D Electrostatics, magnetostatics

106649 Analysis of stationary electrical fields generated by sets of thin conductive electrodes in non-homogeneous environment. K.Adamiak.
Arch. Elektrotech. (Germany), vol.66, no.4, p.217-23 (1983).
Equations are formulated to allow analysis of stationary electrical fields generated by thin electrodes which do not form a closed surface. It is assumed that bodies with different electrical properties (dielectrics or conductors) can be found in the space around the electrodes. The problem is reduced, in general case, to a system of integral equations, of which at least some are Fredholm integral equations of the first kind with singular kernels. Numerical calculations of some selected problems are made by using the finite difference method. (22 refs.)

106650 The capacitances of two arbitrary conductors. Y.L.Chow, M.M.Yovanovich (Dept. of Electrical Engng., Univ. of Waterloo, Waterloo, Ontario, Canada).
J. Electrostat. (Netherlands), vol.14, no.2, p.225-34 (Aug. 1983).
The capacitance or charges of two arbitrary conductors are normally computed by numerical methods. All these numerical methods frequently require substantial computer time and programming effort. It would be desirable to have some simple method in place of these numerical methods and still give acceptable errors of say less than 5 or 10%. There is, in principle, a simple method to calculate the charges and capacitance of a two conductor system. The method is based on the elastance matrix by Smythe (1968), with elastance defined as the reciprocal of capacitance. Through the inversion of a 2×2 elastance matrix, one obtains the capacitance matrix and, subsequently, simple formulas for the charge and capacitance calculations of the two conductors. (9 refs.)

106651 Shape and stability of electrostatically levitated drops. P.M.Adornato, R.A.Brown (Dept. of Chem. Engng., MIT, Cambridge, MA, USA).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1796, p.101-17 (8 Sept. 1983).
An electrically conducting drop held together by surface tension is statistically levitated in an insulating medium by accumulating a net charge on its surface and applying an DC field in the direction of gravity. Asymptotic analysis for small electric fields shows the coupling at $O(E_0^3)$ between the second and third Legendre functions that describe the characteristic three-lobed drop shapes. Drops with large deformations are calculated by a Galerkin finite element scheme that leads to simultaneous determination of shape stability. The locus of $\bar{Q}$ and $\bar{E}_0$ marking the loss of existence of static drops is determined; end points corresponding to no field ($\bar{E}_0=0$) and no charge ($\bar{Q}=0$) agree well with calculations of Rayleigh and Taylor, respectively. Shapes predicted by the perturbation analysis are within two percent of the finite element calculations for almost the entire accessible ranges of $\bar{Q}$ and $\bar{E}_0$. (24 refs.)

106652 Electrical field in cylindrical symmetrical layouts by variational calculus. A.Ivanyi (Dept. of Theoretical Electricity, Tech. Univ., Budapest, Hungary).
Period. Polytech. Electr. Eng. (Hungary), vol.26, no.3-4, p.221-30 (1982). In English.
Deals with the variational solution of static and stationary fields in cylindrical symmetrical layouts of a homogeneous medium. An approximate solution of the two-dimensional Laplace equation exactly satisfying the prescribed Dirichlet-type boundary conditions is constructed in analytical form. The functions needed for satisfying the boundary conditions on curves described at least piecewise analytically are constructed with the aid of R-functions. The application of the method is illustrated in an example. (8 refs.)

106653 Some electrical problems for a torus. V.Belevitch, J.Boersma (Philips Res. Lab., Brussels, Belgium).
Philips J. Res. (Netherlands), vol.38, no.3, p.79-137 (1983).
The classical treatment of the Laplace equation by separation of variables in toroidal coordinates is used to obtain analytical expressions and numerical results for the solution of various electrostatic problems pertaining to a perfectly conducting torus; charged torus in free space, torus in a uniform axial or transverse electric field. Two quasi-stationary electromagnetic problems for a perfectly conducting torus are also solved: (i) current resulting from a uniform alternating potential difference applied over a cut at a meridian cross-section, (ii) current induced by a uniform axial alternating magnetic field; in both cases, the torus inductance is computed and the high-frequency resistance of an imperfectly conducting torus is deduced. For a tight torus, that is, a torus without central hole, a suitable rescaling reduces the conformal representation defining the toroidal coordinates to Kelvin's inversion. Solutions of the mentioned problems for the tight torus are obtained directly by inversion and also as limits of the solutions for the general torus; approximations to the solutions for the case of an almost tight torus are discussed as well. (53 refs.)

41.10F Steady-state electromagnetic fields; electromagnetic induction

106654 On eddy currents in thin plates. J.Poltz.
Arch. Elektrotech. (Germany), vol.66, no.4, p.225-9 (1983).
See also ibid., vol.64, p.307-11 (1982). A method of calculation of eddy currents in thin plates is presented. The stationary eddy-current problem is solved by using a scalar potential. The reaction of the eddy currents on the magnetic field is taken into account by application of an integral equation. Further, a combination of finite elements with the integral equation is presented to calculate an approximated solution for optional configuration of the plate. (6 refs.)

106655 'Eddy-current losses in thin circular and rectangular plates'. A.Prechtl, H.Haas (Tech. Univ. Wien, Wien, Austria).
Arch. Elektrotech. (Germany), vol.66, no.4, p.231-2 (1983).
Points out where Krakowski's analysis fails and presents a modified governing equation relying on the same assumptions. (1 ref.)

106656 Compatibility of Maxwell's field-equations in time and frequency domain. V.A.Vlcek (Tech. Hochschule Darmstadt, Darmstadt, Germany).
Frequenz (Germany), vol.37, no.2, p.26-31 (Feb. 1983). In German. [received: Aug. 1983]
A consequence of the natural frequency dependence of permittivity and permeability is a temporally nonlocal connection between flow densities and fieldstrengths. In the time- and frequency-domain compatible constitutive relations are given and discussed. Consequences on the wave equation are pointed out. (8 refs.)

106657 Finite element steady-state solutions of the traveling magnetic field problem. M.Ikeuchi, H.Niki (Dept. of Appl. Math., Okayama Univ. of Sci., Okayama-shi, Japan), H.Kobayashi.
IEEE Trans. Magn. (USA), vol.MAG-19, no.4, p.1524-9 (July 1983).
The authors are concerned with the stability and accuracy of n-order finite element (FE) steady-state solutions of the traveling magnetic field problem. It is found that the odd-order FE solutions (n is the odd number) are stable under $0<\sigma|u|h/v<f(n)\simeq2.0+1.4(n-1)$, and that the even-order FE solutions (n is the even number) are unconditionally stable. The consistent domain is also proposed, in which the n-order FE solutions are stable and of $2n$-order accuracy. Moreover, three-dimensional cases are dealt with, and the comparison with upwind methods is given. The merit and limits of the n-order FE method are finally cleared. (14 refs.)

106658 To the theory of electromagnetic field contraction. K.A.Barsukov, G.A.Grigoryan.
Izv. Akad. Nauk Arm. SSR Fiz. (USSR), vol.17, no.1, p.3-9 (1982). In Russian.
Using an earlier proposed method of the analysis of cavities having variable boundaries, a simple solution to the problem of magnetic field contraction in a plane nonstationary cavity is given. Simple and clear expressions for the coordinate and time dependences of fields in such a cavity are obtained. The cases of uniform and uniformly accelerated motions of the boundary are considered. The latter case provides an opportunity of following the redistributions of fields in the process of acceleration of the cavity boundary. (8 refs.)

106659 Field singularities at the tip of a cone. J.Van Bladel (Lab. for Electromagnetism & Acoustics, Univ. of Ghent, Ghent, Belgium).
Proc. IEEE (USA), vol.71, no.7, p.901-2 (July 1983).
Data are given on the nature of the singularities near the tip of a sharp metallic cone, and on the structure of the singular fields. Electric and magnetic fields are considered separately, as they become infinite according to different laws. (2 refs.)

Radiation balance and the stochastic Van der Pol-Duffing equation ....See Entry 105237

Some electrical problems for a torus ....See Entry 106653

Topography of electromagnetic field at ferromagnet-air interface generated by volume shear waves ....See Entry 109675

On electromagnetic methods in geophysical probing ....See Entry 110739

41.10H Electromagnetic waves: theory

106660 Electromagnetic field computation in geometries involving non perfectly conducting thick half-planes. V.Daniele, R.Orta (Dipartimento di Elettronica-Cespa, Politecnico di Torino, Torino, Italy), P.L.E.Uslenghi.
Alta Freq. (Italy), vol.52, no.3, p.149-51 (May-June 1983). (4th Italian National Meeting on Applied Electromagnetics, Florence, Italy, 4-6 Oct. 1982).
Some methods to solve functional equations which appear in electromagnetic problems involving thick half-planes are proposed in particular when losses or diffraction coefficients are to be computed. One of them is particularly efficient when the thickness is large with respect to the wavelength. (13 refs.)

106661 Using integral equations of the second kind for analysis of diffraction by thin shields. E.M.Inspektorov (Gomel' State Univ., Gomel', USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.10, p.783-5 (Oct. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.10, p.1099-101 (Oct. 1982). [received: Sept. 1983]
Examines whether the integral equation of the magnetic field (Fredholm equation of the second kind) can be used for analysis of thin shields of finite thickness. The two-dimensional problem for H-mode waves is considered. With the shield contour subdivided into N intervals, the integral equation is reduced to a system of N algebraic equations with coefficients S_{pq} (p q=1, 2, ..., N) each an integral of the kernel of the original equation. A numerical evaluation is shown for a shield which has a cylindrical profile of the dimension 4.5λ and rounded edges in front of an E-sectoral horn radiator. The error of this evaluation is estimated. (6 refs.)

106662 Space and time dynamics of formation of resonance-scattered waves. V.A.Buts, Yu.P.Machekhin.
Radiophys. & Quantum Electron. (USA), vol.25, no.10, p.823-7 (Oct. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.10, p.1152-7 (Oct. 1982). [received: Sept. 1983]
The conditions are established under which resonance-scattered waves build up in thick layers and the maximum amplitude of these waves when damping occurs is calculated. Their characteristic buildup time and the dimension of the region which forms them is also determined. (5 refs.)

106663 Analytical study of the scattering properties of a structure consisting of two partially closed cylindrical baffles. V.V.Veremei (Inst. of Radiophys. & Electronics, Acad. of Sci., Ukrainian SSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.10, p.836-43 (Oct. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.10, p.1170-8 (Oct. 1982). [received: Sept. 1983]
The multiple-reflection method is used to obtain an analytical solution for the problem of the diffraction of an H-polarized electromagnetic wave by two partially closed baffles in the form of circular cylinders with a longitudinal slot. The solution makes it possible to estimate the degree of mutual influence exerted by the elements of the structure and to designate the frequency intervals of the excitation field where the problem can be limited to the approximation of isolated scatterers. Particular attention is given to the influence of element interaction on the scattered field in the far zone when quasinormal modes are excited in the structure. (9 refs.)

106664 The transition layer method in the problem of thermal radiation from a rough surface. V.E.Gershenzon, V.Yu.Raizer, V.S.Etkin (Inst. of Space Studies, Acad. of Sci., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.11, p.914-18 (Nov. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.11, p.1279-84 (Nov. 1982). [received: Sept. 1983]
Investigates the thermal radiation of a periodically irregular water surface in a quasistatistical approximation. The roughness is modeled by a transition dielectric layer. The authors derive the dependence of the emission coefficient on the amplitude of the irregularity, allowing for the anisotropy of the latter. The model calculation has been confirmed experimentally. (12 refs.)

106665 Intensification of wave back scattering by rough surfaces. V.U.Zavorotnyi, V.E.Ostashev (Inst. of Atmospheric Phys., Acad. of Sci., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.11, p.924-7 (Nov. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.11, p.1291-5 (Nov. 1982). [received: Sept. 1983]
The problem of scattering of waves by a set of two areas covered with microroughness is considered. Consideration of mirror reflections between the areas results in intensification of back scattering. It is confirmed that this effect is similar to backscatter intensification in a volume of a randomly inhomogeneous medium, and must also occur for a real two-scale surface. (6 refs.)

106666 Perturbative methods in the electrodynamics of inhomogeneous and nonstationary media (review). V.A.Davydov (Sci.-Res. Inst. of Nuclear Phys., Moscow Univ., Moscow, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.12, p.1010-24 (Dec. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.12, p.1429-48 (Dec. 1982). [received: Sept. 1983]
To find the characteristics of electromagnetic waves propagating in media with variable parameters, the methods of geometrical optics or the WKB method are particularly effective. However, the WKB method is of limited use for the study of radiation from sources, mainly because the quasiclassical solutions of the corresponding wave equations are, in general, nonorthogonal. Therefore, the charge and current densities of sources on the right-hand sides of the equations cannot, as a rule, be expanded in terms of these solutions. The author develops a perturbation theory which makes it possible to calculate, with relative ease, the energy of radiation from sources in inhomogeneous and nonstationary media. (32 refs.)

106667 Scattering of amplitude-modulated waves on bodies of complex form. I.V.Sheinfel'd (Sci.-Res. Radiophys. Inst., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.12, p.1043-6 (Dec. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.12, p.1473-7 (Dec. 1982). [received: Sept. 1983]
Conditions for existence of so-called 'modulation waves' are determined. It is shown that isolation of the modulation wave requires averaging of the scattered field characteristics over fluctuations of the sensing body observation angle. For objects of a more general class, isolation of the modulation wave is possible for a specific form of transmitter-object-receiver channel transfer characteristic, when a channel intensity transfer characteristic exists. (4 refs.)

106668 Scattering coefficients of an infinite circular cylinder excited by a dipole field. T.Ando (Faculty of Engng., Osaka Inst. of Technol., Osaka, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part B (Japan), vol.J66B, no.5, p.655-62 (May 1983). In Japanese.
A general analysis is presented on the electromagnetic wave scattering coefficients of a homogeneous infinite circular cylinder (dielectric and magnetic or conductor) excited by an electric or magnetic dipole field. A numerical result clarifies the relationship between the scattering coefficients and the frequency of incident waves or scattering direction for each natural mode of the cylinder. As the cylinder loss becomes large, the scattering coefficients approach those of a perfectly conductive cylinder. (12 refs.)

106669 Attenuation by rain on Earth-space paths at 13 GHz. R.V.Webber, J.I.Strickland, J.J.Schlesak (Communications Res. Centre, Ottawa, Ontario, Canada).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.127-33
Rain attenuations on earth-space paths have been measured at several locations across Canada using radiometers at 13 GHz. Average monthly and annual rain attenuation statistics are presented for each location. An analysis of worst month statistics shows clearly the contrasting seasonal occurrences for the various climates. In addition, it confirms that the exceedence probabilities for the average year and worst month can be related by a simple power law that is location dependent. In general, the results show a strong dependence of rain attenuation statistics on climate and little dependence on annual accumulations of rain, number of thunderstorm days or geographic latitude. (3 refs.)

106670 Correlation between various radioelectrical data at 11.4, 11.6, and 35 GHz. D.Vanhoenacker, T.Vinois, J.Meganck, S.Jespers, A.Vander Vorst (Lab. de Telecommunications et d'Hyperfrequences, Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.135-9
This paper presents the results of correlation between radioelectrical measurements made on the copolar and crosspolar signals of the OTS beacon at 11.6 GHz, a 11.4 GHz radiometer in two linear polarisations, and a 35 GHz radiometer. All the instruments are oriented in about the same direction. Data obtained in 1981 are computer-processed, looking at correlations both from an event and a statistics point of view. Fluctuations periods of time are also investigated, especially their daily and annual variations. (4 refs.)

106671 Effects of dust/sandstorm on some aspects of microwave propagation. S.Haddad, M.J.H.Salman, R.K.Jha (Dept. of Electrical Engng., Univ. of Technol., Baghdad, Iraq).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.153-62
The purpose of this paper is to investigate the effects of dust and sandstorms on some aspects of microwave propagation in this region. For this four samples are studied. These are dust from the storm, simulated dust and two sand samples. Diameters, percentage and cumulative % weights of the constituents of the samples are analysed. Dielectric constants of these are measured at 9.35 GHz and forward scattering functions, attenuations, phase shifts, refractive indices and loss tangents are determined. Effects of these, on the propagation of microwaves in dust and sandstorms are explored. Measured attenuations are compared with the calculated values. The effects of storms on radio links and satellite are also studied. (13 refs.)

106672 Measurements and analysis of raindrop size distribution in south western Nigeria. G.O.Ajayi (Dept. of Electronic & Electrical Engng., Univ. of Ife, Ile-Ife, Nigeria), R.L.Olsen.
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.173-84
This paper presents new data on the drop size distribution of tropical rain obtained at Ile-Ife, Nigeria (7.5°N, 4.5°E) using impact-type distrometer. They show a modal type distribution which peaks at fairly large drop diameters (e.g. 2 mm for rain rates above about 50 mm/hr) in approximate agreement with some other data for tropical and sub-tropical locations. This finding has important implications for rain attenuation calculations at EHF and above, where the effect of the small drop portion of the distribution is greatest. A new fitting procedure, called the 'moment regression modelling technique' has been employed with the modified gamma distribution to obtain theoretical models for the measured drop size distribution. The theoretical models are in good agreement with the experimental data. (16 refs.)

106673 Numerical comparisons of space-harmonic and full-wave scattering models. D.M.DeLauder, C.A.Balanis (Dept. of Electrical Engng., West Virginia Univ., Morgantown, WV, USA).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.291-7
This paper provides a detailed comparison between a space-harmonic model (SHM) and at full-wave model (FWM) for scattering from corrugated rough surfaces. SHM, used here, is valid only for sinusoidal perfectly conducting surfaces, while the FWM can also be utilized for scatterers of any shape and including finite conductivity. The surfaces considered initially are perfectly conducting sinusoids with either vertical or horizontal polarization incident. The respective algorithmic difficulties are considered along with relative advantages (including a discussion of computational efficiency). (7 refs.)

106674 The development and testing of a stochastic variational principle for electromagnetic scattering. J.A.Krill, R.A.Farrell (Appl. Phys. Lab., Johns Hopkins Univ., Laurel, MD, USA).

Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.299-307

Summarizes the development of the vector stochastic variational principle to allow treatment of electromagnetic wave scattering from random objects or surface with arbitrary inhomogeneous and anisotropic permittivity, conductivity, and permeability. In order to examine the accuracy and efficacy of the method, the authors applied it to test random scattering systems. The results show the method to accurately account for polarization effects and for interactive phenomena such as interference and multiple scattering even with simple trial approximations that do not contain these effects. The merits of using a good, yet simple, trial field are discussed in terms of a non-stochastic example. (21 refs.)

106675 A new perturbation expansion for electromagnetic scattering by stochastic surfaces. H.P.Baltes, A.M.J.Huiser (Dept. of Electrical Engng., Univ. of Alberta, Edmonton, Alberta, Canada).

Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.309-13

The authors study the scattering of electromagnetic waves by perfectly conducting plane mirrors with random corrugations in the resonant region. They consider both the calculation of the scattered field in a fixed configuration and the computation of the correlations in the far-field of the waves scattered from an ensemble of surfaces. The starting point of this approach is the set of integral equations for the values of the fields and their normal derivatives on the surface of the mirror. They show that these equations can be solved in terms of a perturbation expansion with the corrugation height h as parameter. This series converges for sufficiently small h. An extension to non-perfectly conducting and dielectric mirrors is possible. The series is tested on a sinusoidal grating. (4 refs.)

106676 Generalized approach to radio wave scatter from time-varying rough surfaces. D.P.Chrissoulidis, E.E.Kriezis (Dept. of Electrical Engng., Aristotelian Univ. of Thessaloniki, Thessaloniki, Greece).

Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.315-21

The theoretical approach to the problem of radio wave scattering from time-varying random rough surfaces is improved by considering a more general model for the scattering surface. A nonstationary and/or nonhomogeneous continuous and real stochastic process is used to describe the elevation of the rough surface from its mean plane. The scattering behavior of this model for the surface roughness is investigated by using standard scattering theories and the quasistationary (QS) approximation. The results of the analysis can lead to a considerably improved prediction of scatter from either partially developed ocean regions or fully developed lakes. (21 refs.)

106677 Scattering and absorption by atmospheric aerosol models. P.W.Barber, P.E.Geller (Dept. of Electrical & Computer Engng., Clarkson Coll. of Technol., Potsdam, NY, USA).

Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.357-62

The T-matrix method is used to calculate the electromagnetic scattering by prolate spheroidal (rod-shaped) particles in fixed orientation and randomly oriented in 3-D. The method can also be used for oblate spheroidal (disk-shaped) particles. The size and refractive index of the spheroids can be selected to model atmospheric particulates at wavelengths of interest. Of particular interest is the depolarization of a plane wave which occurs upon interaction with a system of nonspherical particles. The physical features of a particle are related to the polarized scattering by a parameterization of both particle shape and the elements of the Mueller matrix. The framework which has been developed may be useful in deducing particle characteristics from the measured polarized scattering dependence. (17 refs.)

106678 Backscattering and differential backscattering characteristics of the melting layer. A.W.Dissanayake (European Space Res. & Technol. Centre, Noordwijk, Netherlands), M.Chandra, P.A.Watson.

Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.363-70

An improved model for the radar bright band is presented to characterise the anisotropy observed by dual polarized radars. Constituent particles in the melting layer is considered to be oblate spheroids with eccentricity equal to corresponding melted rain drops except that the axial ratio of smaller particles has a maximum value of 0.9. Partially melted particles were considered as two layered objects and their backscattering cross-sections were evaluated using Waterman T-matrix method. Model predictions were compared with observations made with a dual polarized radar and fairly good agreement was found. (13 refs.)

106679 Layer response to a sinusoidal electromagnetic excitation by an impulse approximation of a thin plate. P.Degauque, Q.T.Nguyen, M.Cauterman (Univ. des Sci. et Tech., Lille, France).

Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.405-10 In French.

The application of electromagnetic methods to geophysical prospecting implies a priori knowledge of the feasibility of such methods when applied to a given site. Three-dimensional numerical methods have been set up to simulate numerically the response of a layer to the excitation from an antenna on the ground surface. The layer response to an impulsive wave is studied, with due account of a possible variation of the conductivity with frequency. The simplification that might result in the computations from an ad-hoc assumption is then evaluated; the assumption consists in assimilating the layer to a thin plate, having a larger conductivity than the embedding medium and presenting some inclination. (4 refs.)

106680 The dependency on the propagation environment of the frequency scaling of attenuation. R.McGuinness, A.R.Holt, B.G.Evans (Dept. of Electrical Engng. Sci., Univ. of Essex, Colchester, England).

Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.425-36

Attenuation ratios on slant paths through rain have been obtained using the dual-polarisation (ZDR) radar database collected in 1981 by the Rutherford Appleton Laboratory. The authors present results for circular polarisation for 14.455/11.786 GHz, 17.5/11.786 GHz, 30.0/20.0 GHz, together with estimates of the effect of the melting band. They also present results for differential (linear) attenuation. (13 refs.)

106681 Experimental and analytical aspects of atmospheric EHF refractivity. H.J.Liebe, D.H.Layton (Nat. Telecommunications & Information Administration, Inst. for Telecommunication Sci., Boulder, CO, USA).

Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.477-86

Absolute attenuation rates and refractivities due to water vapor and moist nitrogen have been measured in the laboratory at 138 GHz, 300K, pressures up to 1.5 atm, and relative humidities up to 100 percent. The computer-controlled measuring system is comprised of a millimeter wave resonance spectrometer (0.15 km effective path length) and a humidity simulator. Several shortcomings of earlier measurement attempts have been rectified. The data are interpreted as a water vapor continuum spectrum consisting of two terms, namely strong self-broadening (H_2O-H_2O) plus foreign-gas-broadening (H_2O-N_2) contributions. Implications of the new results for modeling atmospheric EHF window transparencies and for revising established H_2O line broadening theory are discussed. (23 refs.)

Soliton propagation in a randomly inhomogeneous medium ...See Entry 105127

X-band measurements of the dielectric constant of dust ....See Entry 105312

Beam solitons in retarding systems ....See Entry 106687

Modal analysis of spatially periodic anisotropic media ....See Entry 106694

Scattering and absorption of electromagnetic waves by an inhomogeneous plasma column ....See Entry 107394

41.70 PARTICLES IN ELECTROMAGNETIC FIELDS: CLASSICAL ASPECTS

(inc. synchrotron radiation)

106682 Interaction of charged particles with an electromagnetic-wave field. B.A.Volodin, A.M.Khapaev (Dept. of Math., Moscow Univ., Moscow, USSR).

Moscow Univ. Phys. Bull. (USA), vol.37, no.5, p.1-6 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.5, p.3-8 (1982).

A differential equation is obtained relating the energy and coordinate of a charged particle in an interaction with the field of a plane electromagnetic wave of nonunity phase velocity. A method of solving the derived equation allowing the electron energy and coordinate to be analytically elucidated in terms of an introduced parameter using the Weierstrass function is presented. On the basis of the solution of the nonlinear differential equation constructed and the constraints imposed on the parameters of the given system, an expression relating the particle energy and coordinate is obtained. The results of tabulating the expression obtained are compared with the results of numerical integration of the relativistic equations of motion. (7 refs.)

106683 Vector particle in a constant magnetic field. I.A.Obukhov, V.C.Perez-Fernandez (Dept. of Quantum Theory, Moscow Univ., Moscow, USSR).

Moscow Univ. Phys. Bull. (USA), vol.37, no.5, p.75-80 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.5, p.66-71 (1982).

The relativistic equations of a vector field in an external magnetic field are investigated. The known arbitrariness in choosing the Lagrangian of a vector field in an external electromagnetic field allows the phenomenological parameter k, characterizing the magnetic moment of the particle, to be introduced. The case $k=1$ corresponds to the 1967 Winberg model. In the present work, accurate solutions of the vector equations are obtained both in the case $k=1$ and for arbitrary k. The spin states of the particles are considered. An energy spectrum of a vector particle in a magnetic field agreeing with earlier known results is found. (7 refs.)

106684 General method for solving the self-consistent equations of motion and Maxwell equations. Yu.G.Pavlenko (Moscow State Univ., Moscow, USSR).

Radiophys. & Quantum Electron. (USA), vol.25, no.11, p.946-54 (Nov. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.11, p.1319-28 (Nov. 1982). [received: Sept. 1983]

A perturbation theory is developed on the basis of the Hamiltonian formalism for solving the system of field equations and the relativistic equations of motion. An algorithm is obtained for determining the time evolution of any experimentally measured quantity in connection with particle-field interaction. The result of the study is presented in the form of a series, each term of which is associated with a corresponding spontaneous and induced process. First-order effects in the motion of particles in a waveguide are discussed. (14 refs.)

106685 Three-wave parametric processes in electron beams. V.I.Zadorozhnyi, A.M.Fedorchenko (T.G. Shevchenko State Univ., Kiev, Ukrainian SSR).

Sov. Phys.-Tech. Phys. (USA), vol.28, no.2, p.235-6 (Feb. 1983). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.53, no.2, p.381-3 (Feb. 1983). [received: Sept. 1983]

It was shown by Zadorozhnyi and Fedorchenko (1980) that there exist five different types of three-wave parametric processes. Type V, corresponding to a backward wave generator is the best understood, both experimentally and theoretically. Type III processes include the phenomenon of optical parametric generation. Type V or III processes may also occur when electromagnetic and acoustic waves interact parametrically in solids. The experiment described by Davis (1976) in which the electromagnetic (EM) wave traveling opposite to the electron beam is transformed into an EM wave of higher frequency traveling in the same direction as the beam, affords an example of a type IV process. This type of process was analyzed theoretically by Kalmykov et al. (1979) with allowance for retardation effects. Brillouin scattering in a plasma from which particles drift away at supersonic speeds is another example of a type IV process. All five types of three-wave parametric interaction can occur when an EM wave interacts parametrically with a space charge wave in a relativistic electron beam. (9 refs.)

106686 Nonlinear theory of stimulated scattering of electromagnetic waves by a magnetized beam of electrons in a waveguide. M.V.Kuzelev, A.A.Rukhadze, G.V.Sanadze, D.S.Filippychev (P.N. Lebedeev Phys. Inst., Acad. of Sci., Moscow, USSR).

Sov. Phys.-Tech. Phys. (USA), vol.28, no.2, p.247-8 (Feb. 1983). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.53, no.2, p.396-9 (Feb. 1983). [received: Sept. 1983]

When an electromagnetic wave is scattered by an electron beam, beat plasma oscillations are excited in the latter. However, if the reciprocal of the characteristic time for the amplitude of the beat wave to change is much less than the plasma frequency, there are no eigenoscillations in the beam. This type of scattering is called Compton scattering, and in this case the beat wave causes modulation and bunching of the electron beam. Of course, Compton scattering is possible only for electron beams of sufficiently low density. (4 refs.)

Unstable electrostatic beam modes in free-electron-laser systems .... See Entry 106770

Two-dimensional analysis of the Raman-type free-electron laser .... See Entry 106773

Second-harmonic photons from the interaction of free electrons with intense laser radiation .... See Entry 106820

41.80 PARTICLE BEAMS AND PARTICLE OPTICS

(see also 07.80 Electron and ion microscopy, 07.77 Beam handling equipment)

106687 Beam solitons in retarding systems. V.K.Grishin, E.N.Shaposhnikova (Dept. of Nuclear Interactions & Accelerators, Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.91-3 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.79-81 (1982).
The authors consider the possibility of propagation of short beams of charged particles (beam solitons) in a retarding system. By using a self-consistent analysis of the nonlinear kinetic equation and the Maxwell equations, the conditions are obtained under which the particles which propagate in a dielectric waveguide are confined by the proper longitudinal field. The possibility is discussed of compression of the beam to durations shorter than one nanosecond by using a transformation of the beam parameters. (3 refs.)

106688 Features of advanced neutron optical devices. H.Rauch (Atominst., Osterreichischen Univ., Wien, Austria).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.71-9 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The features of neutron interferometry and neutron magnetic resonance systems are described. The existence of widely separated coherent beams in perfect crystal neutron interferometry permits a great variety of experiments with matter waves in the field of basic quantum mechanics. For example, the phase of the spatial and spinor wave functions can be measured. Recent results on the 4π-symmetry of a spinor and the first direct verification of the spin-superposition law are discussed. Multiple Laue reflections are used to achieve an angular resolution up to 0.001 sec of arc, which permits the observation of wide slit diffraction effects. Neutron magnetic resonance systems allow a uniform energy shift of the neutrons and may be an important component in the future for the realisation of systems for dynamical neutron polarisation, monochromatisation and focusing of neutrons into certain energy, space, angle or time intervals. Additional advantages exist for pulsed sources, very slow neutrons and highly monochromatic beams. (44 refs.)

41.80D Electron beams and electron optics

106689 Polychromatic MTF of electrostatic point symmetric electron lenses. O.P.Nijhawan, S.K.Gupta, R.Hradaynath (Instruments Res. & Dev. Establ., Dehra Dun, India).
Appl. Opt. (USA), vol.22, no.16, p.2453-5 (15 Aug. 1983).
Electrostatic electron lenses have been evaluated in terms of their image transfer characteristics. The effect of polychromatic radiation with different spectral energy distributions on the performance of an electron emitter-lens combination has been studied. (12 refs.)

106690 Tokamak-like equilibria of relativistic electron beams. Shi Bingren (Southwestern Inst. of Phys., Leshan, Sichuan, China).
Acta Phys. Sin. (China), vol.32, no.4, p.507-14 (April 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)* [received: Sept. 1983]
The toroidal equilibrium properties of relativistic electron beams with double-δ function distribution are considered. The approximate solutions of the magnetic flux and the electric potential equations expanded in terms of the inverse aspect ratio of the torus are obtained analytically. The drift surfaces of electrons in the beam are also described. (6 refs.)

106691 The excitation of microwaves by a relativistic electron beam in a dielectric-lined waveguide. M.Shoucri (Production et Conservation de l'Energie, Inst. de Recherche d'Hydro-Quebec, Varennes, Quebec, Canada).
Phys. Fluids (USA), vol.26, no.8, p.2271-5 (Aug. 1983).
The dispersive properties of a relativistic electron beam in a dielectric-loaded waveguide are investigated. The linearized fluid and Maxwell's equations are used to derive the dispersion relation and to study the eigenmodes for the system. The Cherenkov microwave radiation mechanism is investigated. (12 refs.)

106692 Short-range interactions of high-intensity electron beams. V.A.Varrentsov, V.N.Manuilov, Sh.E.Tsimring (Inst. of Appl. Phys., Acad. of Sci., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.11, p.970-6 (Nov. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.11, p.1349-57 (Nov. 1982). [received: Sept. 1983]
Considers two variant methods of trajectory analysis of axially symmetric electron beams which permit a significant reduction in the scale at which the beam is discretized without substantially increasing the computation time. The methods are based on a separate calculation of the fields of charges in the beam which are located near the observation point. The authors present the results of a trajectory analysis of helical electron beams, which point out the necessity for including a close-range interaction when there are regular intersections of the electron trajectories and regions of electron beam constriction. (6 refs.)

Cerenkov radiation from periodic electron bunches .... See Entry 105133

Electron-beam guiding and phase-mix damping by an electrostatically charged wire .... See Entry 105417

General method for solving the self-consistent equations of motion and Maxwell equations .... See Entry 106684

Three-wave parametric processes in electron beams .... See Entry 106685

Nonlinear theory of stimulated scattering of electromagnetic waves by a magnetized beam of electrons in a waveguide .... See Entry 106686

41.80G Ion beams and ion optics

106693 Unified theory of ion optics. H.Nakabushi (Dept. of Phys., Osaka Univ., Toyonaka, Japan), T.Sakurai, H.Matsuda.
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.319-36 (1 Sept. 1983).
A unified theory of ion optics is developed, which can be applied to all ion-optical devices used currently in particle spectrometers. The second-order trajectory calculation has been performed in unified fields consisting of crossed electric and magnetic fields with arbitrary distributions. Nine parameters (in the second-order approximation) are necessary to designate respective ion-optical devices as well as their arbitrary superpositions. Correction for the relativistic effect on particle mass is included, which is necessary for relativistically fast particles. (19 refs.)

42.00 OPTICS

(for properties of gases and of liquids and solids, see 51.70 and 78. respectively; for atmospheric optics, see 92.65; for physiology of the eye, see 87.32)

42.10 PROPAGATION AND TRANSMISSION IN HOMOGENEOUS MEDIA

106694 Modal analysis of spatially periodic anisotropic media. K.Rokushima, J.Yamakita (Dept. of Electrical Engng., Univ. of Osaka Prefecture, Osaka, Japan), M.Nishimura.
Bull. Univ. Osaka Prefect. Ser. A (Japan), vol.31, no.1, p.25-35 (1982).
A method for analyzing slanted anisotropic gratings is presented. The propagation of electromagnetic waves in the periodic media is expressed by coupled mode equations in a unified matrix form. The solution of the equations is reduced to an eigenvalue problem of the matrix. By introducing the concepts of the transmission and boundary matrices, the diffraction and waveguiding properties of the gratings are obtained rigorously by systematic matrix calculations using typical computer library programs. (12 refs.)

106695 Diffraction characteristics of planar absorption gratings. W.E.Baird, M.G.Moharam, T.K.Gaylord (School of Electrical Engng., Georgia Inst. of Technol., Atlanta, GA, USA).
Appl. Phys. B (Germany), vol.B32, no.1, p.15-20 (Sept. 1983).
Planar (co)sinusoidal conductivity (absorption) transmission gratings are analyzed using rigorous coupled-wave theory. The first-order and higher-order diffraction efficiencies are determined over the entire range of possible conductivities and Bragg angles of incidence (or equivalently, grating periods) for H-mode polarization incident plane waves. The maximum possible first diffracted order efficiency is found to be 5.26%. Rigorous results are compared to approximate results from the Raman-Nath theory and the two-wave first-order coupled-wave (Kogelnik) theory. A regime parameter, ρ_σ is defined which delineates the regions of Raman-Nath diffraction behavior ($\rho_\sigma<1$) and the region of two-wave first-order diffraction theory behavior ($\rho_\sigma>1$). Likewise, the angular selectivity characteristics of conductivity gratings are determined from rigorous theory and are compared with corresponding results from approximate theory. (12 refs.)

106696 Wave beam scattering by a segment of a sphere. O.V.Sulima.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.8, p.57-9 (1983). In Ukrainian.
A rigorous solution is obtained for a problem of Gaussian wave beam scattering by a segment of a sphere arranged near the beam waist. Total and radar cross-sections of scattering versus frequency are calculated. (3 refs.)

106697 The Fresnel number in terms of ray matrix elements. Fan Dianyuan (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, Shanghai, China).
Acta Opt. Sin. (China), vol.3, no.4, p.319-25 (1983). In Chinese.
The number of Fresnel half-period zones for complex optical systems is derived. Its formula is $N=(a^2/\lambda)[(A/B)+(1/R)]$. Since it is expressed by the ray matrix elements, there is a universal significance. The authors have introduced a concept of 'effective propagation path' $L_{\mathrm{eff}}=B/A$, which reflects the influence of the optical system on the diffraction field. For several typical systems, concrete expressions of the Fresnel number are given. The imaging properties of the vacuum spatial filter are indicated using the ray matrix theory. The perfect image-relaying conditions are determined. Finally the Fresnel number is extended to the region of complex number, and used to investigate the diffraction problem of a truncated Gaussian beam. (9 refs.)

106698 Two-dimensional Rayleigh scattering in a semi-infinite cylindrical medium exposed to a laser beam. A.L.Crosbie, R.L.Dougherty (Dept. of Mech. & Aerospace Engng., Univ. of Missouri-Rolla, Rolla, MO, USA).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.30, no.3, p.255-79 (Sept. 1983).
A modification of Ambarzumian's method is used to develop the integro-differential equations for the source function, flux, and intensity at the boundary of a two-dimensional, semi-infinite cylindrical medium with second order Legendre phase function scattering. The incident radiation is collimated, normal to the top surface, and is dependent only on the radial coordinate. Boundary conditions which vary as a Bessel function and as a Gaussian distribution are investigated. The Gaussian distribution approximates a laser beam. Numerical results are presented in graphical and tabular forms for a Rayleigh scattering medium. The results are compared with those of isotropic scattering. (5 refs.)

106699 Geometrical optics in weakly anisotropic media. M.F.F.Nave, J.Gibbons (Dept. of Theoretical Phys., Univ. of Oxford, Oxford, England).
Opt. Acta (GB), vol.30, no.9, p.1245-53 (Sept. 1983).
The propagation of polarized waves in weakly anisotropic media is considered. The geometric optics approximation is used and the ray paths are determined in the approximation that the medium is isotropic. The transport of polarized waves along these rays is described by the first-order approximation; this yields a system of two coupled ordinary differential equations. The effects of birefringence, dispersion and diffraction are given by the second-order approximation. (13 refs.)

106700 Evaluation of the field near a cusp of a caustic. J.J.Stamnes, B.Spjelkavik (Central Inst. for Industrial Res., Oslo, Norway).
Opt. Acta (GB), vol.30, no.9, p.1331-58 (Sept. 1983).
The field in the neighbourhood of a cusp of a caustic can be expressed in terms of a function of two variables, $P(X,Y)$, known as Pearcey's integral or the Pearcey function. The authors develop efficient algorithms for computing this function and its derivatives $\partial P/\partial X$ and $\partial P/\partial Y$. They are based on a

Taylor series expansion in a region close to the cusp at $X=Y=0$, and on asymptotic approximations in regions far from the cusp. The asymptotic results are given in terms of contributions of isolated stationary points in regions far from the caustic, and in terms of the Airy integral function and its derivative in a region close to the caustic. Three terms in the asymptotic expansions are used, and they give an accuracy for $P(X,Y)$ better than 0.006 in amplitude and 0.6° in phase at distances from the cusp greater than $(X^2+Y^2)^{1/2}=4$. (41 refs.)

106701 **Diffraction efficiency of absorption gratings.** T.Jaaskelainen (Dept. of Phys., Univ. of Kuopio, Kuopio, Finland).
Opt. & Quantum Electron. (GB), vol.15, no.5, p.441-6 (Sept. 1983).
The diffraction efficiency of absorpion gratings is investigated using a coupled multiwave analysis. For the four-wave case the analytical expressions for the signal amplitudes are given. The applicability of the four-wave approximation is also included. (11 refs.)

106702 **Experimental improvement of the signal to noise ratio for code detection using the retro-reflective labels.** K.Kiya, T.Hayashi, U.Kato (Univ. of Electro-Communications, Tokyo, Japan).
Rep. Univ. Electro-Commun. (Japan), vol.33, no.2, p.291-303 (Feb. 1983).
Authors have made the experimental studies, on the improvement of the signal light to background light ratio using the retro-reflective labels (Scotch light) and got the following results: (1) The detectability of the reflective signal from the code plates is improved by the high intensity of background light. From this phenomenon, the characteristics of these labels are explained. (2) The background light could be rejected by using the narrow field of view telescope and this effect is specially improved to the weaker signal light detection. (3) Finally, the experimental and analytical confirmations are got for the relations between the width of light pulse and the scanning area to the scanning for the code plates with the ribbon-beam-light. (5 refs.)

Some experiments in partially coherent imaging and modulation transfer function evaluation .... See Entry 105082

Self-imaging phenomenon. Lateral shift of Fresnel images .... See Entry 106717

Spatial periodicities in coherent and partially coherent fields .... See Entry 106718

Temporal coherence characteristics of InGaAsP laser diode with single-longitudinal-mode oscillation .... See Entry 106764

The efficiency of coupling light from a laser diode into an optical fiber with the aid of a lens .... See Entry 106799

Nonlinear birefringence in fluids containing nonspherical molecules. I. Response and mode coupling theory .... See Entry 106806

Correlation of intensities in the Rayleigh scattering of light . See Entry 106819

Diffraction grating efficiencies. An exact differential algorithm valid for high conductivities .... See Entry 106854

Light propagation along periodic metal-dielectric layers .... See Entry 106857

Diffraction of the surface light wave in a planar surface-acoustic-wave light-guide .... See Entry 106862

The beam propagation method: an analysis of its applicability .... See Entry 106863

Combined reciprocal and non-reciprocal birefringence in optical monomode fibres .... See Entry 106878

Method for subaperture testing interferogram reduction .... See Entry 106907

Moire interferometry for damage analysis of composites .... See Entry 107082

Effect of wall scattering on SNR in off-axis differential-type laser Doppler velocimetry .... See Entry 107285

Inverse methods for remote determination of properties of optically thick atmospheres .... See Entry 110666

Diffraction on a segmented telescope mirror .... See Entry 110912

42.20 PROPAGATION AND TRANSMISSION IN INHOMOGENEOUS MEDIA

106703 **Scattering and absorption of turbid materials determined from reflection measurements. I. Theory.** R.A.J.Groenhuis (Lab. for Materia Tech., State Univ. Groningen, Groningen, Netherlands), H.A.Ferwerda, J.J.Ten Bosch.
Appl. Opt. (USA), vol.22, no.16, p.2456-62 (15 Aug. 1983).
To allow the determination of scattering and absorption parameters of a turbid material from reflection measurements the relation of these parameters to the reflection has been described by two theoretical approaches. One approach is based on the diffusion theory which has been extended to include anisotropic scattering. This result is a reflection formula in which the scattering and absorption are described by one parameter each. As a second more general approach a Monte Carlo model is applied. Comparison of the results indicates the range of values of the scattering and absorption parameters where the computationally fast diffusion approach is applicable. (21 refs.)

106704 **Multiple scattering of optical pulses in scale model clouds.** R.A.Elliott (Oregon Graduate Center, Beaverton, OR, USA).
Appl. Opt. (USA), vol.22, no.17, p.2670-81 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
The results of experiments to measure the delay, temporal stretching, attenuation, and spatial spreading of optical pulses in scale model clouds are reported. The model clouds consisted of diiodomethane/water or paraffin oil/water emulsions maintained in a rotating scattering cell to prevent settling of the droplets. The optical pulses were 532-nm, 25-psec duration pulses generated by a frequency-doubled passively mode-locked Nd:YAG laser and were detected with a 10-psec resolution streak camera. The measurements of the delay in the mean arrival time of the pulses due to multiple scattering are the first measured directly. (20 refs.)

106705 **Scattered light intensity cross correlation. I. Theory.** J.K.G.Dhont, C.G.de Kruif (Van't Hoff Lab. voor Fysische en Colloid Chemie, Rijksuniv. Utrecht Padualaan, Utrecht, Netherlands).
J. Chem. Phys. (USA), vol.79, no.4, p.1658-63 (15 Aug. 1983).
It is shown that in a so-called cross-correlation set up, an experimental technique where two laser beams and two detectors are used, double scattering contributions to the measured intensity correlation function are negligibly small compared to the first order contribution. furthermore, it is shown that the theoretical work of Phillies (1981) concerning this subject is incomplete, due to the use of an incomplete Siegert relation. In doing this, an important second order term is overlooked. The cross-correlation set up is best suited for experiments at 90° scattering angle. At other scattering angles experimental difficulties arise, due to the necessity, as is shown in this paper, to position the two detectors at different angles with respect to the laser beams. (9 refs.)

106706 **Fraunhofer scattering by a sub-fractal diffuser.** E.Jakeman (Royal Signals & Radar Establ., Malvern, England).
Opt. Acta (GB), vol.30, no.9, p.1207-12 (Sept. 1983).
It is shown that the contrast of the far-field intensity pattern, generated by illuminating a small area of a gaussian random diffuser with fractal slope, exhibits a characteristic power-law dependence on illuminated area. (12 refs.)

106707 **Correlation of speckle patterns generated by a diffuser illuminated by partially coherent light.** G.R.C.Reddy, V.V.Rao (Dept. of Phys., Regional Engng. Coll., Warangal, India).
Opt. Acta (GB), vol.30, no.9, p.1213-16 (Sept. 1983).
It is shown that, under some experimental conditions, the speckle pattern generated by a diffuse object transilluminated by a partially space coherent light source suffers no decorrelation when the diffuse object is translated in three-dimensional space. (5 refs.)

106708 **Light scattering by large rough particles.** J.-M.Perrin, P.L.Lamy (Lab. d'Astron. Spatiale, CNRS, Marseille, France).
Opt. Acta (GB), vol.30, no.9, p.1223-44 (Sept. 1983).
A model of light scattering by large rough particles is proposed which is based on the high-energy approximation, the laws of geometrical optics and a mathematical description of the properties of the particles roughness. The calculated intensities and polarizations as functions of scattering angles agree well with experimental results except in the case of metallic particles. (25 refs.)

106709 **Dislocation density on wavefront of a speckle-structure light field.** N.B.Baranova, B.Ya.Zel'dovich, A.V.Mamaev, N.F.Pilipetskii, V.V.Shkunov (Inst. of Mech. Problems, Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.83, no.5, p.983-8 (Nov. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.5, p.1702-10 (Nov. 1982). [received: Sept. 1983]
The dislocation density on the wavefront of a speckle-inhomogeneous light field was investigated experimentally as a function of the beam divergence, shape of the angular spectrum, and degree of spatial modulation. The results are in good agreement with the theory. (17 refs.)

Scattering and absorption of turbid materials determined from reflection measurements. II. Measuring method and calibration .... See Entry 105364

Multiplexed speckle and holographic interferometry with color encoding by white-light processing .... See Entry 105368

Optical generation of control signals in adaptive systems .... See Entry 106809

Method for numerical investigation of adaptive optical aperture sensing systems .... See Entry 106846

The beam propagation method: an analysis of its applicability .... See Entry 106863

Effects of stepwise variation of albedo on reflectivity and transmissivity of an isotropically scattering slab .... See Entry 106967

Effect of wall scattering on SNR in off-axis differential-type laser Doppler velocimetry .... See Entry 107285

Extinction and liquid water content of fog at visible wavelengths .... See Entry 110647

Speckle statistics of atmospherically backscattered laser light .... See Entry 110648

Evaporation derived from optical and radio-wave scintillation .... See Entry 110667

42.30 OPTICAL INFORMATION, IMAGE FORMATION AND ANALYSIS

106710 **Hybrid logic processing in parallel.** H.Bartelt, A.W.Lohmann (Phys. Inst., Univ. Erlangen-Nurnberg, Erlangen, Germany).
Appl. Opt. (USA), vol.22, no.17, p.2519-20 (1983).
It is demonstrated how logic operations, and AND operation, for example, can be implemented by simple spatial filtering using theta modulated objects. Theta modulation is a technique which encodes pixel information, e.g. the intensity by the orientation of a grid structure. An electronic preprocessing system to produce theta modulated pictures in TV quality is described. The combination of the eletronic preprocessing step and the optical spatial filtering system classifies the method as a hybrid electronic-optical procedure. (11 refs.)

106711 **Hipparcos: ESA project with substantial Netherlands participation. II. Optical detectors and data processing.**
Elektronica (Netherlands), vol.31, no.12, p.30-1, 33, 39, 41 (17 June 1983). In Dutch.
Describes the procedure adopted for processing the large amounts of data which Hipparcos is expected to provide, and discusses the use of the opto-electrical converter. Particular attention is paid to the principle of the image dissector tube (IDT). The three main types of IDT are reviewed: (a) electromagnetic deflection and focusing; (b) hybrid IDTs—electromagnetic deflection and electrostatic focusing; (c) electrostatic deflection and focusing. The ITT F4012 (entirely e/m) was chosen for the Hipparcos telescope. Hipparcos is due to be launched at the end of 1986/beginning of 1987 by means of an Ariane-1, -2 or -3 rocket. (no refs.) *D.J.B.*

106712 **Color signal correlation detection by matched spatial filtering.** F.T.S.Yu, T.H.Chao (Electrical Engng. Dept., Pennsylvania State Univ., University Park, PA, USA).
Appl. Phys. B (Germany), vol.B32, no.1, p.1-6 (Sept. 1983).
A polychromatic correlation detection technique by complex spatial filtering is presented. This technique utilizes a diffraction grating and three co-lineared (red, green, and blue) coherent sources. The technique of complex spatial filter synthesis for the polychromatic correlation detection is demonstrated. This technique offers true color correlation detection which is very suitable for color signal recognition and identification. The correlation diffraction efficiency with this technique is generally higher than that of the wavelength-multiplexed technique. Several interesting experimental demonstrations of this color signal correlation detection scheme are provided. Finally the authors note that this color signal detection technique is a simple and versatile processing technique which has a broad range of applications to complex color signal detection, recognition and identification. (10 refs.)

106713 **White-light pseudocolor density encoding by means of one photographic step.** Kang Hui, Li Zhengming (Dept. of Phys., Nankai Univ., China).
Acta Opt. Sin. (China), vol.3, no.4, p.298-302 (1983). In Chinese.
A new technique of white light pseudocolor density encoding is described. The exposure to the object to be processed is performed by means of a Ronchi grating in one step. According to the property of the negative encoding plate 'the higher the transmittance, the lower the modulation', when only the zeroth and the first orders of the spectrum of the grating are allowed to pass.

Positive and negative images have been obtained respectively, and hence contrast reversal realized. After color filtering, the authors accomplished the pseudocolor density encoding. (9 refs.)

106714 Spatial filtering real-time spatial frequency and density pseudocolor encoding. He Mingxia, Liu Zhishen (Dept. of Phys., Shandong Coll. of Oceanology, Qingdao, China).
Acta Opt. Sin. (China), vol.3, no.4, p.303-7 (1983). In Chinese.
A real-time image pseudocolor encoding method for spatial frequency and density encoding is presented. Pseudocolor images are obtained through color spatial filtering at a spatial frequency plane. The spatial frequency pseudocolor encoding is accomplished by two-dimensional color spatial filters. The density pseudocolor encoding is obtained through contrast reversal of the color image, and the contrast reversal is accomplished by two-color halfwave phase filtering. ERTS and airborne remote sensing images are processed directly. Experimental results showed that this method is effective. (10 refs.)

106715 White light optical pseudocolor upon the difference between two photographs. Cai Cikai, Zheng Yi, Yang Hui, Tian Zhiwei (Dept. of Phys., Hangzhou Univ., China).
Acta Opt. Sin. (China), vol.3, no.4, p.308-12 (1983). In Chinese.
An optical pseudocolor encoding method based upon the difference between two photographs is presented. It is shown that the difference between two pictures with a continuous change in gray which is discriminated simultaneously by the eyes, can be detected by use of two sources of different color. The pseudocolor image from the optical system is processed in select-color with differentiation by a video system, so that the signal of difference is enhanced. The theory is in agreement with experiment. Finally, some applications are discussed. (8 refs.)

106716 Optical imaging with resolution exceeding the Rayleigh criterion. J.G.Walker (Royal Signals & Radar Establ., Malvern, England).
Opt. Acta (GB), vol.30, no.9, p.1197-202 (Sept. 1983).
Results are presented of an optical imaging experiment in which resolution in excess of the Rayleigh criterion but in accordance with a recent singular value analysis was achieved. A low Shannon number object was illuminated with coherent light and the diffraction-limited image was sampled over a spatial extent many times larger than the geometrical image size. The enhancement in resolution was achieved by using the iterative spectral extrapolation algorithm, known as the Gerchberg method. (10 refs.)

106717 Self-imaging phenomenon. Lateral shift of Fresnel images. K.Patorski (Inst. of Design of Precise & Optical Instruments, Warsaw Tech. Univ., Warsaw, Poland).
Opt. Acta (GB), vol.30, no.9, p.1255-8 (Sept. 1983).
The conditions determining the lateral localization of Fresnel images of a linear binary amplitude grating with respect to the optical axis are derived. The conditions represent the third basic parameter, besides the axial localization and the lateral magnification, characterizing the diffraction images formed by the self-imaging phenomenon. (12 refs.)

106718 Spatial periodicities in coherent and partially coherent fields. A.W.Lohmann, J.Ojeda-Castaneda, N.Streibl (Phys. Inst., Univ. Erlangen, Erlangen, Germany).
Opt. Acta (GB), vol.30, no.9, p.1259-66 (Sept. 1983).
The propagation of light in free space yields images of a certain class of objects. This effect, discovered 150 years ago by Talbot, is known as 'self-imaging'. The self-imaging phenomenon, or the periodic properties of coherent and partially coherent fields, are described as eigenfunctions of the operator that represents the solution of the Helmholtz equation. Using this simple treatment, the authors state the necessary and sufficient conditions for self-imaging in coherent and partially coherent fields. It is indicated that certain laterally aperiodical, partially coherent fields also exhibit self-imaging properties. The treatment is exact, but it disregards evanescent waves. (15 refs.)

106719 Improvement of chromatic aberration of an aspherical plate corrector for prime focus. Shao Lian-Zhen, Su Ding-Qiang (Nanjing Astron. Instrument Factory, Acad. Sinica, Nanjing, China).
Opt. Acta (GB), vol.30, no.9, p.1267-72 (Sept. 1983).
An illustrative example is given of how the chromatic aberration of a three aspherical plate corrector for prime focus may be reduced greatly as the relative positions of the three plates are changed for various wavelength bands. The conclusion drawn from this is that the chromatic aberration of an optical system can be improved if each of those elements which can be moved are adjusted for different wavelength bands. This method may also be used to reduce the aberrations caused by temperature variations. (8 refs.)

106720 Digital line-artifact removal. T.Peli, J.G.Verly (MIT Lincoln Lab., Lexington, MA, USA).
Opt. Eng. (USA), vol.22, no.4, p.479-84 (July-Aug. 1983).
A variety of imaging procedures generate artifacts which have the visual appearance of a set of parallel lines across the image. The authors present a simple frequency-domain algorithm which considerably reduces this type of artifact. It has been found to be effective in a number of applications, and its performance is illustrated by way of examples. (3 refs.)

106721 Real-time image deblurring using four-wave mixing. Y.H.Ja (Res. Labs., Telecom Australia, Clayton North, Victoria, Australia).
Opt. & Quantum Electron. (GB), vol.15, no.5, p.457-9 (Sept. 1983).
The author proposes a real-time image deblurring method using FWM, based on the well-known deconvolution method, proposed and realized by Stroke and his co-workers (1977). The basis of their method involves spatial filtering using a holographic deconvolution filter where image division in the Fourier transform plane is performed. Since the deconvolution (division) filter is usually recorded on a negative photographic film by controlling γ, the slope in the linear region of the Hurter-Driffield curve of the film, the operation cannot be done in real-time. In FWM, the recording of the hologram and the reconstruction of the image occur simultaneously and are almost in real-time (this time delay is usually very small, depending on the response time of the nonlinear medium used as the recording medium) because the time consuming processing of the film is not required. The author first outlines the general principle of image deblurring, and then describes how FWM operated in the nonlinear region can perform real-time image deblurring. (17 refs.)

106722 Fourier processing with phase-reflection gratings. G.Molesini (Istituto Nazionale di Ottica, Firenze, Italy).
Opt. Lett. (USA), vol.8, no.9, p.465-7 (Sept. 1983).
The use of phase reflection gratings for Fourier filtering in the object space is described, and the optical transfer function for resonance at normal incidence is given. Experiments prove in good agreement with theory. (8 refs.)

106723 Fundamental theory on regeneration of high quality image. T.Iijima (Faculty of Engng., Tokyo Inst. of Technol., Tokyo, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part A (Japan), vol.J66A, no.5, p.394-401 (May 1983). In Japanese.
Gives a rational method for regeneration of high quality image from its corresponding compressed information. The main results are as follows: (1) The integral equation for obtaining an original image from its blurred image is rigorously solved. (2) Using its solution a set of partial interpolation polynomials for the original image is derived as a mathematical formula computable from discrete sampled values of the blurred image. (3) It is proved that the image approximately regenerated by the set of polynomials is continuous and smooth over all the domain. The theoretical results may contribute to establishing the quality advancing technology for various images. (1 ref.)

106724 Line-by-line recursive image restoration based on a non-causal stochastic model. Y.Yoshida, H.Ogura, Y.Sakura (Faculty of Industrial Arts, Kyoto Inst. of Technol., Kyoto, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part A (Japan), vol.J66A, no.5, p.432-9 (May 1983). In Japanese.
Describes an image restoration method for a monochromatic image corrupted by an additive white noise. A mathematical model of the image is represented by a noncausal cross-type stochastic difference equation. The two-dimensional equation is reduced to a set of one-dimensional equations, which are modified for applying Kalman filtering. Computer experiments show that this method gives the noise reduction rates predicted theoretically not only for computer-synthetic images but also for a real image. (7 refs.)

Some experiments in partially coherent imaging and modulation transfer function evaluation .... See Entry 105082

Multiplexed speckle and holographic interferometry with color encoding by white-light processing .... See Entry 105368

Aberrations in off-plane spectrometers .... See Entry 105385

The Fresnel number in terms of ray matrix elements .... See Entry 106697

Fourier spectrum analysis of multi-exposure synthetic holograms .... See Entry 106732

Gradient index optical materials .... See Entry 106834

Grazing incidence toroidal mirror pairs in imaging and spectroscopic applications .... See Entry 106843

Design and testing of lenses for optical disk technology .... See Entry 106845

Spatial filtering by a spherically illuminated coherent optical processor .... See Entry 106849

Application of hybrid image processing for the determination of the optical properties of cellular membranes .... See Entry 109976

42.40 HOLOGRAPHY

(for acoustic holography, see 43.63)

106725 Fabrication of a 360° astigmatic rainbow hologram. H.Chen, M.Chen (Saginaw Valley State Coll., University Center, MI, USA).
Appl. Opt. (USA), vol.22, no.16, p.2474-7 (15 Aug. 1983).
A 360° astigmatic rainbow holographic recording scheme is proposed. The experimental result is also included. (6 refs.)

106726 UV-holographic gratings in TS-diacetylene single crystals. Spatial resolution and sensitivity. K.H.Richter, W.Guttler, M.Schwoerer (Phys. Inst., Univ. Bayreuth, Bayreuth, Germany).
Appl. Phys. A (Germany), vol.A32, no.1, p.1-11 (Sept. 1983).
Holographic gratings with grating periods between 0.37 μm and 4.4 μm, respectively, were recorded on the surface of TS-diacetylene single crystals by two interfering 257 nm laser beams. Diffraction efficiencies of up to 35% were obtained for read-out with red light of $\lambda=633$ nm. The main modulation mechanism was phase modulation. The spatial resolution was better than 1600 lines/mm. The upper limit of the polymer chain length was 0.6 μm. The holographic sensitivity was 4.5 cm^2/J for immediate read-out at 633 nm without processing after exposure. A weakly exposed latent hologram may be developed simply by gentle annealing the crystal which increases the sensitivity by one order of magnitude. (39 refs.)

106727 Nonlocal photovoltaic response function for the interpretation of hologram writing in ferroelectric crystals. R.von Baltz, C.Lingenfelder (Inst. fur Theorie der Kondensierten Materie, Univ. Karlsruhe, Karlsruhe, Germany), R.Rupp.
Appl. Phys. A (Germany), vol.A32, no.1, p.13-18 (Sept. 1983).
The general properties of the nonlocal relationship between light intensity and bulk photovoltaic current density are studied within the linear response theory. As a result, only the even part of the response function is related to the bulk photovoltaic effect whereas the odd part is connected with diffusion of hot carriers. In addition, the authors present a calculation of the response function for a model of impurity centers in a ferroelectric crystal. They conclude that the characteristic decay length for the response is neither the anisotropy length nor the mean-free path but the hot carrier diffusion length. (31 refs.)

106728 A laser scanner applicable to scanning any graphics. Ye Quanshu, Gao Wenqi (Dept. of Phys., Nanjing Univ., China).
Acta Opt. Sin. (China), vol.3, no.4, p.313-18 (1983). In Chinese.
A type of computer-generated holographic scanner, being able to scan any type of 2-D patterns such as characters, is described. Methods of improving the focusing ability and reversing the scanning direction are introduced and the experimental results are presented. (6 refs.)

106729 Imaging analysis of one-step rainbow holography. Chen Guicong (Dept. of Phys., Shandong Coll. of Oceanology, Qingdao, China), H.Chen.
Acta Opt. Sin. (China), vol.3, no.4, p.326-32 (1983). In Chinese.
Starting from scaler diffraction theory, various possible recording and reconstruction geometries of one-step rainbow holography are analyzed, and quantitative conditions for obtaining orthoscopic or pseudoscopic reconstructed images are derived. (5 refs.)

106730 Design of aberration-reduced holographic gratings for Seya-Namioka monochromators. R.Iwanaga, T.Oshio (Res. Inst. for Atomic Energy, Osaka City Univ., Osaka, Japan).
J. Spectrosc. Soc. Jpn. (Japan), vol.32, no.3, p.166-72 (1983). In Japanese.
A designing method of aberration-reduced holographic gratings has been studied for Seya-Namioka monochromators. Aberrations such as astigmatism, coma and image curvature have been tested analytically without using numerical integration employed in a case of aberration balancing. Satisfying results have been given for both spherical and toroidal gratings. (5 refs.)

106731 The effect of angular selectivity on the monochromatic imaging performance of volume holographic lenses. R.R.A.Syms, L.Solymar (Dept. of Engng. Sci., Univ. of Oxford, Oxford, England).
Opt. Acta (GB), vol.30, no.9, p.1303-18 (Sept. 1983).
Angular selectivity is shown to have a significant effect on the size of objects that may be imaged acceptably by volume holographic lenses, so that a definition of imaging performance based purely on classical lens aberrations may no longer be considered adequate. The performance of single elements and compound systems is examined qualitatively by means of photographs of real and virtual images, and suggestions are made for improvements in performance. (21 refs.)

106732 Fourier spectrum analysis of multi-exposure synthetic holograms. M.Kujawinska (Precision Mech. Dept., Warsaw Tech. Univ., Warsaw, Poland).
Opt. Acta (GB), vol.30, no.9, p.1319-29 (Sept. 1983).
Two methods of determining the localization, spectrum content and distribution of the intensity in the Fourier plane of a product-type multi-exposure hologram are presented. The analytical considerations of the localizations and dimensions of diffraction orders of the spectrum of synthetic interferograms are verified by one- and two-dimensional calculations. (4 refs.)

106733 Coordinate transformations via multifacet holographic optical elements. H.Bartelt, S.K.Case (Dept. of Electrical Engng., Univ. of Minnesota, Minneapolis, MN, USA).
Opt. Eng. (USA), vol.22, no.4, p.497-500 (July-Aug. 1983).
Arbitrarily prescribed space variant operations can be carried out with high efficiency by multifacet holographic optical elements recorded in dichromated gelatin. The authors describe the use of such elements to perform coordinate transformations from Cartesian to polar coordinates. Theoretical calculations of resolution limits and experimental results are given. (6 refs.)

106734 Review of resolution factors in holography. O.D.D.Soares (Centro de Fisica, Faculdade de Ciencias, Univ. do Porto, Porto, Portugal).
Opt. Eng. (USA), vol.22, no.4, p.107-112 (July-Aug. 1983).
High resolution has long been considered one of the achievable advantages in holography. This has induced the pursuit of research on the application of holographic techniques into several fields. Though the holographic principle ensures the feasibility of high resolution of the order of the radiation wavelength and superresolution, in practice, the obtainable resolution in a holographic experiment remains as one of the most complex features to assess. This is a result of the large number of interactive parameters involved and the difficulty of expressing quantitatively their role upon the resolution expected for the implementation of the conceived experiment. A discussion of the factors that affect resolution is reviewed to establish the range of the physical parameters that should define the experimental setup. A systematic procedure to guarantee a desired resolution is presented, as well as its corresponding implications on the experimental design, namely, angular tolerances ranging to orders of microradians. (41 refs.)

106735 Reconstruction by multidirectional holographic interferometry of the concentration field in a supersaturated solution near a growing $NaClO_3$ crystal. F.Bedarida, L.Zefiro, P.Boccacci, C.Pontiggia (Istituto di Mineralogia, Univ. di Genova, Genova, Italy).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.139-43
Holographic interferometry that is usefully applied to check crystal growth from solution on earth, may also be used in a microgravity field. The simplest method is one-directional holographic interferometry that allows a measurement in real time of the concentration averaged on the direction of observation. Multidirectional holographic interferomety is a more sophisticated method that gives a mapping of the concentration in the solution near the growing crystal. (8 refs.)

Multiplexed speckle and holographic interferometry with color encoding by white-light processing .... See Entry 105368

Real-time image deblurring using four-wave mixing .... See Entry 106721

Photoresist strongly absorbent in optical spectrum .... See Entry 106838

Experimental determination of frequencies and shapes of natural oscillations of small bracket plate using holographic interferometry .... See Entry 107083

Determination of the stress state of bodies with flaws by the method of holographic photoelasticity .... See Entry 107086

Evaluation of residual stresses in welded joints of thin plate by a holographic method .... See Entry 109625

Holographic three-dimensional hard copy for medical computer graphics ....
.... See Entry 110131

42.50 QUANTUM OPTICS

106736 Effects of laser fluctuations on the driven Dicke model. R.R.Puri (Dept. of Math., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England), S.V.Lawande.
Physica A (Netherlands), vol.120A, no.1-2, p.43-54 (1983).
The exact steady-state solution is presented for the reduced density operator for a model of N identical two-level atoms on a single site (the Dicke model) driven by a laser field with phase fluctuations. Exact expressions are given for the phase averaged atomic observables and atomic correlation functions of arbitrary order. Results show that the inclusion of phase fluctuations tends to smooth the discontinuities in the observables and their correlation functions found in the nonfluctuating resonant case. Quantum fluctuations are also reduced to the effects of the phase fluctuations and with increasing N, the atomic observables tend to assume their semi-classical value. (31 refs.)

106737 Laser phase and amplitude fluctuations in the fluorescent Dicke model. R.R.Puri (Dept. of Math., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England), S.S.Hassan.
Physica A (Netherlands), vol.120A, no.1-2, p.55-67 (1983).
The authors derive a master equation for the ensemble averaged atomic density operator for a system of N identical superimposed two-level atoms (the Dicke model) driven by an intense, fluctuating laser field of finite phase/amplitude bandwidth by using the theory of multiplicative stochastic processes. It is shown that in spite of the appearance of time-dependent terms, this master equation still describes a Markov process. The quantum regression theorem can, therefore, be used to calculate the fluorescent spectrum which is found to consist of a single Lorentzian located at the central driving laser frequency and a sum of symmetrically displaced Lorentzians. There are broadening and narrowing effects. The intensity correlations are also evaluated. The results are also extended to the case when the atomic system is in n-photon resonance with the phase fluctuating laser field. (14 refs.)

106738 Broadband population inversion. R.Tycko (Dept. of Chem., Univ. of California, Berkeley, CA, USA).
Phys. Rev. Lett. (USA), vol.51, no.9, p.775-7 (29 Aug. 1983).
A theory is presented for construction of sequences of phase-shifted radiation pulses for coherently inverting populations over a broad band of transition frequencies. Such sequences have applications in nuclear magnetic resonance and coherent optics. Examples of sequences are derived, together with computer simulations of their inversion properties. (13 refs.)

106739 Contribution to the Dicke superradiance theory. Exact solution of the quasi-one-dimensional quantum model. V.I.Rupasov (Spectroscopy Inst., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.83, no.5, p.989-96 (Nov. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.5, p.1711-23 (Nov. 1982). [received: Sept. 1983]
The quantum inverse-scattering method problem is used to show that the Dicke quasi-one-dimensional model of superradiance theory is completely integrable. Commutation relations are obtained for the action-angle variables, and the eigenstates and eigenvalues of the commuting integrals of motion of the model are found. It is shown that the eigenstates of the system include, besides 'continuous' spectrum states corresponding to usual spontaneous emission, also bound complexes of quasiparticles (quantum solitons) that correspond to the Dicke superradiance. (16 refs.)

Using superluminescence to improve ultrashort-pulse characteristics ....
.... See Entry 106766

Photon statistics of the free-electron-laser startup .... See Entry 106771

Resonant interaction of the noise radiation with a two-level system ....
.... See Entry 106808

Second-harmonic photons from the interaction of free electrons with intense laser radiation .... See Entry 106820

42.55 LASING PROCESSES

106740 Photolytic dual-media nuclear pumping of excimer lasers. F.P.Boody, M.A.Prelas (Nuclear-Pumped Laser Corp., Kingston, NJ, USA).
AIP Conf. Proc. (USA), no.100, p.349-53 (1983). (Topical Meeting on Excimer Lasers, Incline Village, NV, USA, 10-12 Jan. 1983).
Presents a novel photolytic nuclear pumping scheme, utilizing concentration of nuclear-pumped excimer fluorescence and a new high-efficiency nuclear pumping source that overcomes nuclear pumping's previous problems of insufficient pumping power density and the deleterious effects of nuclear pumping sources on laser kinetics. Utilizing this scheme should produce absorbed pumping power densities of 50-100 kW/cm^3 in the photolytic laser medium—more than sufficient for long pulse pumping of efficient excimer and excimerlike laser systems. Laser system efficiency should exceed 1%. (5 refs.)

42.55B General theory of lasing action

106741 Influence of seeding radiation on the dynamics of single-pulse laser generation. A.A.Kovalev, B.N.Tyushkevich, V.N.Sadovskii, N.A.Usova.
J. Appl. Spectrosc. (USA), vol.37, no.5, p.1236-41 (Nov. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.741-8 (Nov. 1982). [received: Sept. 1983]
The method of narrowing the radiation spectrum of single-pulse lasers with active loss modulators based on the creation of narrow-cavity seeding radiation in the laser resonator is very effective, and of great practical value. This method is most simply realized in a laser with two resonators that are optically coupled through an electrooptical gate (EOG), with one resonator serving additionally to form the seeding radiation by free generation up to the moment when the Q-factor is switched on. The influence of the drop in inversion on the behaviour of the frequency and intensity is investigated. (9 refs.)

42.55D CO_2 lasers

106742 Fine tuning of lasers by an intracavity interferometer containing an absorbing gas. J.R.Izatt, P.Mathieu (Lab. de Recherche en Optique et Laser, Univ. Laval, Quebec, Canada).
Can. J. Phys. (Canada), vol.61, no.9, p.1278-83 (Sept. 1983).
Laser emissions can be tuned to an absorption line of a gas if the usual output coupler is replaced by a Michelson interferometer with a cell containing the absorbing gas introduced in one of its arms. For a TEA-CO_2 laser, this method allows one to tune the emission spectrum over a frequency range equal to the width of the gain curve (3.5 GHz) while maintaining the spectral width around 70 MHz. The analysis of such a system is carried out by taking into account anomalous dispersion and saturation of the absorbing gas. This enables one to determine the optimal values of the experimental parameters and to evaluate the tuning range and the energy efficiency of the laser. Many other practical considerations are also discussed in the text. (3 refs.)

A folded tunable single-mode TEA CO_2 laser with two beams ....
.... See Entry 106783

Small-size CO_2 laser with transverse high-frequency excitation ....
.... See Entry 106785

Improved welding penetration of a 10-kW industrial laser .....See Entry 106802

42.55F Inert gas lasers

106743 Routes to chaotic output from a single-mode, DC-excited laser. R.S.Gioggia, N.B.Abraham (Dept. of Phys., Bryn Mawr Coll., Bryn Mawr, PA, USA).
Phys. Rev. Lett. (USA), vol.51, no.8, p.650-3 (22 Aug. 1983).
Instabilities in a single-mode, Fabry-Perot, predominantly inhomogeneously broadened xenon laser show progressions through increasingly complicated periodic behavior, ultimately reaching a deterministic chaotic behavior. Period doubling, two-frequency, and intermittency routes to chaos have been observed. (23 refs.)

A dye laser synchronously pumped by Ar^+laser .... See Entry 106782

42.55H Lasing action in other gas lasers

106744 Noise of He-Cd laser and its suppression. Y.G.Tseng, J.L.Jiang, J.H.Lu, M.S.Chiu (Shanghai Inst. of Laser Technol., Shanghai, China).
Appl. Opt. (USA), vol.22, no.16, p.2484-6 (15 Aug. 1983).
Linear relations have been observed between the reciprocal of the noise ratio and the reciprocal of the output power of the He-Cd laser as well as between the noise ratio and the net gain within the laser cavity. By a feedback method with an acoustooptic modulator in the laser cavity at the Brewster angle for low optical loss, a stable laser with high power output and low noise has been obtained. The noise ratio and the output power are 0.8% and 33 mW, respectively, at 4416 Å. (11 refs.)

106745 XeCl excimer laser excited by longitudinal discharge. Zhenzhuo Zhou, Yongjian Zeng, Mingxin Qiu (Shanghai Inst. of Laser Technol., Shanghai, China).
Appl. Phys. Lett. (USA), vol.43, no.4, p.347-9 (15 Aug. 1983).
XeCl excimer laser excited by longitudinal gas discharge is reported. The main characteristics of the laser output and the laser energy in dependence of the operating parameters were measured. The laser pulse duration was 35 ns and the maximum laser energy 317 μJ with improvement by preionization. (2 refs.)

106746 Gain characteristics of XeCl laser. Chen Jianwen, Fu Shufen, Liu Miaohong, Chao Liming, Guo Weichong (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, Shanghai, China).
Acta Opt. Sin. (China), vol.3, no.4, p.364-8 (1983). In Chinese.
Reports the experimental measurement of gain characteristics of a XeCl laser pumped by a Blumlein fast discharge device, using the method of varying the output coupling, according to the relation betweem the output power of the laser consisting of a stable cavity and homogeneously broadened gain medium, and other laser parameters, such as small-signal gain coefficient g_0, constant absorption loss coefficient saturation intensity I_s and cavity length. Finally, the optimum transmittance of the laser is determined. The authors find that the optimum transmittance is a function of pumping power. (6 refs.)

106747 Measuring saturation intensity of the He:Cd laser. M.S.Chiu, Y.G.Tseng (Shanghai Inst. of Laser Technol., Shanghai, China).
Opt. Acta (GB), vol.30, no.9, p.1203-6 (Sept. 1983).
A new method of obtaining the saturation intensity of the He:Cd laser by means of measuring the laser noise is introduced. The value of the saturation intensity of the He:Cd laser at 4416 Å obtained by this method is quite close to that obtained by the determination of the maximum unsaturated gain. (4 refs.)

106748 Probabilities for transition processes crucial to Li lasers. G.Aspromallis, C.A.Nicolaides (Theoretical & Phys. Chem. Inst., Nat. Hellenic Res. Found., Athens, Greece).
Phys. Rev. A (USA), vol.28, no.3, p.1879-82 (Sept. 1983).
The authors present results of electron correlation calculations in the Briet-Pauli approximation for radiative allowed and forbidden transition probabilities of highly excited Li states, contained in recent schemes for short-wavelength lasers. This is the first quantitative prediction for the phenomenon of relativistic radiative autoionization (RAA). RA has already been singled out as a fundamental deexcitation mechanism which might lead to efficient lasing systems. (26 refs.)

Measurement of discharge circuit distributive inductance for Blumlein excimer laser .... See Entry 106774

Subnanosecond pulse generation of 193 nm radiation by pulse slicing .... See Entry 106786

Effects of the coupling hole and tube diameter on the output power of an RF-excited CW HCN laser .... See Entry 106801

42.55K Chemical lasers

(see also 82.40T Chemiluminescence and chemical laser kinetics)

106749 Short-cavity hydrogen-halide laser. P.Arrowsmith, J.C.Polanyi, H.H.Telle, B.Yang (Chem. Dept., Univ. of Toronto, Toronto, Ontario, Canada).
Appl. Opt. (USA), vol.22, no.17, p.2716-20 (1983).
Laser action in HCl and HBr with a short-length-cavity TEA laser has been investigated. Support of the discharge by preionization resulted in reliable operation with pulse-to-pulse stability of better than 5%. Both efficient multiline and single-line operation are described. Maximum output energies of 120 and 35 mJ were measured in multiline operation, and 55 and 6 mJ were obtained from a single line for HCl and HBr, respectively. Energy conversion was 0.89 and 0.26% for the HCl and HBr system. (18 refs.)

106750 Continuous-wave HF optical resonance transfer laser model. M.A.Kwok, R.L.Wilkins (Aerospace Corp., Los Angeles, CA, USA).
Appl. Opt. (USA), vol.22, no.17, p.2721-31 (1983).
A nonreactive kinetics model of the flowing gaseous medium of a CW HF optical resonance transfer laser (ORTL) was developed and a parametric study performed. Cross sections were generated for $HF(\nu_1,J_1)+HF(\nu_2,J_2)$ V-V, $R \rightarrow T$, and V-R processes by classical trajectory calculations and by surprisal methods. The ORTL medium model was validated by modeling the reported experimental results of past ORTL experiments. The collisional processes were found to be important in creating positive gain. The study, observing the effects on small signal gain by varying parameters such as pumping laser radiative flux, flux distribution, flow velocity, flow density, and HF mole fractions, has suggested possible regimes of large gain. (20 refs.)

106751 Lasing on the $B \rightarrow X$ band of cadmium monoiodide (CdI) and ^{114}CdI in a UV-preionized, transverse discharge. D.P.Greene, J.G.Eden (Dept. of Electrical Engng., Univ. of Illinois, Urbana, IL, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.418-20 (1 Sept. 1983).
Stimulated emission on the $B \rightarrow X$ band of CdI and isotopically enriched (98.6%) ^{114}CdI has been observed in a UV-preionized, transverse discharge device with a gain length of 50 cm. For natural CdI, the laser energy is distributed among several transitions between 656 and 658 nm. The isotopically enriched ^{114}CdI spectrum, in contrast, is dominated by a single line at 657.1 nm, which contains >50% of the output energy. With a high-Q optical cavity, output energies >10 μJ have been measured in a 85-ns full width at half-maximum (FWHM) pulse. (11 refs.)

Luminescence of I_2/Ar mixture flowing out of a quenching setup at atmospheric pressure .... See Entry 109749

42.55M Lasing action in liquids and organic dyes

106752 Detection of triplet states in a laser dye from linear and circular polarization studies. T.W.Barrett, J.F.Guiliani (US Naval Res. Lab., Chem. Div., Washington, DC, USA).
Appl. Opt. (USA), vol.22, no.17, p.2522-5 (1983).
Presents a technique based on a polarization study of dye fluorescence. This procedure not only identifies weak triplet-triplet absorption states involved in a dye laser system, but it also allows for the optimum selection of excitation wavelengths with which to more efficiently pump the dye to produce nearly pure singlet emission and thereby to avoid wasted pump energy transfer into the deleterious overlapping triplet band or bands. The technique was tested for the lasing dye, oxazine perchlorate, in an ethanol solvent. Basically, the technique involves the application of the semiclassical oscillator theory in a polarizator study of the polarized fluorescence emission spectrum from a dye excited at a number of selected, narrowband, excitation wavelengths. These wavelengths are used to pump specific portions of the dye absorption band, first under linearly polarized light to detect singlet emission only, and second, under circularly polarized light to detect changes in the spin states (i.e. triplet conversion). (6 refs.)

106753 Dye stability under excimer-laser pumping. II. Visible and UV dyes. V.S.Antonov, K.L.Hohla (Lambda Phys., Gottingen, Germany).
Appl. Phys. B (Germany), vol.B32, no.1, p.9-14 (Sept. 1983).
For pt.I see ibid., vol.B30, p.109 (1983). The stability of laser dyes under the excitation of a XeCl-laser (308 nm) has been investigated. The measurements were performed in an oscillator amplifier device where the amplifier was fully saturated. This allows the comparison with the theoretical model showing that the main reason for dye degradation is the absorption of photo-products. Results for the most important dyes are presented. Dye stabilities range from 46 (fluorescein 27) to 3.4×10^4 (QUI) absorption processes per molecule before the dye solution has degraded to 1/2 of its initial energy output. (2 refs.)

106754 Continuous laser amplification in a monomode fiber longitudinally pumped by evanescent field coupling. B.F.Lamouroux, A.G.Orszag, B.S.Prade, J.Y.Vinet (Lab. d'Optique Appl., Ecole Polytech., Palaiseau, France).
Opt. Lett. (USA), vol.8, no.9, p.504-5 (Sept. 1983).
Amplification of continuous laser radiation propagating in a monomode optical fiber was obtained by evanescent field coupling with a pumped dye solution deposited in the neighborhood of the fiber core. A factor-of-25 signal gain was recorded for 632.80-nm He-Ne radiation and DCM dye solution. (8 refs.)

Seventeen psec pulses from a nitrogen laser-pumped short-cavity rhodamine 6G dye laser .... See Entry 106776

A dye laser synchronously pumped by Ar^+laser .... See Entry 106782

Bistable operation of a dual-wavelength synchronously mode-locked CW dye laser .... See Entry 106790

The effect of ammonia ions on the absorption and fluorescence of an oxazine dye .... See Entry 109778

42.55P Lasing action in semiconductors with junctions

106755 Long-lived GaAlAs laser diodes with multiple quantum well active layers grown by organometallic vapor phase epitaxy. C.Lindstrom, T.L.Paoli, R.D.Burnham, D.R.Scifres, W.Streifer (Xerox Palo Alto Res. Center, Palo Alto, CA, USA).
Appl. Phys. Lett. (USA), vol.43, no.3, p.278-80 (1 Aug. 1983).
Proton-defined stripe geometry GaAlAs laser diodes with multiple quantum well active layers grown by organometallic vapor phase epitaxy have been operated continuously at 5 mW/facet for over 1800 h at 70°C and over 1100 h at 100°C. With a 0.7-eV activation energy, these times extrapolate respectively to 11.7 and 47.9 years of continuous operation at 20°C. In the present mode of degradation, the authors estimate that the mean time to double the initial operating current is greater than 138 years at 20°C. (21 refs.)

106756 Superluminescent damping of relaxation resonance in the modulation response of GaAs lasers. K.Y.Lau, I.Ury, N.Bar-Chaim (Ortel Corp., Alhambra, CA, USA), C.Harder, A.Yariv.
Appl. Phys. Lett. (USA), vol.43, no.4, p.329-31 (15 Aug. 1983).
It is demonstrated experimentally that the intrinsic modulation response of injection lasers can be modified by reducing mirror reflectivities, which leads to suppression of relaxation oscillation resonance and a reduction of nonlinear distortions up to multi-GHz frequencies. A totally flat response with a 3-dB bandwidth of 5 GHz was obtained using antireflection coated buried heterostructure lasers fabricated on a semi-insulating substrate. Harmonic distortions were below 40 dB within the entire 3-dB bandwidth. These results are in accord with theoretical predictions based on an analysis which include the effects of superluminescence in the laser cavity. (17 refs.)

106757 Mode-locked semiconductor lasers with gateable output and electrically controllable optical absorber. W.T.Tsang, N.A.Olsson, R.A.Logan (Bell Labs., Murray Hill, NJ, USA).
Appl. Phys. Lett. (USA), vol.43, no.4, p.339-41 (15 Aug. 1983).
The authors propose and demonstrate for the first time an electronically gateable mode-locked semiconductor laser capable of coding information on the picosecond optical pulses emitted. They further introduced an electronically controllable optical absorber which made it possible to electrically control the optical performance of the mode-locked semiconductor laser. (9 refs.)

106758 Broadly tunable mode-locked HgCdTe lasers. R.S.Putnam, M.M.Salour (Dept. of Electrical Engng. & Computer Sci., MIT, Cambridge, MA, USA), T.C.Harman.
Appl. Phys. Lett. (USA), vol.43, no.5, p.408-9 (1 Sept. 1983).
The authors report tunable CW mode-locked laser action from synchronously pumped HgCdTe lasers. 4-8-μm-thick liquid phase epitaxial layers lasing at $\lambda = 1.2$ and $\lambda = 1.73$-2.0 μm are longitudinally pumped by a neodymium:yttrium aluminum garnet (Nd:YAG) laser. Peak output powers of 50 W using a chopped pump beam, and a CW mode-locked average output power of 5.6 mW, have been achieved at a wavelength of 1.2 μm. Nearly bandwidth-limited pulses of 6-ps duration have also been obtained. Tuning from $\lambda = 1.82$ to 2.0 μm via the Burstein-Moss shift has been accomplished on a single epilayer by varying the loss in the external cavity. (8 refs.)

106759 Influence of an external cavity on semiconductor laser phase noise. M.Tamburrini, P.Spano, S.Piazzolla (Fondazione Ugo Bordoni, Roma, Italy).
Appl. Phys. Lett. (USA), vol.43, no.5, p.410-12 (1 Sept. 1983).
Investigation of phase noise in semiconductor lasers allows one to understand the physical processes that influence both the width and the shape of the emission line. Furthermore, the limitations associated with phase noise have to be taken into account when semiconductor lasers are employed in coherent optical communication systems. In this letter the authors report phase-noise measurements on single-mode semiconductor lasers in the presence of optical feedback. They are able to observe, besides the expected linewidth reduction, a peculiar behavior in the high-frequency region not yet reported in the high-frequency region not yet reported in the literature, strongly dependent on the external cavity length. (12 refs.)

106760 Control of mutual phase locking of monolithically integrated semiconductor lasers. E.Kapon, J.Katz, C.Lindsey, S.Margalit, A.Yariv (California Inst. of Technol., Pasadena, CA, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.421-3 (1 Sept. 1983).
The mutual coherence of two coupled semiconductor lasers is investigated experimentally. It is demonstrated that by varying the gain in the overlap region, the degree of phase coherence can be continuously controlled. The quantitative characterization of the degree of phase coherence by fringe visibility is demonstrated. (10 refs.)

106761 Transverse second-order mode oscillations in a twin-stripe laser with asymmetric injection currents. S.Mukai, H.Yajima, S.Uekusa, A.Sone (Electrotetch. Lab., Ibaraki, Japan).
Appl. Phys. Lett. (USA), vol.43, no.5, p.432-4 (1 Sept. 1983).
Transverse second-order mode oscillations in asymmetrically pumped twin-stripe lasers are described. Both far-field patterns and near-field patterns have two peaks, and a stronger peak appears on the weakly pumped side. The dependence of light intensity in one peak of the far-field pattern on the current into one stripe shows threshold characteristics. On application of rectangular pulse to one stripe, switching from one peak to the other occurs within 5 ns. (6 refs.)

106762 Optical stability of narrow stripe, proton-isolated AlGaAs double heterostructure lasers with gain guiding. H.W.M.Salemink, J.W.M.Biesterbos (Philips Res. Labs., Eindhoven, Netherlands).
Appl. Phys. Lett. (USA), vol.43, no.5, p.434-6 (1 Sept. 1983).
Optically stable, proton-isolated, gain-guided (AlGa)As double heterostructure injection lasers are described. A narrow stripe width (3.5 μm) and a very shallow implantation are employed (1.3 μm from the active layer); this results in a $\cosh^{-2}$-like optical mode of $\sim$9.0-μm full width at half-maximum. The far-field profiles possess strong sidelobes at high optical output power. The optical material loss coefficient and the antiguiding parameter are derived from the measured far-field profiles, using the theory of gain guiding. Key parameters in the description of the optical mode distribution are calculated for several values of output power. (5 refs.)

106763 Above-threshold current leakage effects in stripe-geometry injection lasers. K.A.Shore (Dept. of Electrical Engng. & Electronics, Univ. of Liverpool, Liverpool, England).
Opt. & Quantum Electron. (GB), vol.15, no.5, p.371-9 (Sept. 1983).
Lateral current-spreading in stripe-geometry injection lasers is treated in the above-threshold range of device operation. The model represents an extension of previous formalisms which have concentrated on analysing current leakage in the absence of lasing action. The present analysis is used to examine the characteristics of devices with a range of current-spreading parameters and is suitable for assessing the significance of current leakage effects, particularly for mode-stability properties, in stripe-geometry lasers. Furthermore, the description of multi-stripe-geometry lasers requires a consistent model for current-spreading in the above-threshold regime. (11 refs.)

106764 Temporal coherence characteristics of InGaAsP laser diode with single-longitudinal-mode oscillation. Y.Yamabayashi, M.Saruwatari (Yokosuka Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Kanagawa-ken, Japan).
Opt. Lett. (USA), vol.8, no.9, p.506-8 (Sept. 1983).
Temporal coherence characteristics of the InGaAsP laser diode in the single longitudinal mode are measured using an unbalanced Michelson interferometer. It is demonstrated that the coherence characteristics can be expressed by the sum of the Fourier transformation of a spectral fine structure, which consists of a main mode and two adjacent submodes. These submodes cause the coherence length to be shorter than would be expected if direct line width measurements were made. (5 refs.)

106765 Lead chalcogenide tunable diode lasers. D.Dadarlat, R.M.Candea, P.Fitori, A.Darabont (Inst. de Tehnologie Izotopica si Moleculara, Cluj-Napoca, Rumania).
Stud. & Cercet. Fiz. (Rumania), vol.35, no.6, p.546-66 (1983). In Rumanian.
A brief view on the specific physical (band structure; temperature and pressure dependence of the refractive index and of the cavity length) and technological (single crystal growth; p-n junction, thermal and electrical contacts manufacturing, shock isolation, temperature and injection current stabilisation) problems connected with the lead chalcogenide diode lasers, is presented. The peculiarities of the laser emission in lead chalcogenides are analysed, stressing the tuning mechanisms (compositional, by temperature, injection current, pressure, magnetic field) and the influence of the variations of the tuning parameters on the laser emission in Pb-salt diode lasers. The up-to-date performances concerning resolution, emitted power, tuning range, stability in time, threshold current and maximum operation temperature are discussed. A summary of the application areas is given. (81 refs.)

Wavelength multiplexing of 1.31-μm InGaAsP buried crescent laser arrays .... See Entry 106778

Selective low-temperature mass transport in InGaAsP/InP lasers .... See Entry 106779

Twisted double-heterostructure GaAs-(AlGa)As laser .... See Entry 106780

A 1.59 μm wavelength GaInAsP/InP distributed feedback laser with first-order grating on anti-meltback layer .... See Entry 106781

GaAs-(AlGa)As large optical cavity lasers .... See Entry 106784

The generation of ultrashort laser pulses .... See Entry 106789

Optically-steered twin-stripe laser beam scanner .... See Entry 106805

Reflected light in the coupling of semiconductor lasers with tapered hemispherical end fibers .... See Entry 106870

Emission and transmission cathodoluminescence analysis of InGaAsP/InP double heterostructures emitting at 1.3 and 1.6 micron .... See Entry 109022

42.55R Lasing action in other solids

(inc. solid Raman lasers)

106766 Using superluminescence to improve ultrashort-pulse characteristics. L.S.Kornienko, N.V.Kravtsov, Yu.P.Yatsenko (Sci. Res. Inst. of Nuclear Phys., Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.5, p.40-4 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.5, p.37-41 (1982).
A solid-state laser with a filter operating under conditions of overlap of the saturation stages of the active medium and the nonlinear absorber, with large amplification factors of the active medium, is considered. It is shown that the superluminescence arising under these conditons, which reduces the need for precise maintenance of the optimum level of pumping, may facilitate an increase in the probability of obtaining stable ultrashort pulses with high contrast. (9 refs.)

106767 Passive Q-switch with color centers for neodymium lasers. A.Lupei, V.Lupei, F.Domsa, S.Georgescu, V.I.Manzatu, I.Ursu (Central Inst. of Phys., Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.6, p.525-8 (1983).
Properties of a crystalline passive Q-switch based on F_2^- color centers in LiF are presented. Preparation, spectroscopic and Q-switching characteristics (in a YAG:Nd laser) are given. Energies of 50-60 mJ in pulses of 15-20 nsec have been obtained. (6 refs.)

106768 Laser glass. T.Izumitani, H.Toratani.
Solid State Phys. (Japan), vol.18, no.5, p.287-96 (May 1983). In Japanese.
Radiative and non-radiative properties of rare earth ions in various kind of glasses and their site variation due to inhomogeneous structure of glass are reviewed. (33 refs.)

106769 Oxide and halide laser glasses. M.J.Weber (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.2-3, p.239-50 (1983). In English. (Otto-Schott-Colloquium on the State of Optical Glass Research 1982, Jena, Germany, 1982).
Optical and spectroscopic properties of oxide and halide glasses are compared for optically-pumped laser applications. Properties considered include the transparency, linear and nonlinear refractive indices, and damage threshold of the host glass and the absorption spectrum, radiative and nonradiative transition probabilities, fluorescence wavelength, stimulated emission cross section, and spectroscopic inhomogeneities of the lasing ion. Most of these properties exhibit systematic variations with glass composition which can be used to tailor laser parameters. Measured properties for the ${}^4F_{3/2}\rightarrow{}^4I_{11/2}$ lasing transition of Nd^{3+} are surveyed for oxide (silicate, phosphate, borate, germanate, tellurite), halide (fluoroberyllate, fluoroaluminate, fluorozirconate, fluorohafnate, chloride), and oxyhalide (fluorophosphate, chlorophosphate) glasses. (35 refs.)

Simple ruby laser producing variable pulse lengths from 800-psec to 80-nsec duration .... See Entry 106777

Antisaturation in stimulated Raman emission .... See Entry 106821

42.55T Free electron lasers

106770 Unstable electrostatic beam modes in free-electron-laser systems. H.P.Freund, P.Sprangle (Naval Res. Lab., Washington, DC, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1835-7 (Sept. 1983).
The electrostatic stability of the free-electron laser is studied for a configuration in which a relativistic electron beam propagates through combined helical wiggler and axial guide fields. Instability is found for certain specific parameter regimes which, in the beam frame, is shown to be purely growing and to require the presence of both the wigler and axial guide fields. The electrostatic stability is also studied for a configuration which consists of a linearly polarized wiggler and an axial guide field, for which analogous results are found. (14 refs.)

106771 Photon statistics of the free-electron-laser startup. W.Becker, J.K.McIver (Dept. of Phys. & Astron., Univ. of New Mexico, Albuquerque, NM, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1838-40 (Sept. 1983).
The authors show that, for the high electron currents used in present-day free-electron lasers, spontaneous radiation is distributed according to thermal statistics. (8 refs.)

106772 Generation of high power, very coherent radiation by interaction of a free electron laser with a molecular (or ionic) medium. H.Wilhelmsson, H.G.Gustavsson (Inst. for Electromagnetic Field Theory, Chalmers Univ. of Technol., Goteborg, Sweden), L.Stenflo.
Phys. Scr. (Sweden), vol.28, no.2, p.205-8 (Aug. 1983).
Intense, very coherent electromagnetic radiation can, in principle, be generated by the interaction of a relativistic electron beam and a molecular medium in the presence of a wiggler field (or a strong electromagnetic pump wave). Enhanced spatial growth in a narrow frequency region results from the presence of the molecules as demonstrated in graphs from computer calculations. These effects are found to occur when the molecules (or ions) have inverted populations, i.e. for maser or laser media, as well as for situations where this is not the case, i.e. when the molecules act like micro-cavities (passive resonators), distributed over the volume of interaction. (10 refs.)

106773 Two-dimensional analysis of the Raman-type free-electron laser. T.Nakashima, T.Shiozawa, H.Morita (Faculty of Engng., Osaka Univ., Suita, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.6, p.439-46 (June 1983). In Japanese.
The authors consider a class of the Raman-type free-electron laser utilizing a two-dimensional relativistic electron beam of finite thickness enclosed by two perfectly conducting planes. For this type of laser the problem of coupling between the positive-energy scattered wave and the negative-energy electron plasma wave under the influence of an electromagnetic pump wave is discussed. From a numerical estimate of the spatial growth rate for the scattered wave, the finite sizes of the beam thickness and the separation between two conducting planes are found to bring several significant modifications in the oscillation characteristics of this type of laser. (13 refs.)

The free-electron laser: medicine's rising star .... See Entry 110116

42.60 LASER SYSTEMS AND LASER BEAM APPLICATIONS

106774 Measurement of discharge circuit distributive inductance for Blumlein excimer laser. Chen Jian-wen, Xia Kang-min, Liu Miao-hung, Zhong Fan (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, China).
Acta Phys. Sin. (China), vol.32, no.4, p.548-52 (April 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)* [received: Sept. 1983]
The technique of measuring discharge current of Blumlein circuit using magnet-light method is described briefly in this paper. The more exact method estimating distributive inductance of discharge circuit is presented. The circuit equations are solved and the analytic expression of distributive inductance is derived. Finally, the calculated result is discussed. (4 refs.)

106775 Metrological features of a laser device with a single-mirror deflecting unit. A.A.Ivanov, G.M.Maksimov, Yu.S.Nechaev (Inst. of High-Energy Phys., Serpakhov, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.6, pt.2, p.1482-5 (Nov.-Dec. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.6, p.151-3 (Nov.-Dec. 1982).
The features of the readout systems are considered for the laser device for recording graphics information with a one-mirror deflecting unit. The couplings between the systems and the nonlinearity are examined. The calibration procedure is described. Results are given from an examination based on the calibration program together with data on the stability of the calibration constants. The device provides coordinate determination with a mean-square error of about 3-5 μm. (4 refs.)

Interferometric detectors for gravitational radiation .... See Entry 105213

Picosecond light-pulses tunable from the violet to the near infrared .... See Entry 106816

A prism reflector of anti-resonant ring configuration .... See Entry 106852

42.60B Design of specific laser systems

106776 Seventeen psec pulses from a nitrogen laser-pumped short-cavity rhodamine 6G dye laser. G.W.Liesegang (US Nat. Inst. of Health, Lab. of Tech. Dev., Bethesda, MD, USA).
Appl. Opt. (USA), vol.22, no.16, p.2405-7 (15 Aug. 1983).
Reports the generation of 17-psec pulses of 200-kW intensity from a nitrogen-pumped rhodamine 6G short-cavity dye laser. This dye laser has a cavity length of 120 μm and is axially pumped by the nitrogen laser. (8 refs.)

106777 Simple ruby laser producing variable pulse lengths from 800-psec to 80-nsec duration. B.Gellert (Res. Center, Brown Boveri et Cie Baden-Dattwil, Switzerland), C.Heupts.
Appl. Opt. (USA), vol.22, no.17, p.2709-11 (1983).
Remote control of ruby laser pulse length could be achieved over 2 orders of magnitude. The technique for generating such a variability of pulse lengths with the same laser makes use of well-known cavity dumping and mechanical or simple electronic modifications. Short pulses could be lengthened by increasing the parallel capacity of a laser-triggered spark gap. (9 refs.)

106778 Wavelength multiplexing of 1.31-μm InGaAsP buried crescent laser arrays. J.P.van der Ziel, H.Temkin, R.A.Logan (Bell Labs., Murray Hill, NJ, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.401-3 (1 Sept. 1983).
A monolithic array of five noninteracting buried crescent lasers has been optically multiplexed using an external cavity with a grating as a dispersive element. The lasers have a center to center separation of 8 μm, and with an external cavity consisting of a 4-mm focal length lens and a 600-line/mm grating used in second order, the lasers emit at $\approx$1.31 μm in essentially single longitudinal modes separated by 19.6 Å. Single longitudinal mode operation has also been obtained using a cleaved coupled cavity (C^3) laser array. In this case the dominant mode is determined by the coherent interference of the mode spectrum of the two subcavities. (12 refs.)

106779 Selective low-temperature mass transport in InGaAsP/InP lasers. A.Hasson, L.C.Chiu, T.R.Chen, U.Koren, Z.Rav-Noy, K.L.Yu, S.Margalit, A.Yariv (California Inst. of Technol., Pasadena, CA, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.403-5 (1 Sept. 1983).
A low-temperature mass transport process in InP was investigated. Mass transport of InP was achieved at 570-600°C in a closed ampoule using iodine or InI as a catalytic transporting agent. Accomplishing the mass transport process at lower temperature has eliminated the problem of thermal etching and resulted in lasers with higher T_0. (7 refs.)

106780 Twisted double-heterostructure GaAs-(AlGa)As laser. T.Sugino, S.Wang (Dept. of Electrical Engng. & computer Sci., Univ. of California, Berkeley, CA, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.427-9 (1 Sept. 1983).
A novel laser structure in which a terraced substrate laser and a channeled substrate laser are connected is fabricated. The active layer of the composite cavity is twisted in the junction area between the two laser cavities. Internal reflection and polarization change occur in the twisted region. A built-in refractive index variation is formed by the terraced substrate and the channeled substrate structures. Remarkable characteristics of the laser are a low threshold current of 40 mA, a stable fundamental transverse-mode and single longitudinal-mode oscillation, and a wavelength locking over a temperature range of more than 6°C. (11 refs.)

106781 A 1.59 μm wavelength GaInAsP/InP distributed feedback laser with first-order grating on anti-meltback layer. S.Uchiyama, K.Iga (Res. Lab. of Precision Machinery & Electronics, Tokyo Inst. of Technol., Yokohama, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.6, p.L348-9 (June 1983).
A 1.59 μm wavelength GaInAsP/InP distributed feedback laser with a first-order grating has been fabricated by a two-step liquid phase epitaxial (LPE) growth. The first-order grating was formed on the anti-meltback layer grown on the active layer. The threshold current was 680 msA for 18 μm stripe width and 510 μm cavity length and single-longitudinal-mode operation was obtained from -50 to 0°C. (10 refs.)

106782 A dye laser synchronously pumped by Ar$^+$laser. Liu Yupu, Zhang Yinghua, Zhang Guoxuan, Fu Baoxiang (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, Shanghai, China).
Acta Opt. Sin. (China), vol.3, no.4, p.333-8 (1983). In Chinese.
The parameters for acousto-optic mode-locking of an Ar$^+$-laser are investigated. Stable mode-locked operations at 4880 Å and 5145 Å have been obtained. The average power is up to 300 mW. The pulse-width is about 200 ps. The fluctuation of the pulse amplitudes is less than 5%. A dye laser with an astigmatically compensated cavity synchronously pumped by this Ar$^+$-laser has been operated. Its pulse-width is less than 10 ps, and the average power is about 20 mW at 5840 Å. The pulses of the mode-locked dye laser are wavelength tunable over the range 5700$\sim$6200 Å. Particularly, the effects of the mismatch of the cavity length or frequency on the mode-locking behaviour are emphasized. (4 refs.)

106783 A folded tunable single-mode TEA CO_2 laser with two beams. Zhou Yueliang, Chen Zhenghao, Cui Dafu, Lu Huibin (Inst. of Phys., Acad. Sinica, Beijing, China).
Acta Opt. Sin. (China), vol.3, no.4, p.339-43 (1983). In Chinese.
This laser can produce two beams which have the temporal coincidence of the pulses. Each beam can be tuned by grating independently within the range of 9.2 μm$\sim$10.9 μm. The highest peak powers of the single-mode/single-line output and the multi-mode/single-line output are about 1 MW and 4 MW respectively. The authors discuss the optimum transmittance and the mode selection of this laser and the temporal coincidence of the pulses. Some experimental results are given. (6 refs.)

106784 GaAs-(AlGa)As large optical cavity lasers. Zhang Xingde, Ren Dacui (Changchun Coll. of Optics & Fine Mech., Changchun, China).
Acta Opt. Sin. (China), vol.3, no.4, p.358-63 (1983). In Chinese.
GaAs-(AlGa)As large optical cavity lasers have been fabricated using a liquid phase epitaxy method and its main parameters, have been measured, such as laser pulse power, beam divergence angle, wavelength and external differential quantum efficiency etc. (11 refs.)

106785 Small-size CO_2 laser with transverse high-frequency excitation. Sh.Kh.Zakirov, A.T.Mirzaev, A.A.Sipailo, V.A.Stepanov, M.Sh.Sharakhimov (Tashkent State Univ., Tashkent, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.6, pt.2, p.1473-5 (Nov.-Dec. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.6, p.143-5 (Nov.-Dec. 1982).
Two versions of the construction of sealed-off small-size CO_2 lasers with tubes made from technical quartz and ceramics with capacitive high-frequency excitation systems in a mixture of CO_2, N_2 and He are described. The parameters of these lasers are compared with the parameters of DC CO_2 lasers. (4 refs.)

106786 Subnanosecond pulse generation of 193 nm radiation by pulse slicing. D.A.Jaroszynski, T.A.King (Phys. Dept., Schuster Lab., Manchester Univ., Manchester, England).
J. Phys. E (GB), vol.16, no.9, p.862-5 (Sept. 1983).
An optical gate and associated techniques are described for the generation of subnanosecond UV radiation from pulsed lasers. Pulses of 400 ps duration at 193 nm have been produced by pulse slicing the output of an ArF laser using a KDP electro-optic modulator driven by a krytron-cable voltage pulse generator. (14 refs.)

XeCl excimer laser excited by longitudinal discharge ....See Entry 106745

Gain characteristics of XeCl laser ....See Entry 106746

Short-cavity hydrogen-halide laser ....See Entry 106749

Broadly tunable mode-locked HgCdTe lasers ....See Entry 106758

Optical stability of narrow stripe, proton-isolated AlGaAs double heterostructure lasers with gain guiding ....See Entry 106762

Lead chalcogenide tunable diode lasers ....See Entry 106765

42.60D Laser resonators and cavities

106787 Mode matching for a passive resonant ring laser gyroscope. T.D.Baxter, T.T.Saito, G.L.Shaw, R.T.Evans, R.A.Motes (US Air Force Acad., Colorado Springs, CO, USA).
Appl. Opt. (USA), vol.22, no.16, p.2487-91 (15 Aug. 1983).
An analytical method of matching the mode of an input laser to the lowest-order mode of a passive resonant ring laser gyro is described, as are the steps in determining the location and focal length of cylindrical mode matching lenses. Results were obtained with no mode matching, with a compromise spherical lens, with horizontal mode matching only, and with the proper cylindrical mode matching lenses. Compared with no mode matching, the latter case shows that the amplitude of the lowest-order mode is increased $\sim$2.5 times. In addition, the number and intensity of higher-order modes are reduced to near zero, and the relative intensity of the lowest-order mode to the higher-order mode increased from $\sim$5 to $\sim$60 times greater. (5 refs.)

106788 Optical resonators with Gaussian reflectivity mirrors: misalignment sensitivity. N.McCarthy, P.Lavigne (Inst. Nat. de la Recherche Sci., Univ. de Quebec, Varennes, Quebec, Canada).
Appl. Opt. (USA), vol.22, no.17, p.2704-8 (1983).
An analytical solution to the problem of the misaligned optical resonator with a Gaussian reflectivity mirror is presented. It is shown that the fundamental mode of such a resonator remains a Gaussian beam which propagates along a tilted axis in the misalignment plane. The exact analytical solution yields simple expressions that characterize the misalignment sensitivity of the resonator by giving the beam-steering angle and the loss variations. (17 refs.)

Fine tuning of lasers by an intracavity interferometer containing an absorbing gas ....See Entry 106742

Noise of He-Cd laser and its suppression ....See Entry 106744

Short-cavity hydrogen-halide laser ....See Entry 106749

Superluminescent damping of relaxation resonance in the modulation response of GaAs lasers ....See Entry 106756

Influence of an external cavity on semiconductor laser phase noise ....See Entry 106759

Seventeen psec pulses from a nitrogen laser-pumped short-cavity rhodamine 6G dye laser ....See Entry 106776

Simple ruby laser producing variable pulse lengths from 800-psec to 80-nsec duration ....See Entry 106777

Wavelength multiplexing of 1.31-μm InGaAsP buried crescent laser arrays ....See Entry 106778

GaAs-(AlGa)As large optical cavity lasers ....See Entry 106784

Bistable operation of a dual-wavelength synchronously mode-locked CW dye laser ....See Entry 106790

Effects of the coupling hole and tube diameter on the output power of an RF-excited CW HCN laser ....See Entry 106801

42.60F Laser beam modulation

106789 The generation of ultrashort laser pulses. G.H.C.New (Dept. of Phys., Imperial Coll. of Sci. & Technol., London, England).
Rep. Prog. Phys. (GB), vol.46, no.8, p.877-971 (Aug. 1983).
Ultrashort laser pulses are finding increasing application in numerous branches of science and technology. This article is an attempt to provide a comprehensive review of the whole field of ultrashort pulse generation, covering both the experimental and the theoretical aspects of the subject. By far the commonest method of generating pulses in the picosecond and subpicosecond regime is the technique known as 'mode-locking' and it is with this that the review is therefore largely concerned. After introductory remarks and a simple treatment of some of the general principles, the central sections of the review deal with the main generic techniques, namely spontaneous mode-locking, active mode-locking (including mode-locking by synchronous pumping) and passive mode-locking. Within each section the material is organised into three main categories, namely (a) general background, (b) historical survey (mainly relating to experimental work and densely packed with references to published work) and (c) theoretical methods (presented with a strongly pedagogical flavour). A major section at the end deals with a mass of important (and mostly recent) work that does not fit naturally into the main framework of the review. This includes USP generation in semiconductor lasers, a number of special methods such as injection mode-locking (and others where two or more mode-locking techniques are combined), as well as chopping and switching techniques. (490 refs.)

Noise of He-Cd laser and its suppression ....See Entry 106744

Superluminescent damping of relaxation resonance in the modulation response of GaAs lasers ....See Entry 106756

Mode-locked semiconductor lasers with gateable output and electrically controllable optical absorber ....See Entry 106757

Simple ruby laser producing variable pulse lengths from 800-psec to 80-nsec duration ....See Entry 106777

A dye laser synchronously pumped by Ar$^+$laser ....See Entry 106782

Subnanosecond pulse generation of 193 nm radiation by pulse slicing ....See Entry 106786

42.60H Optical problems related to properties and interactions of laser beams

106790 Bistable operation of a dual-wavelength synchronously mode-locked CW dye laser. I.S.Ruddock, R.Illingworth (Dept. of Phys., Univ. of Strathclyde, Glasgow, Scotland).
Appl. Phys. B (Germany), vol.B32, no.1, p.7-8 (Sept. 1983).
Bistable operation of a dual-wavelength synchronously mode-locked CW dye laser is reported. Wavelength switching is found to depend on the pump power and the dye laser cavity lengths. (5 refs.)

106791 Precise measurement of laser power using calorimetric method. T.Honda, M.Endo.
J. Soc. Instrum. & Control Eng. (Japan), vol.22, no.6, p.508-21 (June 1983). In Japanese.
Calorimetric methods for precise measurement of laser power are surveyed, and a new double calorimeter designed to establish the CW laser power measurement standard is discussed. The double calorimeter consists of a standard thermopile unit (conduction-type calorimeter) having fast response and an electronic-cooling calorimeter (isothermal-type calorimeter) of which the thermal load is borne by the thermopile unit. In a description of the principle of the double calorimeter, the substitution ratio of DC power for laser power (which is termed the effective efficiency) in the thermopile unit is defined. The thermopile unit and the electronic-cooling calorimeter are operated simultaneously, and the effective efficiency of the thermopile unit is determined. (26 refs.)

106792 Plastics for high-power laser applications: a review. R.M.O'Connell, T.T.Saito (Frank J. Seiler Res. Lab., US Air Force Acad., Colorado Springs, CO, USA).
Opt. Eng. (USA), vol.22, no.4, p.393-9 (July-Aug. 1983).
Reviews studies of single- and multiple-shot laser damage to plastics and theories of the damage mechanism. Single-shot damage is caused by absorbing defects, many of which can be eliminated by monomer purification. Multiple-shot damage is controlled by viscoelastic properties; plasticization improves damage resistance. Also, the authors review high-power laser studies of dye-impregnated plastics. Photobleaching is the most serious problem. The authors review progress in understanding the physics of that process. Dye-induced lowering of laser damage resistance and thermal bleaching are other important problems discussed. Plasticization to improve multiple-shot damage resistance may encourage thermal bleaching. Finally, the authors present a list of as yet untested and potentially damage-resistant commercially available plastics. (51 refs.)

106793 On the nature of the accumulation effect in laser-induced damage to optical materials. A.A.Manenkov, G.A.Matyushin, V.S.Nechitailo, A.M.Prokhorov, A.S.Tsaprilov (Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Opt. Eng. (USA), vol.22, no.4, p.400-4 (July-Aug. 1983).
Features of multiple-shot laser-induced damage to optical materials are analyzed. The methodology of studying the accumulation effect responsible for catastrophic damage, based on the statistical approach, is suggested, and the basic characteristics of multiple-shot damage are introduced. Possible mechanisms of microdamage in materials under multiple laser irradiation are discussed. The experimental data on the laser-induced damage to optical polymer materials which demonstrate some basic properties of the accumulation effect are presented. The ways of suppressing the accumulation effect in transparent polymers which result in a considerable increase of laser damage resistance are proposed. (42 refs.)

106794 Multiple pulse laser-induced bulk damage in crystalline and fused quartz at 1.064 and 0.532 μm. L.D.Merkle, M.Bass, R.T.Swimm (Center for Laser Studies, Univ. of Southern California, Los Angeles, CA, USA).
Opt. Eng. (USA), vol.22, no.4, p.405-10 (July-Aug. 1983).
Reports bulk damage measurements on single crystal quartz and two types of fused silica under single and multiple pulse laser irradiation at 1.064 μm and 0.532 μm. Whereas the single pulse damage threshold varies little among the materials or with wavelength, the multiple pulse induced damage behavior depends strongly upon material and wavelength. Laser calorimetry and measurements of light scattered during irradiation give no evidence of change prior to the pulse on which macroscopic damage occurs. However, the distribution of the number of pulses needed to produce macroscopic damage as a function of intensity is indicative of an accumulation process in which some minimum intensity is required to initiate the accumulation of microscopic damage. (14 refs.)

106795 Single and multiple pulse catastrophic damage in diamond-turned Cu and Ag mirrors at 10.6, 1.06 and 0.532 μm. N.Koumvakalis, C.S.Lee, M.Bass (Center for Laser Studies, Univ. of Southern California, Los Angeles, CA, USA).
Opt. Eng. (USA), vol.22, no.4, p.419-23 (July-Aug. 1983).
The results of single and multiple pulse damage studies at 10.6, 1.06, and 0.532 μm in diamond-turned bulk Cu and diamond-turned electro-deposits of Ag on Cu are presented. The single pulse damage threshold decreases or remains constant with increasing spot size, as previously reported. On the other hand, the multiple pulse threshold increases with increasing spot size. The difference in their behavior suggests that the two phenomena are the result of different mechanisms. Localized surface defects and impurities appear to be responsible for single pulse damage, while for multiple pulse damage a model is proposed based on the cumulative effect of plastic deformation induced by thermal stresses. (8 refs.)

106796 Picosecond damage studies at 0.5 and 1 μm. M.J.Soileau, W.E.Williams, E.W.Van Stryland, T.F.Boggess, A.L.Smirl (Dept. of Phys., North Texas State Univ., Denton, TX, USA).
Opt. Eng. (USA), vol.22, no.4, p.424-30 (July-Aug. 1983).
The laser-induced damage (LID) thresholds of fused silica and single crystal NaCl were studied at wavelengths of 0.5 and 1 μm for pulses as short as 4 ps for a variety of focal spot sizes. The problem of sample-to-sample variation was minimized by performing parametric studies on a single sample at a time. Beam distortion measurements and polarization dependence studies of the LID thresholds demonstrate that the contribution of self-focusing to the LID measurements was negligible. The damage threshold field E_B was found to increase as the pulsewidth was decreased in both materials at both wavelengths. The strongest pulsewidth dependence observed was approximately an inverse square root proportionality observed in NaCl at 1 μm for pulses shorter than 10 ps. For conditions of equal pulsewidth and the same focal spot size, E_B was less at 0.5 μm than at 1 μm for both materials. (22 refs.)

106797 Bulk and surface damage thresholds of crystals and glasses at 248 nm. F.Rainer, W.H.Lowdermilk, D.Milam (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
Opt. Eng. (USA), vol.22, no.4, p.431-4 (July-Aug. 1983).
The authors used 20 ns, 248 nm pulses to study surface and bulk damage in bare, polished samples of UV-transmitting glasses, fluoride crystals, and isomorphs of potassium dihydrogen phosphate (KDP). The intent was to test enough samples to establish the safe operating limits for currently available windows and crystals finished by routine techniques for optical fabrication. In fluoride crystals, thresholds for bulk inclusion damage and for rear-surface damage were comparable. The median rear-surface threshold was 16 J/cm^2. The fluence limit in fused silica windows was determined by the threshold for rear-surface damage, which ranged from 5 to 9 J/cm^2. For the isomorphs of KDP, the limiting fluence was the threshold for front-surface damage, which ranged from 3 to 9 J/cm^2. (6 refs.)

106798 Continuous wave laser damage on optical components. J.R.Palmer (TRW Inc., Redondo Beach, CA, USA).
Opt. Eng. (USA), vol.22, no.4, p.435-46 (July-Aug. 1983).
Continuous wave laser damage on optical components is a major problem encountered in the operation of high energy chemical lasers. Although the damage phenomena on cooled and uncooled optical components are very similar to those on pulsed laser devices, mechanisms of damage are different. Unlike pulsed laser systems, maintenance of optical figure due to thermal distortion becomes an important aspect of the complete optical train for a device that may be required to operate for a number of seconds. The author deals with damage mechanisms on cooled and uncooled optical components and how the damage may be predicted. Further, predictive tools for determining the thermal and mechanical forces that operate on optical components to induce distortions in the optical train are evaluated. (31 refs.)

106799 The efficiency of coupling light from a laser diode into an optical fiber with the aid of a lens. W.Nakwaski (Politech. Lodz, Lodz, Poland).
Rozpr. Electrotech. (Poland), vol.28, no.1-2, p.233-45 (1982). In Polish. [received: Aug. 1983]
The analysis of radiative losses during laser diode-optical fiber coupling is the subject of the paper. It enables one to calculate an efficiency of coupling as well as showing how this efficiency can be increased with the aid of a suitable change of system parameters. (16 refs.)

106800 Reconstruction of the intensity distribution of heating radiation from the thermal damage profile of a thin plate. I.S.Spevak (All-Union State Sci.-Res. Inst. of Metrology, Khar'kov, Ukrainian SSR).
Sov. Phys.-Tech. Phys. (USA), vol.28, no.2, p.245-6 (Feb. 1983). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.53, no.2, p.394-6 (Feb. 1983). [received: Sept. 1983]
It was proposed by Appolonov et al. (1978, 1979) that the spatial intensity distribution of light be determined by measuring the induced thermal deformation of a mirror-like surface irradiated by high-power laser radiation. The author suggests employing a thin transparent plate instead of using a mirror as the sensitive element. It is possible by using a plate to increase the maximum measurable intensities without sacrificing the advantages characteristic of the thermodeformation method. This is because in most cases the fraction of radiation absorbed by the plate is less than that absorbed by a mirror. Thus for NaCl plates the absorbed energy is $\sim$0.2% at $l=1$ cm, $\lambda=10.6$ μm (it is proportional to $\gamma l+2\beta$, where γ and β are the bulk and surface absorption coefficients and l is the thickness of the plate); on the other hand, $\approx$1% of the radiation is absorbed when light is reflected from an aluminum mirror. Even though rather large amounts of heat can be shed by cooled porous mirrors, there are technical reasons why it may be preferable to use a transparent plate (the measurements are obviously simpler and can be carried out anywhere in the optical system without disrupting operation, etc.). (5 refs.)

106801 Effects of the coupling hole and tube diameter on the output power of an RF-excited CW HCN laser. H.Ute, I.Okabayashi, M.Makiuchi, M.Kawamura (Faculty of Engng., Tokyo Inst. of Technol., Tokyo, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.6, p.480-1 (June 1983). In Japanese.
Experimental studies of effects of the coupling hole and the tube diameter on the output power of an RF-excited CW HCN laser have been performed. It has been found that there exists an optimum hole diameter for the maximum output and that the output power increases with the tube diameter. (2 refs.)

Fine tuning of lasers by an intracavity interferometer containing an absorbing gas .... See Entry 106742

A folded tunable single-mode TEA CO$_2$ laser with two beams .... See Entry 106783

Laser bias effect on the receiver sensitivity of passive fibre optic star bus networks .... See Entry 106899

***Q*-switched frequency-doubled Nd:YAG laser surface finishing of metals** .... See Entry 106904

Ion beam sputter deposition of optical coatings .... See Entry 109150

42.60K Optical problems related to applications of laser beams

106802 Improved welding penetration of a 10-kW industrial laser. A.S.Kaye, A.G.Delph, E.Hanley, C.J.Nicholson (UKAEA Culham Lab., Abingdon, England).
Appl. Phys. Lett. (USA), vol.43, no.5, p.412-14 (1 Sept. 1983).
The weld penetration of a multikilowatt CO$_2$ laser has been increased by reducing the laser beam divergence. This near diffraction limited laser has now demonstrated that CO$_2$ lasers are capable of full-penetration welding of 1-in. steel with typically 11 kW on the work. Bead-on-plate tests combined with previous data indicate that the penetration scales with laser power as $P^{0.8}$. (5 refs.)

106803 Blue green lasers and their military potential. V.V.Rampal (Defence Electronics Applications Lab., Dehradun, India).
Def. Sci. J. (India), vol.33, no.2, p.183-93 (April 1983). [received: Aug. 1983]
An overview of the state of art regarding the research and development of lasers in the blue green region of the spectrum is presented. Possible application of these lasers in the area of underwater detection, ranging, and submarine communication, is discussed. (15 refs.)

106804 Methodology of lidar probing of atmospheric temperature from Raman spectra. S.A.Danichkin.
J. Appl. Spectrosc. (USA), vol.37, no.5, p.1249-53 (Nov. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.757-62 (Nov. 1982). [received: Sept. 1983]
Remote-sensing determination of the physical and chemical parameters of the atmosphere is quite practicable on account of the development of lidar prob-

ing methods and apparatus. Temperature measurement still represents a complicated problem, however. Recently, the pure rotation PR spectrum in Raman scattering RS has been used with air molecules, as the intensity distribution is dependent on the temperature. The resultant method has already found practical use. Nevertheless, the author's studies refine and extend the method by improving the performance. (12 refs.)

106805 Optically-steered twin-stripe laser beam scanner. K.A.Shore (Dept. of Electrical Engng. & Electronics, Univ. of Liverpool, Liverpool, England).
Opt. & Quantum Electron. (GB), vol.15, no.5, p.461-2 (Sept. 1983).
A stripe-geometry injection laser configuration has been described in which the optical near-field position may be controlled by adjusting currents injected through two stripe contacts (1981). The response time for the device in this mode of operation is constrained by the speed at which modulation of the injection currents may be achieved and also by the time taken for changes in the injection current to be communicated to the optical field. Although the limitations imposed by these factors may not be serious in many applications it is of interest to examine alternative methods for implementing the scanning function of the device. The author points out that optical injection can provide a mechanism for fulfilling the suggested scanning application for the twin-stripe laser. Used in this way the device may be considered as a component of an all-optical processing system and potential gains in speed of response are made available. (5 refs.)

Real-time measurements of spatial velocity distribution with a laser Doppler imaging system .... See Entry 105311

XUV excitation of H_2 using the third harmonic or a frequency-double dye laser .... See Entry 106509

A laser scanner applicable to scanning any graphics .... See Entry 106728

Mode matching for a passive resonant ring laser gyroscope .. See Entry 106787

Wide-beam atmospheric optical communication for aircraft application using semiconductor diodes .... See Entry 106897

Effect of wall scattering on SNR in off-axis differential-type laser Doppler velocimetry .... See Entry 107285

Laser-induced fluorescence technique for velocity field measurements in subsonic gas flows .... See Entry 107286

Laser-2-focus velocimeter and wall scattering .... See Entry 107287

On automatic measurements of very low sedimentation velocity .... See Entry 107288

A computer controlled laser-Doppler anemometer for flow rate measurement .... See Entry 107303

Production and detection of energetic species by laser photolysis and detection techniques .... See Entry 109763

The free-electron laser: medicine's rising star .... See Entry 110116

Frequency-doubled CO_2 lidar measurement and diode laser spectroscopy of atmospheric CO_2 .... See Entry 110671

Assessment of relative error sources in IR DIAL measurement accuracy .... See Entry 110679

42.65 NONLINEAR OPTICS

106806 Nonlinear birefringence in fluids containing nonspherical molecules. I. Response and mode coupling theory. D.Ronis (Dept. of Chem., Harvard Univ., Cambridge, MA, USA).
Physica A (Netherlands), vol.120A, no.1-2, p.369-87 (1983).
The orientation density in nonequilibrium systems is expressed in terms of equilibrium time-correlation functions to quadratic order in the gradients in density, pressure and velocity fields. These are evaluated by mode coupling theory in the reversible bare vertex approximation at infinite dilution of the nonspherical component and using a two-variable model prediction for the two-point orientation correlations. A very simple nonlinear correction term is found, predicting no nonlinear shear birefringence and a nonlinear acoustic birefringence which scales as $\Omega I^{1/2}/\Gamma$ with respect to the linear birefringence (Ω is the driving frequency, I is a dimensionless acoustic intensity and Γ is the equilibrium orientation relaxation rate). (20 refs.)

106807 The fifth order susceptibility calculus of alkali metal vapours. I.M.Popescu, N.N.Puscas, P.E.Sterian, I.Baranovski (Polytech. Inst. of Bucharest, Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.5, p.383-8 (1983).
Presents a method for the evaluation of the fifth order susceptibility of alkali metals vapours, considering only the step processes induced by the incident laser field. The Eicher model takes into account the spin-orbit coupling and the damping effect utilising also the oscillator strengths for the calculation of the dipole matrix element. The obtained values $\chi^{(5)}=1.3410.10^{-44}$ esu are in accordance with other published results. (17 refs.)

106808 Resonant interaction of the noise radiation with a two-level system. G.M.Krochik (Sci. Res. Inst. of Intermediate Organic Products & Dyes, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.10, p.812-22 (Oct. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.10, p.1138-51 (Oct. 1982). [received: Sept. 1983]
The behaviour of a two-level system in a strong Gaussian noise field with an arbitrary width of the spectrum is studied. It is shown that the relaxation of the average difference of populations takes place quasiperiodically rather than exponentially. As the intensity of field fluctuations increases, the oscillation frequency tends to the Rabi frequency. The stationary value of the population difference as a function of the ratio between the correlation times of the random field, transverse and longitudinal relaxation, and the deviation of the frequency from resonance are studied, as well as the phase relaxation. It is established that the correlation function for the density matrix of the transition in a strong noise field carries out oscillations which are related to the oscillations of the population difference. The corresponding spectrum of the transition contains a dip whose magnitude increases with increasing intensity of the field fluctuations. A comparison with the results of other work is made. (17 refs.)

106809 Optical generation of control signals in adaptive systems. M.A.Vorontsov, V.I.Shmal'gauzen (Moscow State Univ., Moscow, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.10, p.843-9 (Oct. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.10, p.1179-87 (Oct. 1982). [received: Sept. 1983]
Discusses adaptive focusing systems for radiation in a nonlinear, optically inhomogeneous medium. Spectral criteria are introduced for an estimate of the focus quality based on an analysis of the scattered field within the receiving aperture. Methods are proposed which enable one to generate control signals for a wavefront corrector using optical filtering of the scattered radiation. (6 refs.)

106810 Line shape of spontaneous resonance hyper-Raman scattering of intense optical fields. L.Kancheva, S.Rashev (Inst. of Solid State Phys., Sofia, Bulgaria).
Spectrosc. Lett. (USA), vol.16, no.7, p.489-97 (1983).
The authors present some preliminary theoretical investigations on the multicomponent structure of the resonance spontaneous hyper-Raman spectrum from a four-level system. The central result is the demonstration of the 13-component spectral structure, and the establishment of certain general conditions for its appearance. (13 refs.)

106811 Six-wave interaction in liquid crystal mesophase. N.V.Tabiryan, S.G.Odulov.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1152-5 (Aug. 1983). In Russian.
Efficient degenerate six-wave interaction of low-power beams of CW gas lasers due to the fifth-order orientational optical nonlinearity of liquid crystals is predicted. Nonlinear susceptibility is evaluated for the geometry of interaction where ordinary third-order nonlinearity does not occur, $\chi^{(5)}\approx 10^{-6}$ cm^6/erg^2, which is 10 orders higher than that of semiconductor materials with two-photon absorption. (5 refs.)

Nonlinear antiresonant ring interferometer .... See Entry 105369

Time-resolved nonlinear luminescence spectroscopy by picosecond excitation correlation .... See Entry 105388

Homogeneous linewidth and optical dephasing of the $S_1 \leftarrow S_0$ transition of magnesium porphin in an *n*-octane crystal: a study by transient and photochemical hole-burning .... See Entry 106502

Collisional broadening of nonlinear optical resonances .... See Entry 106539

Theoretical description of photochemical hole burning in soft glasses .... See Entry 107852

Optical dephasing of excitonic polaritons in CuCl studied by time-resolved, nondegenerate four-wave mixing .... See Entry 108307

Nonlinear interaction of electromagnetic and plasma waves in periodic semiconductor structures .... See Entry 108465

Photoselection of conformational substrates and the hyposochromic photoproduct of rhodopsin .... See Entry 109780

42.65C Stimulated Raman, Brillouin and Rayleigh scattering; parametric oscillations and harmonic generation

106812 Temperature effects in $AgGaS_2$ nonlinear devices. G.C.Bhar (Phys. Dept., Burdwan Univ., Burdwan, India), D.K.Ghosh, P.S.Ghosh, D.Schmitt.
Appl. Opt. (USA), vol.22, no.16, p.2492-4 (15 Aug. 1983).
Refractive indices of $AgGaS_2$ crystal are measured at different temperatures using the classical minimum deviation technique and are fitted in appropriate dispersion relations. The variation of pump laser wavelength for noncritical upconversion of signal at 10.6 μm with the change in crystal temperature has been verified using the above data. Temperature tunable infrared generation by noncritically phase-matched difference-frequency mixing has been predicted from 3 to 18 μm. (22 refs.)

106813 Efficient SHG of IR radiation by guided waves in MNA. G.I.Stegeman, C.Liao (Optical Sci. Center, Univ. of Arizona, Tucson, AZ, USA).
Appl. Opt. (USA), vol.22, no.17, p.2518-19 (1983).
The efficiently produce blue light by second harmonic generation (SHG), a high power density fundamental beam must be propagated over long distances in a highly nonlinear material in a phase-matched geometry. One of the most nonlinear materials reported to date is 2-methyl-4-nitroaniline (MNA) with $d_{11}=2.3\times10^{-10}$ m.V(vs$d_{33}=4\times10^{-11}$m/V for $LiNbO_3$). However, the large dispersion in refractive index with wavelength in this material ($n_x=1.8$ at $\lambda=1.06$ μm and $n_x=2.2$ at $\lambda=0.53$ μm) has precluded use of this coefficient for phase-matched SHG with plane waves. In a guided wave context, this dispersion can be compensated for by the well-known dispersion with thickness, as first suggested by Levine et al. (1979) It is shown in their work on the nonlinear properties of MNA. It is shown numerically that there exists at least one geometry and a set of mode parameters which lead to very efficient doubling of IR radiation in MNA. (7 refs.)

106814 Interpretation of Livermore third-harmonic-generation experiments. R.S.Craxton (Lab. for Laser Energetics, Univ. of Rochester, Rochester, NY, USA).
Appl. Opt. (USA), vol.22, no.17, p.2739-42 (1983).
Third-harmonic-generation experiments at the Lawrence Livermore National Laboratory were recently reported by Linford et al. [Appl. Opt., vol.21, p.3633 (1982)]. Here the theory pertaining to these experiments is discussed in detail. The Livermore results are shown to be in accordance with calculations using the harmonic generation code MIXER, whose predictions of highly efficient frequency tripling were first confirmed experimentally at the University of Rochester using the Type II/Type II polarization-mismatch configuration. The Livermore experiments confirm the advantages of this configuration. (9 refs.)

106815 Angular distribution and bandwidth effects observed in stimulated Raman emission. D.J.Brink, D.Proch, K.L.Kompa (Max-Planck-Inst. fur Quantenoptik, Garching, Germany).
AIP Conf. Proc. (USA), no.100, p.325-33 (1983). (Topical Meeting on Excimer Lasers, Incline Village, NV, USA, 10-12 Jan. 1983).
Presents and discusses the results of two experiments, namely: a) a study of the spatial quality of anti-Stokes stimulated Raman scattering (AS-SRS) generated light and b) an investigation on the impact of excitation bandwidth on that of the shifted radiation and on the efficiency of conversion. (18 refs.)

106816 Picosecond light-pulses tunable from the violet to the near infrared. F.Wondrazek, A.Seilmeier, W.Kaiser (Phys. Dept. E11, Tech. Univ. Munchen, Munchen, Germany).
Appl. Phys. B (Germany), vol.B32, no.1, p.39-42 (Sept. 1983).
System parameters of an optical parametric generator pumped by the third harmonic of a Nd:glass laser are presented. The tuning range extends from 5700 to 22700 cm^{-1}; i.e. it covers a frequency range of 17000 cm^{-1}. Experimental data on spectral bandwidths, conversion efficiencies, and pulse shape are discussed. A pump beam with a divergence of four degrees simultaneously generates the entire visible spectrum (blue to red) separated by the angle of emission. (9 refs.)

106817 Second harmonic wave coherent Raman mixing in $LiIO_3$ crystal. Liang Peihui, Gu Zhongmin, Zhang Geiqing (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, Shanghai, China), Liu Songhao.
Acta Opt. Sin. (China), vol.3, no.4, p.289-97 (1983). In Chinese.
By pumping a $LiIO_3$ crystal with a 1.06 μm picosecond laser pulse train at a proper incident angle, 8 stimulated Raman scattering lines have been obtained

in the visible region from 4896 Å to 6119 Å:$\omega=2\omega_1 \pm n\omega_P$, $n=1, 2, 3$, concerned elementary excitations being the *LO* mode and *TO* mode of the $(A+E_1)$ oblique polariton in the crystal. The process of such a complex stimulated Raman scattering is as follows: with phase matching the intense 1.06 μm laser beam and its scattered light generate SHG in the crystal; meanwhile it excites coherently the elementary excitations of the crystal, the latter scatter the SHG into Stokes and antiStokes radiation resulting in a complex effect of $\chi^{(2)}$ and $\chi^{(3)}$ nonlinear optical processes. Furthermore the reflected stimulated Raman scattering with distinct wavelength has been observed from the forward one. The reflected scattering is also the SHG coherent Raman mixing but generated by the 1.06 μm beam reflected upon the exit crystal surface. (13 refs.)

106818 Some features of second-harmonic generation in sequentially positioned nonlinear crystals. B.V.Bokut, N.S.Kazak, A.T.Malashchenko, Yu.A.Sannikov.
J. Appl. Spectrosc. (USA), vol.37, no.5, p.1242-5 (Nov. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.748-52 (Nov. 1982). [received: Sept. 1983] (4 refs.)

106819 Correlation of intensities in the Rayleigh scattering of light. N.I.Lebedev (Dept. of Quantum Radiophys., Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.5, p.45-7 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.5, p.41-3 (1982).
The correlation of light intensities in the quasielastic scattering of two-beam pumping is investigated. It is shown that the fields scattered in different directions will be statistically related under two different conditions of spatial synchronism. The relation between this effect and the effect of correlation of the Stokes and anit-Stokes components of Raman scattering is considered. (5 refs.)

106820 Second-harmonic photons from the interaction of free electrons with intense laser radiation. T.J.Englert, E.A.Rinehart (Dept. of Phys. & Astron., Univ. of Wyoming, Laramie, WY, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1539-45 (Sept. 1983).
A preliminary experimental investigation of the generation of second-harmonic photons from the interaction of free electrons with an intense laser beam has been performed. Second-harmonic photons with a wavelength of 530 nm generated from the interaction of free electrons with 1060-nm photons from a neodymium-glass laser are implied by observing Doppler-shifted photons with wavelengths of 490 and 507 nm. The observed photon wavelengths result from a Doppler shift of the laser photon wavelength as viewed in the rest frame of the electrons, combined with a Doppler shift of the second-harmonic photon emitted from 1600- and 500-eV electrons. Comparison of experimental results with those predicted by cross sections, derived from classical and quantum electrodynamics, shows reasonable agreement with both theories. Although second-harmonic photons are created, the dynamics of second-harmonic-photon generation (accelerated electron motion due to the electromagnetic field or actual two-photon interaction with the electron) cannot be resolved without further experiment. (22 refs.)

106821 Antisaturation in stimulated Raman emission. B.Fain (Chem. Dept., Tel Aviv Univ., Ramat Aviv, Tel Aviv, Israel).
Phys. Rev: A (USA), vol.28, no.3, p.1843-4 (Sept. 1983).
It is shown that in the regime of the Raman laser, at the threshold of its excitation, the absorption of the driving field has a singularity. (9 refs.)

106822 Raman scattering of light by stationary nonlinear polarization waves. T.M.Makhviladze, M.E.Sarychev (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. Phys.-JETP (USA), vol.83, no.5, p.952-8 (Nov. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.5, p.1650-60 (Nov. 1982). [received: Sept. 1983]
It is shown that new light-scattering regimes should arise in the case of Raman scattering of light in a medium in which optical solitons are propagating. Investigation of the formation and evolution of Stokes pulses has revealed the dependences of their principal characteristics on the scattering length and on the density of the molecules. The feasibility of the transformation of ultra-short pulses by utilizing optical solitons is considered for single-photon absorption solitons and stimulated Raman scattering solitons. (17 refs.)

106823 Nonlinear optical properties of semiconductors due to phonon flows. E.P.Pokatilov, V.M.Fomin.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1155-62 (Aug. 1983). In Russian.
Based on the collision integral calculation in the equation of motion for a density matrix of band charge carriers, the spectrum of polarization due to the response of the carriers to a strong electromagnetic field is obtained for the case of nonequilibrium phonon distributions. The tensor is found describing the second harmonic field generation caused by the presence of phonon flows in the semiconductor. The optimum conditions for this effect to reveal itself are studied. An increase in the second harmonic field per unit length due to deformational and piezoelectric interactions is calculated for InSb and CdS crystals. It is shown that, in contrast to the optical effects under conditions of equilibrium phonon distributions, the spatial symmetry of an electron-phonon interaction may be directly investigated by means of the second harmonic field generation in the presence of phonon flows. The examined nonlinear optical effects in semiconductors may be used to study the phonon flows detecting electromagnetic waves. (16 refs.)

106824 Nonlinear absorption of electromagnetic waves in crystals with large dielectric constant caused by SBS. G.N.Burlak, A.L.Kalapusha, N.Ya.Kotsarenko.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1162-5 (Aug. 1983). In Russian.
Nonlinear absorption of electromagnetic waves caused by stimulated Brillouin scattering (SBS) is investigated theoretically in crystals with large dielectric constants ($SrTiO_3$, $KTaO_3$). Coefficients of nonlinear absorption and threshold values of the fields are obtained. Their dependence on the coefficients of sound reflection from crystal boundaries is presented. A comparison of nonlinear losses caused by SMS and other parametrical mechanisms is given. (6 refs.)

Thermometry by CARS in an automobile engine .... See Entry 105324

XUV excitation of H_2 using the third harmonic or a frequency-double dye laser .... See Entry 106509

Nonlinear theory of stimulated scattering of electromagnetic waves by a magnetized beam of electrons in a waveguide .... See Entry 106686

Two-dimensional analysis of the Raman-type free-electron laser .... See Entry 106773

Stimulated scattering of a large amplitude electromagnetic wave by the eigenmodes of a plasma slab .... See Entry 107383

Femtosecond-time-resolved surface structural dynamics of optically excited silicon .... See Entry 108138

Determination of molecular orientation of monolayer adsorbates by optical second-harmonic generation .... See Entry 108178

Growth and stimulated emission spectroscopy of $Ca_3Ga_2Ge_3O_{12}$-Nd^{3+} garnet crystals .... See Entry 108979

42.65F Phase conjugation

106825 Degenerate four-wave mixing due to intervalance band transition in *p*-type mercury cadmium telluride. S.Y.Yuen (Francis Bitter Nat. Magnet Lab., MIT, Cambridge, MA, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.479-81 (1 Sept. 1983).
Degenerate four-wave mixing in *p*-type HgCdTe has been observed with CO_2 lasers. A room temperature third order nonlinear susceptibility $\chi^{(3)}$ of 8×10^{-6} esu has been measured. This is the largest $\chi^{(3)}$ with picosecond relaxation time reported. The observed nonlinearity is interpreted in terms of the effective mass change induced by the transition from the heavy to light hole band. This process is shown to be stronger than the nonlinearity caused by the saturation of the intervalence band absorption. (20 refs.)

106826 Dependence of the efficiency of resonant four-wave interaction on the frequency difference of the pumping waves. A.A.Afanas'ev.
J. Appl. Spectrosc. (USA), vol.37, no.5, p.1245-9 (Nov. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.752-7 (Nov. 1982). [received: Sept. 1983]
Recently, there has been intensive development in the investigation of wavefront rotation (WFR) of light fluxes in four-wave interactions (FWI) in nonlinear media. Particular attention has been paid to the FWI process in resonant media, allowing not only considerable reflective indices ($R\gg1$) to be obtained, but also the spectrum of reflected radiation to be effectively controlled. On account of the nonlinear interaction of the signal wave with one of the pumping waves, an amplitude-phase lattice is induced in the medium, and the diffraction of the second pumping wave on this leads to the generation of a wave with WFR with respect to the signal wave. If the frequencies of the pumping wave and the signal wave coincide (degenerate FWI), then the process of wavefront rotation occurs without change in frequency. The author investigates the WFR of weak radiation with resonant FWI in the field of specified pumping waves of different frequency. (12 refs.)

106827 Nonlinear optics with a diode-laser light source. D.A.B.Miller, D.S.Chemla, P.W.Smith (Bell Labs., Holmdel, NJ, USA), A.C.Gossard, W.Wiegmann.
Opt. Lett. (USA), vol.8, no.9, p.477-9 (Sept. 1983).
The authors report results of CW degenerate four-wave mixing experiments on room-temperature GaAs-GaAlAs multiple-quantum-well material using a commercial semiconductor diode laser as the sole light source. With CW powers of $\sim$3 mW and intensities of $\sim$13 W/cm^2, the authors observe diffraction efficiencies of $\sim10^{-4}$, corresponding to an effective nonlinear coefficient of $\chi^3\sim6\times10^{-2}$ esu. (8 refs.)

106828 Continuous-wave self-pumped phase conjugator with wide field of view. J.Feinberg (Dept. of Phys., Univ. of Southern California, Los Angeles, CA, USA).
Opt. Lett. (USA), vol.8, no.9, p.480-2 (Sept. 1983).
A self-pumped phase conjugator is demonstrated that operates over a wide field of view, phase conjugates separate images without cross talk, and when pumped by one incident beam will self-oscillate with mirrors placed in all four quadrants. The phase conjugator uses a single crystal of $BaTiO_3$. (8 refs.)

Real-time image deblurring using four-wave mixing .... See Entry 106721

42.65G Photon echoes, self-induced transparency, optical saturation and related effects

106829 Storage and time reversal of light pulses using photon echoes. N.W.Carlson, L.J.Rothberg, A.G.Yodh (Div. of Appl. Sci., Harvard Univ., Cambridge, MA, USA), W.R.Babbitt, T.W.Mossberg.
Opt. Lett. (USA), vol.8, no.9, p.483-5 (Sept. 1983).
The authors have studied in the temporal profile of photon-echo signals generated by combined gated CW and pulsed dye-laser excitation of the inhomogeneously broadened, 555.6-nm absorption line of ^{174}Yb vapor. The authors find that the echo profile is, after time reversal, essentially identical with that of the first excitation pulse. The authors give a new analysis of this effect. Since time-reversed pulse reproduction should also occur in inhomogeneously broadened solid samples, and since the authors observe time-reversed reproduced pulses up to 4% as intense as the input pulse, this effect may have important applications in optical signal-processing systems. (6 refs.)

106830 Spin dependence of optical dephasing in ruby: the frozen core. A.Szabo (Div. of Electrical Engng., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
Opt. Lett. (USA), vol.8, no.9, p.486-7 (Sept. 1983).
Measurements of the $^4A_2(-3/2)$ to $\bar{E}(-1/2)$ optical dephasing time in ruby are obtained for the first reported time and compared with the previously studied $^4A_2(-1/2)$ to $\bar{E}(-1/2)$ transition. Frozen-core effects reduce the ratio of dephasing times $T_2(-1/2)/T_2(-3/2)$ to 1.5 from the value 7.6 expected from a simple magnetic tuning rate consideration. (15 refs.)

106831 Three-wave mixing and nonlinear optical transients in the space domain. D.S.Ray (Dept. of Chem. Phys., Indian Assoc. for the Cultivation of Sci., Jadavpur, Calcutta, India).
Phys. Rev. A (USA), vol.28, no.3, p.1841-2 (Sept. 1983).
Three-wave mixing equations under parametric approximation have been recast in the form of Bloch equations for optical modes and a new echo analog of optical transient in the space domain is predicted. (10 refs.)

Interstate dynamics in xanthione: a picosecond photon-echo and optical study .... See Entry 106483

Plastics for high-power laser applications: a review .... See Entry 106792

Oxygen vacancies in lithium niobate .... See Entry 108981

42.65J Beam trapping, self focusing, thermal blooming, and related effects

106832 Self-focusing and self-modulation of electromagnetic waves in semiconductor with superlattice. A.P.Tetervov (Inst. of Semiconductor Phys., Acad. of Sci., Lithuanian SSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.11, p.875-82 (Nov. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.11, p.1231-9 (Nov. 1982). [received: Sept. 1983]
The study deals with propagation of nonlinear electromagnetic waves through the current plasma in a semiconductor with a superlattice. The conditions for self-focusing and self-channeling of a nonlinear wave propagating within a small vicinity of Stark resonance are established and the respective characteristic lengths are determined. The self-modulation of one-dimensional nonlinear waves is also considered. The fundamental equations are shown to admit solutions in the form of solitons. (11 refs.)

Nonlinear antiresonant ring interferometer .... See Entry 105369

Efficient femtosecond optical Kerr shutter .... See Entry 106851

42.70 OPTICAL MATERIALS

106833 How to specify and select transparent EC coatings. C.Bright (Optical & Conductive Coatings, Pacheco, CA, USA).
Photonics Spectra (USA), vol.17, no.7, p.35-6, 38-9 (July 1983).
For pt.I see ibid., vol.17, no.6, p.37-43 (1983). Typical optical, electrical and environmental performance requirements of metallic and metallic oxide transparent electroconductive (EC) coatings are compared with manufacturers' data to determine suitability of coatings for each of the major application types. Special capabilities and technology required of EC coating manufacturers when doing heating and EMI shielding applications are examined citing a specific design example in each case, and preparing specifications for these examples. Finally, these specifications are used in a hypothetical evaluation/selection analysis. (2 refs.)

106834 Gradient index optical materials. D.T.Moore.
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.2-3, p.193-203 (1983). In English. (Otto-Schott-Colloquium on the State of Optical Glass Research 1982, Jena, Germany, 1982).
It is only within the last few years that the potential for gradient indexing in imaging systems has been shown and that the importance of chromatic aberration correction has been demonstrated. As more gradient index materials become available, it may be possible to incorporate them in to conventional lens systems, including photographic objectives and binoculars. (8 refs.)

Otto-Schott-Colloquium on the State of Optical Glass Research 1982 .... See Entry 105025

On the nature of the accumulation effect in laser-induced damage to optical materials .... See Entry 106793

Multiple pulse laser-induced bulk damage in crystalline and fused quartz at 1.064 and 0.532 μm .... See Entry 106794

Picosecond damage studies at 0.5 and 1 μm .... See Entry 106796

Bulk and surface damage thresholds of crystals and glasses at 248 nm .... See Entry 106797

Efficient femtosecond optical Kerr shutter .... See Entry 106851

Fabrication of germanium-coated nickel hollow waveguides for infrared transmission .... See Entry 106859

Some optical properties of materials measured at 1.3 μm .... See Entry 108909

Electrooptic effect in anodic Nb_2O_5 films .... See Entry 109030

Ion beam sputter deposition of optical coatings .... See Entry 109150

Tests of a module for a parabolocylindrical solar installation .... See Entry 109909

42.70C Glass

106835 Refractive-index dispersion for BaF_2-GdF_3-ZrF_4-AlF_3 glasses. S.Mitachi, T.Miyashita (NTT Ibaraki Electrical Communication Lab., Ibaraki-ken, Japan).
Appl. Opt. (USA), vol.22, no.16, p.2419-25 (15 Aug. 1983).
Refractive-index dispersion measurements were performed on bulk specimens of 2-, 4-, or 6-mol% AlF_3 doped $33BaF_2$-$4GdF_3$-$63ZrF_4$ (mol%) glass and 4-mol% LiF, CsF, YF_3, CdF_2, SnF_2, or PbF_2 doped $31.68BaF_2$-$3.84GdF_3$-$60.48ZrF_4$-$4AlF_3$ (mol%) glass in the wavelength region from 0.4047 to 5.3036 μm. The material dispersion curve and zero material dispersion wavelength were estimated on the basis of refractive-index dispersion measurements. The slope of the material dispersion curve for these fluoride glasses was less steep than that for SiO_2 glass in the wavelength range estimated. The zero material wavelength λ_0 shifted to a shorter wavelength with increasing AlF_3 concentration. The λ_0 is 1.675 μm for $31.68BaF_2$-$3.84GdF_3$-$60.48ZrF_4$-$4AlF_3$ (mol%) glass. When 4-mol% LiF, CsF, YF_3, CdF_2, SnF_2, or PbF_2 were doped into these glasses, each λ_0 shifted from 1.675 to 1.670, 1.668, 1.673, 1.681, 1.683, or 1.704 μm, respectively. The temperature dependence values of the refractive-index dispersion and material dispersion for $31.68BaF_2$-$3.84GdF_3$-$60.48ZrF$-$4AlF_3$ (mol%) glass were also obtained. The temperature coefficients of the refractive index were negative values ($dn/dT_{\mathrm{relative}} = -1.0\times10^{-5}/°C$) and the wavelength dependence of dn/dT was small. The wavelength λ_0 shifted from 1.675 to 1.605 μm, due to the rise in the measurement temperature from 25°C to 250°C. (15 refs.)

106836 Recent advances in optical fiber materials. P.C.Schultz.
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.2-3, p.215-25 (1983). In English. (Otto-Schott-Colloquium on the State of Optical Glass Research 1982, Jena, Germany, 1982).
This review summarizes important new results in optical fiber materials and processes, concentrating on published reports of the past year. Included are high deposition rate/large size preforms made by RF-plasma inside vapor deposition (IVD) and outside vapor deposition(OVD), all-vapor-deposited singlemode fibers made by OVD and VAD, and a 6 dB/km fiber made by sol gel techniques. New oxide glasses include Ta_2O_5, Sb_2O_3, and Al_2O_3-doped silicas (the latter 0.7 dB/km), and a 13 dB/km Sb_2O_3-GeO_2 fiber. A very active research field is fluoride glass fibers with potentially 10^{-3} dB/km losses: a record 21 dB/km ZrF_4-based glass fiber is reported made by direct melt techniques, as well as data on impurity absorption, optical dispersion, viscosity, strength and fatigue of these glasses. (32 refs.)

106837 Glass-forming in ternary tellurite systems. M.Marinov, V.Kozhukharov (Inst. of Chem. Technol., Sofia, Bulgaria), W.Vogel, H.Burger.
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.2-3, p.253-61 (1983). In English. (Otto-Schott-Colloquium on the State of Optical Glass Research 1982, Jena, Germany, 1982).
Presents results of glassforming investigations in binary- and ternary-component tellurite systems. Studies are carried out mainly on semiconducting and optical glasses. Semiconducting glasses from the systems TeO_2-R_mO_n-T_mX_n, TeO_2-R_mX_n-T_mX_n, where R_mO_n is a metal oxide, R_mX_n—a non-transition metal halide and T_mX_n—a transition metal halide (fluoride, chloride or bromide) have been investigated at atm. pressure, for glass formation ability and some physicochemical properties. A detailed study has also been carried out for glass formation in systems without transition metal oxides. The authors have used the combinations: TeO_2-P_2O_5-R_mO_n, TeO_2-P_2O_5-R_mX_n, TeO_2-B_2O_3-R_mO_n, and TeO_2-B_2O_3-R_MX_N, as a basis for stable optical glass preparation, the latter exhibiting high values of refractive index and low dispersion. This has been accomplished with several tellurite-metaphosphate and tellurite-metabolrate ternary systems. (35 refs.)

Oxide and halide laser glasses .... See Entry 106769

On the nature of the accumulation effect in laser-induced damage to optical materials .... See Entry 106793

Bulk and surface damage thresholds of crystals and glasses at 248 nm .... See Entry 106797

Gradient index optical materials .... See Entry 106834

Precision molded-glass optics .... See Entry 106902

New light on fiber fabrication and materials .... See Entry 106905

Some optical properties of materials measured at 1.3 μm .... See Entry 108909

The influence of the structure of different arsenic chalcogenide glasses on refractive index and dispersion .... See Entry 108910

Influence of glass structure on refractive index and dispersion .... See Entry 108917

Absorption and dispersion of optical glass intrinsic absorption in vacuum ultraviolet region .... See Entry 108977

Influence of elementary structure defects on the optical properties of glasses .... See Entry 108986

Reactivity and optical properties of silicate glass surfaces .... See Entry 109808

42.70G Light-sensitive materials

106838 Photoresist strongly absorbent in optical spectrum. K.H.Brown, R.J.von Gutfeld (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.2, p.486-7 (July 1983).
This photoresist, which can be subjected to conventional UV treatment, is useful for producing optimal or acoustic holograms with laser excitation. (no refs.)

Thermophotographic characteristics of phenanthrene .... See Entry 105404

Some SEM studies on photographic emulsions .... See Entry 105410

Transparent conducting tin oxide films for application in heterojunction solar cells .... See Entry 109900

42.72 OPTICAL SOURCES AND STANDARDS

(for spectroscopic light sources, see also 07.65)

106839 Modified AC light source for constant output. A.J.Burke (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.2, p.637-9 (July 1983).
The author describes a synchronization circuit which effectively modifies an AC light source to provide a constant output to an optical signal. (no refs.)

106840 Conversion of a light beam by an intricate quasi-stochastic system of diffusers. A.V.Gnatovskii, M.I.Kovelenko.
Ukr. Fiz. Zh. (USSR), vol.28, no.7, p.1108-9 (July 1983). In Russian.
Discusses the possibility of directed formation of light field with averaged spatial-angular characteristics using various quasi-stochastic systems of diffusers, connected by an aperture. (3 refs.) *V.G.P.*

A readily portable source unit for the calibration of Dobson ozone spectrophotometer wedges .... See Entry 105383

42.78 OPTICAL LENS AND MIRROR SYSTEMS

(for microscopes, see 07.60P; for photographic instruments, see 07.68; for astronomical telescopes, see 95.55)

106841 Application of VanderLugt's operational notation to finite aperture lens systems: comment. D.Stoler (Riverside Res. Inst., New York, NY, USA).
Appl. Opt. (USA), vol.22, no.16, p.2405-7 (15 Aug. 1983).
Comments on Hagler's work (see ibid., vol.22, p.768, 1983) the content of which is that, when the numerical values of the parameters permit, one should treat finite apertures by means of the method of stationary phase. (2 refs.)

106842 Optical performance of a diffraction-limited molded-glass biaspheric lens. R.O.Maschmeyer, R.M.Hujar, L.L.Carpenter, B.W.Nicholson, E.F.Vozenilek (Res. & Dev. Labs., Corning Glass Works, Corning, NY, USA).
Appl. Opt. (USA), vol.22, no.16, p.2413-15 (15 Aug. 1983).
Optical performance results are reported for a molded-glass biaspheric lens. The 6-mm optical diam lens is intended for use in a laser-based optical disk application. The design with fabrication tolerances has an expected on-axis transmitted wave-front performance of 0.06-wave rms optical path difference (OPD) when tested at 0.6328 μm and a numerical aperture of 0.45. Transmitted wave-front aberrations were measured on actual molded lenses using a heterodyne interferometer. Typical performance was 0.05-0.08-wave rms-OPD. Experimental results involving mold rotation indicate that lens performance is primarily limited by a surface figure accuracy of one of the molds. (1 ref.)

106843 Grazing incidence toroidal mirror pairs in imaging and spectroscopic applications. A.M.Malvezzi (CISE, Milano, Italy), G.Tondello.
Appl. Opt. (USA), vol.22, no.16, p.2444-7 (15 Aug. 1983).
The optical performance of pairs of toroidal mirrors in grazing incidence has been studied analytically and numerically. Two types of toroidal surface are possible: football and bicycle tire. In grazing incidence and for configurations that compensate up to second-order aberrations, there are significant differences in performance between the two types. For football-type tori the best configuration appears to be *Z*-shaped with tangential and sagittal foci at the

middle point between the mirrors. For bicycle tire-type tori the best configuration is *U*-shaped with the tangential focus at the middle point and the sagital at infinity. (6 refs.)

106844 A method of synthesis of optical coverings which uses the necessary optimality conditions. A.V.Tikhonravov (Dept. of Math., Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.108-10 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.91-3 (1982).
The study of necessary conditions for a minimum of the estimator functional in the problem of synthesis of optical coverings, leads to a result which is analogous to the Pontryagin principle of the maximum. It is shown that these results can be used for the construction of solution of the synthesis problem. (7 refs.)

106845 Design and testing of lenses for optical disk technology. P.Kuttner (Optische Werke G. Rodenstock, Munchen, Germany).
Opt. Eng. (USA), vol.22, no.4, p.473-8 (July-Aug. 1983).
Optical disk technology today finds widespread application in laser vision, compact disk, and data storage equipment. The required specifications of lenses which meet these requirements are discussed. Their image quality is given by RMS of wave aberration, by point spread function by encircled energy, or by modulation transfer function (MTF). Due to the automatic servo focusing technique, a certain amount of field curvature can be tolerated. Measured results of image quality are compared with theoretical values. (16 refs.)

106846 Method for numerical investigation of adaptive optical aperture sensing systems. M.A.Vorontsov, S.S.Chesnokov (Moscow State Univ., Moscow, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.11, p.939-46 (Nov. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.11, p.1310-18 (Nov. 1982). [received: Sept. 1983]
A method is proposed for analyzing multichannel adaptive aperture sensing systems numerically, based on calculation fo the increment to the functional being optimized (quality criterion) via the solution of auxiliary problems. The method permits studying the operation of an adaptive system with an arbitrary number of control channels. The influence of the configuration of the receiving aperture and the properties of the reflecting surface of the object on the efficiency of adaptive focusing of radiation in a linear randomly inhomogeneous medium is analyzed using numerical solutions. (9 refs.)

Accurate method of measuring the temperature independence of the reflectance of metal mirror surfaces .... See Entry 105365

The Fresnel number in terms of ray matrix elements .... See Entry 106697

Improvement of chromatic aberration of an aspherical plate corrector for prime focus .... See Entry 106719

The effect of angular selectivity on the monochromatic imaging performance of volume holographic lenses .... See Entry 106731

Metrological features of a laser device with a single-mirror deflecting unit .... See Entry 106775

Optical resonators with Gaussian reflectivity mirrors: misalignment sensitivity .... See Entry 106788

Single and multiple pulse catastrophic damage in diamond-turned Cu and Ag mirrors at 10.6, 1.06 and 0.532 μm .... See Entry 106795

Gradient index optical materials .... See Entry 106834

Limit of concentration for cylindrical concentrators under extended light sources .... See Entry 106847

Spatial filtering by a spherically illuminated coherent optical processor .... See Entry 106849

Double ion exchanged chirp grating lens in lithium niobate waveguides .... See Entry 106858

The effect of axial gradient index lens .... See Entry 106860

A method of calculating the efficiency for coupling light power from a LED into an optical fibre by use of a sphere lens .... See Entry 106879

Electrooptical Fresnel lens-scanner with an array of channel waveguides .... See Entry 106900

Aspheric lenses: an easier way .... See Entry 106901

Precision molded-glass optics .... See Entry 106902

Scatter ratio test for lens surface quality measurement .... See Entry 106903

***Q*-switched frequency-doubled Nd:YAG laser surface finishing of metals** .... See Entry 106904

Method for subaperture testing interferogram reduction .... See Entry 106907

Directional intercept factor of truncated CPCs .... See Entry 109850

Automatic methods of adjusting facet concentrators and heliostats .... See Entry 109852

Tests of a module for a parabolocylindrical solar installation .... See Entry 109909

Three-dimensional stereometric measurement system using optical scanners, cylindrical lenses, and line sensors .... See Entry 110121

Diffraction on a segmented telescope mirror .... See Entry 110912

42.78H Coatings

How to specify and select transparent EC coatings .... See Entry 106833

A method of synthesis of optical coverings which uses the necessary optimality conditions .... See Entry 106844

Scaling up the neutral solution antireflection process .... See Entry 106906

Two-layer antireflection coating for silicon photoelements .... See Entry 109887

Plasma-enhanced CVD silicon nitride antireflection coatings for solar cells .... See Entry 109898

42.80 OPTICAL DEVICES, TECHNIQUES AND APPLICATIONS

(for optical instruments and techniques, see 07.60; for optical spectroscopy, see 07.65; for photography, see 07.68; for holography, see 42.40; for lasers, see 42.55 and 42.60; for masers, see 42.52)

106847 Limit of concentration for cylindrical concentrators under extended light sources. J.C.Minano, A.Luque (Univ. Politecnica, Inst. de Energia Solar, Madrid, Spain).
Appl. Opt. (USA), vol.22, no.16, p.2437-43 (15 Aug. 1983).
Cylindrical concentrators illuminated by an extended source with an arbitrary distribution of radiance are analyzed taking into account basic properties derived from the Fermat principle and not from the specific concentrator shape. The upper limit of concentration achievable with this type of concentrator is obtained and it is found to be lower than that of general (3-D) concentrators. Cylindrical compound parabolic concentrators are analyzed in the light of this theory, and it is shown that they achieve the highest optical concentration possible for a cylindrical concentrator. (5 refs.)

106848 Optical transmissivity of magneto-optic switching elements. B.Hill (Philips GmbH Forschungslab. Hamburg, Hamburg, Germany).
Philips J. Res. (Netherlands), vol.38, no.3, p.150-63 (1983).
Magneto-optic switching elements are used in the light switching array LISA, a linear array of miniaturized light valves integrated on a garnet chip. LISA has been developed for high resolution optical printers on the basis of electrophotography or for grey-scale electronic recording on photographic material. In this article the optical properties of a switching element of LISA are outlined as a function of the wavelength of light. The typical features for special applications are summarized, and design rules for optimizing the component in view of the application are given. (8 refs.)

Otto-Schott-Colloquium on the State of Optical Glass Research 1982 .... See Entry 105025

Some experiments in partially coherent imaging and modulation transfer function evaluation .... See Entry 105082

A hinged prism device for alignment in hilly terrain .... See Entry 105355

Cyclic interferometers for optical testing .... See Entry 105367

A readily portable source unit for the calibration of Dobson ozone spectrophotometer wedges .... See Entry 105383

Method for numerical investigation of adaptive optical aperture sensing systems .... See Entry 106846

A prism reflector of anti-resonant ring configuration .... See Entry 106852

Light propagation along periodic metal-dielectric layers .... See Entry 106857

Axis-alignment method for arc-fusion splice of single-mode fiber using a beam splitter .... See Entry 106882

Orientational relationships for optically non-symmetric solar collectors .... See Entry 109916

Three-dimensional stereometric measurement system using optical scanners, cylindrical lenses, and line sensors .... See Entry 110121

Pickering-racine prisms revisited .... See Entry 110914

42.80B Spatial filters, zone plates

106849 Spatial filtering by a spherically illuminated coherent optical processor. R.S.Kasana (Phys.-Tech. Bundesanstalt, Braunschweig, Germany).
Acta Phys. Pol. A (Poland), vol.A64, no.2, p.239-47 (Aug. 1983).
This paper reports on the spatial filtering in the case of a spherically illuminated processor consisting of a single lens or a pair of lenses. Various theoretical conditions for using it in different forms have been established. The flexibility provided by this type of (general) illumination in scaling parameter and Fourier-transform planes is investigated. The salient features of this processor are also discussed here. A simple spatial filtering technique has been utilised for generating higher frequencies which are arranged in the form of an interference matrix. A condition for achieving the exact Fourier transform without using any collimating device has been theoretically investigated and experimentally verified. It is also proved that the processor illuminated by parallel light is a particular case of this. Several spatial filtering operations have been performed with the exact Fourier transforms and the results obtained in both cases of a coherent optical processor illuminated by spherical as well as collimated wave fronts have been compared. (27 refs.)

The Fresnel number in terms of ray matrix elements .... See Entry 106697

Hybrid logic processing in parallel .... See Entry 106710

Color signal correlation detection by matched spatial filtering .... See Entry 106712

Spatial filtering real-time spatial frequency and density pseudocolor encoding .... See Entry 106714

Electrooptical Fresnel lens-scanner with an array of channel waveguides .... See Entry 106900

42.80C Spectral and other filters

106850 Harmonic response of a tunable Solc filter. J.F.Lotspeich, R.R.Stephens, D.M.Henderson (Hughes Res. Labs., Malibu, CA, USA).
Appl. Opt. (USA), vol.22, no.17, p.2743-6 (1983).
The spectral evolution and transitional behavior of the odd harmonic windows in a broadly tuned electrooptic Solc filter are described theoretically and demonstrated experimentally. The authors show how the fundamental and all the odd harmonic passbands split and eventually merge in pairs with nearest neighbors to become even harmonics of the fundamental λ_f as the principal pass wavelength λ_p is tuned from $\lambda_p=\lambda_f$ to $\lambda_p \gg \lambda_f$. (7 refs.)

Fourier processing with phase-reflection gratings .... See Entry 106722

42.80D Monochromators

Design of aberration-reduced holographic gratings for Seya-Namioka monochromators .... See Entry 106730

42.80E Shutters, windows, diaphragms, deflectors, choppers

106851 Efficient femtosecond optical Kerr shutter. J.Etchepare, G.Grillon, A.Migus, J.L.Martin, G.Hamoniaux (Lab. d'Optique Appl., Ecole Polytech.-Ecole Nat. Superieure de Tech. Avancees, Palaiseau, France).
Appl. Phys. Lett. (USA), vol.43, no.5, p.406-7 (1 Sept. 1983).
Conjugated molecules, with large optical nonlinearities, are tested as materials usable for femtosecond optical Kerr shutter technique. With β-carotene, in acetone solution, the authors have achieved responses limited by the 100-fs width of the optical pulses and characterized by a resolution better than 1 ps with a dynamic range of 100. (13 refs.)

106852 A prism reflector of anti-resonant ring configuration. I.D.Carr, D.C.Hanna (Dept. of Phys., Univ. of Southampton, Southampton, England).
Opt. & Quantum Electron. (GB), vol.15, no.5, p.447-50 (Sept. 1983).
Two identical prisms are combined to form an anti-resonant ring reflector, giving total reflection without the use of coatings or roof edges. When used as the total reflector in a Q-switched Nd:YAG laser this device has shown a damage threshold twice that of a multilayer reflector. (11 refs.)

High-speed shutter for single lens reflex cameras ....See Entry 105399

Metrological features of a laser device with a single-mirror deflecting unit ....See Entry 106775

42.80F Gratings, echelles

106853 Mechanically ruled aberration-corrected concave gratings for a polychromator with a self-scanned sensor array. T.Kita (Hitachi Ltd., Central Res. Lab., Tokyo, Japan).
J. Spectrosc. Soc. Jpn. (Japan), vol.32, no.3, p.173-82 (1983). In Japanese.
A method of designing a mechanically ruled aberration-corrected concave grating and its mounting for a polychromator with a self-scanned sensor array is described. An aberration-corrected concave grating with flat detection field and astigmatism free focusing properties has been designed and fabricated for a wavelength-meter to measure the laser diode oscillation in the wavelength range of 720-820 nm. The grating has been designed so as to take also the linearity of wavelength and the channel number of a sensor array into account. (11 refs.)

106854 Diffraction grating efficiencies. An exact differential algorithm valid for high conductivities. R.A.Depine, J.M.Simon (Dept. de Fisica, Univ. de Buenos Aires, Buenos Aires, Argentina).
Opt. Acta (GB), vol.30, no.9, p.1273-86 (Sept. 1983).
An exact differential algorithm is developed, using a conformal transformation for the half-space outside the grating and a non-conformal transformation that coincides with the former for the interior of the metal. As an example, the theory is applied to the $\mathbf{E}_\parallel$ mode for a cycloidal profile. (8 refs.)

Nonlinear antiresonant ring interferometer ....See Entry 105369

Modal analysis of spatially periodic anisotropic media ....See Entry 106694

Diffraction characteristics of planar absorption gratings ....See Entry 106695

Diffraction efficiency of absorption gratings ....See Entry 106701

Color signal correlation detection by matched spatial filtering ....See Entry 106712

Self-imaging phenomenon. Lateral shift of Fresnel images ....See Entry 106717

Fourier processing with phase-reflection gratings ....See Entry 106722

UV-holographic gratings in TS-diacetylene single crystals. Spatial resolution and sensitivity ....See Entry 106726

Design of aberration-reduced holographic gratings for Seya-Namioka monochromators ....See Entry 106730

The effect of angular selectivity on the monochromatic imaging performance of volume holographic lenses ....See Entry 106731

Coordinate transformations via multifacet holographic optical elements ....See Entry 106733

Double ion exchanged chirp grating lens in lithium niobate waveguides ....See Entry 106858

Simple theory for surface-plasmon-polariton resonance on sinusoidal metal surface: application to SERS ....See Entry 108943

Automatic topography using high precision digital moire methods ....See Entry 110123

Diffraction on a segmented telescope mirror ....See Entry 110912

42.80K Optical beam modulators

106855 Two-dimensional magneto-optic spatial light modulator for signal processing. W.E.Ross (Litton Data Systems, Van Nuys, CA, USA), D.Psaltis, R.H.Anderson.
Opt. Eng. (USA), vol.22, no.4, p.485-90 (July-Aug. 1983).
This electrically alterable magneto-optic device can be used as a two-dimensional spatial light modulator in an optical image processor or a display system. A thin magnetic garnet film is epitaxially deposited on a transparent nonmagnetic garnet substrate in the manner of magnetic bubble memory films. Semiconductor photolithographic techniques are used to etch the film into a two-dimensional array of mesas and to deposit X-Y drive lines for matrix-addressed current switching of the mesa magnetization. Electromagnetic switching provides higher speed switching than a previously reported thermal switching method. The axis of polarization of polarized light transmitted through the film is rotated by the Faraday effect in opposite directions where opposite magnetic states have been written, and a polarization analyzer converts this effect into image brightness modulation. The resulting high speed random access light modulator is applicable to all three planes of the classic coherent three-plane correlator. Although the basic effect is binary, there are at least four possible configurations which achieve gray scale rendition. (8 refs.)

106856 Frequency shifting of light by means of two phase modulators in tandem. T.Tudor, I.Legrand, I.Winkler, M.Ciobanu (Faculty of Phys., Univ. of Bucharest, Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.4, p.343-50 (1983).
Analysis of the spectral structure of the light modulated by means of an electrooptic device which uses two phase modulators in tandem is carried out. The matrix treatment of this modulator and the three-dimensional vector diagram of the modulated light are presented. The conditions in which the modulator acts as a frequency translator are experimented. (10 refs.)

High-speed retardation modulation ellipsometer ....See Entry 105361

Subnanosecond pulse generation of 193 nm radiation by pulse slicing ....See Entry 106786

Waveguide light modulators using the Keldysh-Franz effect in gallium arsenide ....See Entry 106867

42.80L Optical waveguides

(for fibre optical waveguides, see 42.80M)

106857 Light propagation along periodic metal-dielectric layers. S.Kawakami (Res. Inst. of Electrical Communication, Tohoku Univ., Sendai, Japan).
Appl. Opt. (USA), vol.22, no.16, p.2426-8 (15 Aug. 1983).
Analysis and experiments on TE and TM waves along periodically laminated metal-dielectric layers are described; the waves propagate parallel to the layers. Aluminum (Al) and silica (SiO_2) are chosen as the metal and the dielectric, respectively. The author finds that the attenuation for TE waves is much higher than that for TM waves. Typically, α_{TE}/α_{TM} ranges from 10^3 to 10^4. Thus, an optical polarizer can be made in a multilayer structure. (6 refs.)

106858 Double ion exchanged chirp grating lens in lithium niobate waveguides. C.Warren, S.Forouhar, W.S.C.Chang (Dept. of Electrical Engng. & Computer Sci., Univ. of California, San Diego, La Jolla, CA, USA), S.K.Kao.
Appl. Phys. Lett. (USA), vol.43, no.5, p.424-6 (1 Sept. 1983).
An integrated optical chirped grating lens has been produced which exhbits high throughput efficiency (75%) and large angular field of view (3°). The waveguide substrate is x-cut lithium niobate, and ion exchange in benzoic acid is the method using for making the lens and the waveguide. (6 refs.)

106859 Fabrication of germanium-coated nickel hollow waveguides for infrared transmission. M.Miyagi, A.Hongo, Y.Aizawa, S.Kawakami (Res. Inst. of Electrical Communication, Tohoku Univ., Sendai, Japan).
Appl. Phys. Lett. (USA), vol.43, no.5, p.430-2 (1 Sept. 1983).
Circular hollow nickel waveguides with an inner germanium layer are fabricated by using a method based on RF sputtering, plating, and etching techniques. Transmission losses less than 0.5 dB are achieved incuding launching losses for straight waveguides with 1.5 mm$\phi\times$1 m at 10.6-μm wavelength. Bending losses of the waveguides are also examined. (12 refs.)

106860 The effect of axial gradient index lens. Chen Yaosheng (Xian Inst. of Optics & Fine Mech., Acad. Sinica, Beijing, China).
Acta Opt. Sin. (China), vol.3, no.4, p.374-9 (1983). In Chinese.
Presents a derivation of the locus equation for a rectangular waveguide for which the index distribution function is $n_{(x)}=n_0(1-1/2\ Ax^2)$. The locus of light rays can be described with a logarithmic function as the incidence plane is the central plane having refractive index n_0, and the locus of light rays can be indicated with an arc tangent function. When the tangential plane crosses the n_0 plane, the locus of paraxial rays located in the tangential plane is a well-known sinusoidal function. According to the locus equation, this waveguide has a function similar to a parallel plate or divergent lens or cylindrical lens. When it is used as parallel plate, the waveguide offers much larger displacement than that given by a parallel plate made of homogenous medium. As a divergent lens, the waveguide cannot be used as an image-forming element, because it only acts when light rays have a certain angle with the optical axis. The image-forming feature depends on the distribution constant A, the central refraction index n_0 and the thickness z_0. Thus, the locus line may be located in the outside or inside or at the end of the medium. The waveguide may be used in optical systems. Emphasis is placed on deriving the locus equation of light ray motion in the inside of the medium according to the eikonal equation. (4 refs.)

106861 Waveguide properties of gradient periodic fiber lightguides. P.M.Kolesnikov, I.P.Rudenko (A.V. Lykov Inst. of Heat & Mass Transfer, Acad. of Sci., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.44, no.1, p.109-13 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.129-35 (Jan. 1983). [received: Sept. 1983]
Propagation of lower surface waves is studied in gradient fibers with longitudinal additive inhomogeneity. (19 refs.)

106862 Diffraction of the surface light wave in a planar surface-acoustic-wave lightguide. V.N.Parygin, N.S.Tankovski (Dept. of Phys. of Oscillations, Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.55-9 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.48-52 (1982).
The authors formulate a general equation for the interaction of light in the planar surface-acoustic-wave lightguide and obtain a solution of this equation which determines the intensity of light in all possible modes and diffraction orders. An analogy is shown between the diffraction of light in a multi-mode lightguide and in an anisotropic medium. (3 refs.)

106863 The beam propagation method: an analysis of its applicability. L.Thylen (Telefonaktiebolaget L.M. Ericsson, Stockholm, Sweden).
Opt. & Quantum Electron. (GB), vol.15, no.5, p.433-9 (Sept. 1983).
Simple quantitative conditions for the applicability of the beam propagation method (BPM) in isotropic and anisotropic media are given. These conditions are derived using the operator formalism employed in the BPM in its conventional formulation. The basic limitations of the BPM are highlighted at the same time. (10 refs.)

106864 Optical waveguides in $LiTaO_3$ formed by proton exchange. W.B.Spillman,Jr., N.A.Sanford, R.A.Soref (Sperry Res. Center, Sudbury, MA, USA).
Opt. Lett. (USA), vol.8, no.9, p.497-8 (Sept. 1983).
The authors describe the fabrication of optical waveguides in $LiTaO_3$ using proton exchange in hot benzoic acid. All specimens analyzed were X cut. An increase in surface extraordinary index of $\sim$0.14 has been observed for samples exchanged for 3 h at a melt temperature of 249°C. No change was observed in the ordinary index. Waveguide fabrication was facilitated by further baking the samples for an extended period of time at a temperature hotter than the acid melt. The latter technique also served to minimize the surface damage that is characteristic of acid baths exceeding roughly 4 h. The depth of proton exchange in X-cut $LiTaO_3$ appears to be considerably less than would be the case for X-cut $LiNbO_3$ under the same conditions. (5 refs.)

106865 Expressions for the coupling coefficient of a rectangular-waveguide directional coupler. M.Kuznetsov (Dept. of Electrical Engng. & Computer Sci., MIT, Cambridge, MA, USA).
Opt. Lett. (USA), vol.8, no.9, p.499-501 (Sept. 1983).
More-accurate expressions are obtained for the coupling coefficient of the dielectric rectangular-waveguide directional coupler. The previous expressions may overestimate the coupling coefficient by as much as a factor of 2 in some cases of interest. (7 refs.)

106866 Optical waveguide components in organic photochromic materials. I.Bennion (Allen Clark Res. Centre, Plessey Res. (Caswell), Caswell.Ltd.,England), A.G.Hallam, W.J.Stewart.
Radio & Electron. Eng. (GB), vol.53, no.9, p.313-20 (Sept. 1983).
The principles and techniques for preparing and using photochromic waveguide passive components for fibre optics are described. The sandwiched layer is considered to have a robust format in which fibre-to-waveguide alignment is fairly easy and reliable. (no refs.)

106867 Waveguide light modulators using the Keldysh-Franz effect in gallium arsenide. A.V.Maksimov, A.N.Blagodarov, N.A.Nagovitsyn, V.Ya.Kunin, V.I.Fomichev (M.I. Kalinin Polytech. Inst., Leningrad, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.28, no.2, p.243-5 (Feb. 1983). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.53, no.2, p.392-4 (Feb. 1983). [received: Sept. 1983]
An important task in designing integrated optical systems is to develop waveguide light modulators which are fast and compact. Of particular promise in this regard is the use of the Keldysh-Franz effect (electroabsorption) in GaAs to directly modulate the emission intensity of lasers and light-emitting diodes fabricated using GaAs. The authors study electroabsorption in plane waveguides with epitaxial $(n-n^+)$ GaAs structures. (6 refs.)

106868 Phase matched optical dielectric waveguide using the artificial anisotropic structure. T.Mizumoto, Y.Naito (Faculty of Engng., Tokyo Inst. of Technol., Tokyo, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.6, p.454-61 (June 1983). In Japanese.
The authors propose a new phase matching technique using an artificial anisotropic structure. The proposed structure, which does not require an optical anisotropic crystal, is constructed with a dielectric slab waveguide loaded by dielectric strips of appropriate dimensions. The propagation constants of *Ex* and *Ey* modes of this waveguide are calculated by a rigorous numerical analysis based on the mode matching method The phase matching conditions are shown. The authors also fabricate the artificial anisotropic dielectric waveguide to confirm the function of the proposed structure experimentally. A thin film nonreciprocal mode converter and/or isolator may be realized by this phase matching technique. (9 refs.)

106869 Multi-glass-rod optical-fiber splicers and connectors made by drawing technique. S.Nagasawa, H.Murata (Ibaraki Electrical Communication Lab., NTT, Ibaraki, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Sect. E (Japan), vol.E66, no.5, p.305-12 (May 1983).
New splicers and connectors for multimode fibers have been fabricated. They contain precision multi-glass-rod arrangement, made by drawing, for aligning the fibers. In the multirod fabrication, the rod deformation of pyrex glass due to fusing is less than 1% in the rod array direction, in the 900-1000°C heating temperature range. The small deformation of 1% has no effect on splicing loss and fiber setting on the fabricated grooves. The multirod arrangement exhibits about 1 μm fabrication precision, because of the scaling down effect due to the drawing process. The splicers using a linear-multi-glass-rod arrangement exhibit 0.1 dB average splicing losses and slight loss fluctuation, less than 0.05 dB, in the $-20°C-+60°C$ temperature range. The connectors using a polygonal-multi-glass-rod arrangement exhibit 0.2 dB average connecting losses with index matching and 3.5 μm average off-axes. The splicers and connectors are potentially low in cost. (9 refs.)

Efficient SHG of IR radiation by guided waves in MNA ....See Entry 106813

A method of calculating the efficiency for coupling light power from a LED into an optical fibre by use of a sphere lens ....See Entry 106879

Electrooptical Fresnel lens-scanner with an array of channel waveguides ....See Entry 106900

42.80M Fibre optics

106870 Reflected light in the coupling of semiconductor lasers with tapered hemispherical end fibers. H.Kuwahara, Y.Onoda, M.Goto, T.Nakagami (Fujitsu Labs. Ltd., Kawasaki, Japan).
Appl. Opt. (USA), vol.22, no.17, p.2732-8 (1983).
The amount of reflected light fed back in the coupling of semiconductor lasers and tapered hemispherical-end (TH) fiber is estimated. Reflection from incident hemisphere is estimated to be below -50 dB, from the loss in the coupling between the laser and its virtual image. For multimode TH fiber reflection of backward-propagating light from connections can be reduced to below -50 dB by an $\sim$10-μm lateral displacement parallel to the junction plane; there is a small penalty in forward-coupling efficiency. The reduction of reflection is confirmed by measuring relative intensity noise of coupled laser light. (10 refs.)

106871 Optical loss increase of phosphor-doped silica fiber at high temperature in the long wavelength region. N.Uesugi, T.Kuwabara, Y.Koyamada, Y.Ishida, N.Uchida (Ibaraki Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Ibaraki-ken, Japan).
Appl. Phys. Lett. (USA), vol.43, no.4, p.327-8 (15 Aug. 1983).
The wavelength-dependent loss increase in the long wavelength region is revealed for phosphor-doped silica fiber at a high temperature around 200°C. The loss increases around 1.3 μm and becomes larger for longer wavelength regions. The loss increase is suppressed by reducing P_2O_5 dopant concentration. The overtone absorption of Ge-OH at 1.41 μm as well as that of Si-OH at 1.39 μm also increases markedly. The possible origin of the loss increase is discussed. (10 refs.)

106872 The development of optical communication. W.A.Gambling (Univ. of Southampton, Southampton, England).
J. Electr. & Electron. Eng. Aust. (Australia), vol.3, no.2, p.80-5 (June 1983).
A description is given of the requirements which led to the need for increased bandwidth in communication systems, together with an outline of the early attempts at optical communication, which resulted in optical fibre waveguides. The various potential optical communication systems and their microwave equivalents are compared. The properties of optical fibres are reviewed and comparisons with coaxial and microwave relay systems presented. Existing optical fibre systems are comparatively crude and possible future developments are discussed. (no refs.)

106873 Absorption losses and thermal diffusivity of optical fibers investigated by photothermal method: theory and experiments. D.Chardon, S.J.Huard (Lab. d'Experiences Fondamentales en Optique, Centre Univ. d'Orsay, Orsay, France).
Can. J. Phys. (Canada), vol.61, no.9, p.1334-46 (Sept. 1983).
Both the absorption coefficient and the thermal diffusivity of an optical fiber have been measured using photothermal methods: photoacoustics (PA) and photothermal deflection (PD). The amplitude of the photothermal signal is proportional to the heat density generated in the fiber core. This in turn is proportional to the light absorption coefficient β. Thus, these techniques allow one to separate the absorption and Rayleigh scattering losses. The results obtained by the two methods are in agreement. A threshold value of 10 dB km^{-1} mW has been determined experimentally. In both cases, the device is calibrated by replacing the fiber with a heated electric wire. Moreover, the heat must diffuse from the core to the gas so that when the light is modulated, a phase delay appears. A study of phase delay versus modulation frequency gives the thermal diffusivity of the fiber. This is required in order to improve fiber sensors. Theoretically, the cylindrical geometry of the sample permits simple calculations. The thermoelastic equations in solids and coupled thermodynamic ones in the gas have been solved without neglecting viscosity effects. Noting that silica is almost unexpansible, an algebraic expression of the signal has been obtained without any assumptions on the gas transformation processes. Finally, the PA and PD techniques are compared and some extensions are presented. (23 refs.)

106874 Very low-loss and highly reproducible optical fibres by a pressurized MCVD method. E.Modone, G.Parisi, G.Roba (CSELT, Torino, Italy).
CSELT Rapp. Tec. (Italy), vol.11, no.4, p.283-7 (Aug. 1983).
Very low-loss fibres have been obtained by a pressurized MCVD-method (modified chemical vapour deposition). The minimum loss is 0.35 dB/km at 1.58 μm wavelength for a high numerical aperture (NA=0.23) graded-index optical fibre. The improvement is based on a fluid-dynamic control of preform inner pressure and diameter, and is obtained by a feedback loop between a pressurizing apparatus and a mass flow controller of a gas parallel line. By preform pressurizing, pure silica clad and germania-doped silica core optical fibres have been realized with very high optical and geometrical reproducibility: minimum attenuation values in 0.35-0.55 dB/km range at 1.5-1.6 μm wavelengths; circularity and core/cladding concentricity with errors smaller than 1%. (13 refs.)

106875 Multiquartic approximation in single-mode optical fibres. G.Coppa, P.Di Vita (CSELT, Torino, Italy).
CSELT Rapp. Tec. (Italy), vol.11, no.4, p.289-91 (Aug. 1983).
A new stratification method based on the approximation of the actual index profile of the fibre by means of a set of quartic curves is proposed. The method allows one to deduce accurately the propagation characteristics in a small calculation time, particularly for fibres with non-monotonic index profiles. (6 refs.)

106876 Fibre-optic gyroscope. V.N.Saxena (Inst. of Armament Technol., Pune, India).
Def. Sci. J. (India), vol.33, no.2, p.177-81 (April 1983). [received: Aug. 1983]
Comparative study of mechanical, ring-laser and fibre-optic gyroscopes has been made. The single mode fibre-optic gyroscope having a large number of turns of the optical fibre in the spool, replacing *He-Ne* gas laser by a *GaAs* laser diode, thereby reducing the noise level, and using fully integrated fibre-optics, works out to be the final analysis, for safe navigation and homing of the guided missiles. (9 refs.)

106877 Theory of multiplicative noise caused by coupling loss and amplitude vector rotation in optical communication channels. O.Hirota (Dept. of Phys. Electronics, Tokyo Inst. of Technol., Tokyo, Japan), J.Toda.
IEEE Trans. Commun. (USA), vol.COM-31, no.8, p.992-9 (Aug. 1983).
From a general optical channel model, it is shown that the coupling loss intensity noise generated at connections of optical channels is caused by amplitude vector rotation and its dependency upon the coupling coefficient. The shape of the polarization is not important. This noise becomes multiplicative noise so that the noise disturbs signals directly even if fluctuations of rotation of the amplitude vector are of low frequency. Detailed spectral properties and SNR are given for this type of noise, and the existence of a lower bound of SNR is shown. The coupling loss intensity noise becomes serious in the coupling of fibers and optical circuits, while it will not be important for the splicing of fibers. (21 refs.)

106878 Combined reciprocal and non-reciprocal birefringence in optical monomode fibres. V.Annovazzi-Lodi, S.Donati (Istituto di Elettronica e Comunicazioni Elettriche, Univ. di Pavia, Pavia, Italy).
Opt. & Quantum Electron. (GB), vol.15, no.5, p.381-8 (Sept. 1983).
The authors analyse the overall birefringence which arises from the combined effects of Faraday rotation (non-reciprocal) and bending stress (reciprocal) applied to a monomode optical fibre loop. The theory is substantiated by numerical evaluations and appropriate experimental data are reported. These indicate how it is possible to build non-reciprocal birefringent components, i.e. rotators and isolators by means of monomode coils. (15 refs.)

106879 A method of calculating the efficiency for coupling light power from a LED into an optical fibre by use of a sphere lens. C.Heinz (Lehrstuhl fur Tech. Elektronik, Tech. Univ. Munchen, Munchen, Germany).
Opt. & Quantum Electron. (GB), vol.15, no.5, p.389-96 (Sept. 1983).
The use of sphere lenses of high refractive index material to improve the coupling efficiency between a light-emitting diode and an optical fibre is well known. A general method of calculating the coupling efficiency for such systems is described. The mathematical model is based on analytical geometry in vector notation. Experimental results obtained with GaAlAs-LEDs and a step-index fibre are compared with the data from the theoretical evaluations. (6 refs.)

106880 Bandwidth of multimode fibres with random fluctuation in the index profile: a Monte Carlo approach. V.Rizzoli, C.G.Someda (Istituto di Elettronica, Univ. di Bologna, Bologna, Italy).
Opt. & Quantum Electron. (GB), vol.15, no.5, p.407-17 (Sept. 1983).
Random variations of the index profile along the length of a multimode fibre are analyzed by means of a Monte-Carlo technique, within the framework of the WKBJ approximation, assuming linear profile dispersion. Previous results (concerning fibres with deterministic profile variations) would suggest that very broad bandwidths could be obtained even in the presence of strong deviation from uniformity, with a suitable choice of the average profile. On the contrary, the authors' analysis shows that similar results are obtained only under restrictive assumptions. In particular, if the random fluctuations are specified in terms of their RMS deviation, then the probability of getting a broad bandwidth is always significantly less than unity, no matter how accurate the choice of the average profile. (8 refs.)

106881 Calculation of equivalent step-index parameters for single-mode fibres. M.Fox (BICC Res. & Engng. Ltd., London, England).
Opt. & Quantum Electron. (GB), vol.15, no.5, p.451-5 (Sept. 1983).
Various methods have been used to calculate wavelength-independent equivalent step-index values of core diameter and relative refractive index difference for a non-step-index fibre. The discrepancies in the results indicate that this system of fibre description should not be used without an express statement of the mode of calculation. (15 refs.)

106882 Axis-alignment method for arc-fusion splice of single-mode fiber using a beam splitter. K.Imon, M.Tokuda (Ibaraki Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Ibaraki-ken, Japan).
Opt. Lett. (USA), vol.8, no.9, p.502-3 (Sept. 1983).
A new axis-alignment method for single-mode fibers is proposed. To align core axes of the fibers to be spliced light beams are excited by bending the fibers near the splice point; the fiber end faces are observed through a beam splitter. An average splice loss of 0.09 dB is attained. (5 refs.)

106883 Electron microprobe analysis of a glass fibre.
Philips Tech. Rev. (Netherlands), vol.40, no.11-12, p.349 (1982).
To determine whether glass fibres meet the requirements for optical communication it is necessary to use sensitive methods of analysis such as electron microprobe analysis. The result of the analysis of a graded-index optical fibre made by the double-crucible system is described. The graded index is produced during glass transport in the double crucible by diffusion of Ca^{++} ions towards the cladding and diffusion of Mg^{++} ions towards the core. To determine how far the diffusion process has proceeded, the glass fibre is scanned radially in steps of about 1 μm by an electron beam with a spot diameter of about 1 μm. The electron bombardment causes the material to emit X-rays. (3 refs.)

106884 Application of the Ambartsumyan invariance principle to study of lengthy light guides with random inhomogeneities. M.Kh.Zakhar-Itkin (All-Union Sci.-Res. Inst. of Electrical Energy, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.11, p.928-32 (Nov. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.11, p.1296-301 (Nov. 1982). [received: Sept. 1983]
A method is proposed for statistical experiments on short segments of an optical fibre to determine the coefficients in the expressions relating the probability distribution of power scattered by the light guide over modes to the distribution of power exciting the light guide over modes. (6 refs.)

106885 Propagation of a surface wave along a dielectric waveguide with an abrupt change of parameters. I. Solution by the factoring method. A.B.Manenkov (Inst. of Phys. Problems, Acad. of Sci., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.11, p.954-60 (Nov. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.11, p.1329-36 (Nov. 1982). [received: Sept. 1983]
The diffraction of a surface wave by abrupt irregularities of a thin anisotropic waveguide optical fibre is investigated by means of a spectral expansion. The cases of wave scattering by a small change in diameter and at the open end of a semidefinite waveguide are analyzed in detail. (14 refs.)

106886 From optical fibre to the complete system. I. Mechanics of attenuation in optical fibres. R.A.Ares, J.L.Tondi Resta.
Rev. Telegr. Electron. (Argentina), vol.71, no.839, p.261-4 (April 1983). In Spanish.
Begins a series in which the whole subject of optical fibre technology is to be treated. Discusses the nature and properties of glass and the mechanisms by which optical signals in glass fibres are attenuated, which are mainly those due to the nature of the glass itself, to inhomogeneities, to bending of the fibre and to imperfections in the fibre surface due to mechanical damage, chemical action and ageing. (6 refs.) *C.J.O.G.*

106887 The transfer factor of an optical fiber. G.I.Gordon, I.I.Teumin.
Telecommun. & Radio Eng. Part 1 (USA), vol.36, no.8, p.5-8 (Aug. 1982). Translation of: *Elektrosvyaz (USSR)*, vol.36, no.8, p.12-13 (Aug. 1982).
In optical-cable communication systems the signals are transmitted by modulating the power of the optical radiation. Therefore, an optical cable (OC) should have the complex modulated-power transfer factor. This factor contains two characteristics. One is the amplitude modulation-frequency characteristic which can be interpreted as the modulus of the complex transfer factor of the optical radiation power, modulated by a harmonic signal, expressed as a function of the modulation frequency. The second characteristic is the phase modulation-frequency characteristic, which is the phase of the complex transfer factor of the power envelope of the optical radiation modulated by a harmonic signal, expressed as a function of frequency. These characteristics can be used as secondary OC parameters which determine its potential ability to transmit the required volume of information, or they can be used as initial information required to design lines and construct correctors that improve the frequency response of the OC. (7 refs.)

106888 A method of estimating signal propagation time in an optical cable. M.D.Kontorov.
Telecommun. & Radio Eng. Part 1 (USA), vol.36, no.8, p.9-11 (Aug. 1982). Translation of: *Elektrosvyaz (USSR)*, vol.36, no.8, p.14-15 (Aug. 1982).
Discusses an exact method of measuring the signal propagation time in an optical cable, using the Einstein method to synchronize such devices, and also proposes a method of calculating the measurement errors. (3 refs.)

106889 An optical directional coupler. Yu.A.Baklunov, P.A.Mishnayevskiy, P.P.Ovvyan.
Telecommun. & Radio Eng. Part 1 (USA), vol.36, no.8, p.12-14 (Aug. 1982). Translation of: *Elektrosvyaz (USSR)*, vol.36, no.8, p.16-18 (Aug. 1982).
The authors consider a coupler structure consisting of two meshing biconical cones, constructed from two-layer fibers. The operation of this coupler is based on the transfer of energy from one fiber to the other due to the change in their geometrical parameters. The interest in this coupler is due to its constructional simplicity because it can be constructed from the same fiber that is used in the optical line. This allows one to effectively match the coupler to the line circuit. Furthermore, the coupler allows one to obtain a wide range of coupling coefficients with a high directivity. They developed a theory for calculating the parameters of a coupler which allows one to determine its insertion loss, the optimum length of the junction and the corresponding coupling coefficients. (4 refs.)

106890 Reliability of arc-fusion spliced fiber with reinforcement element. M.Matsumoto, T.Haibara (Ibaraki Electrical Communication Lab., NTT, Ibaraki, Japan), M.Miyauchi.
Trans. Inst. Electron. & Commun. Eng. Jpn. Part B (Japan), vol.J66B, no.5, p.615-22 (May 1983). In Japanese.
Describes the breaking mechanism of optical fiber inside a reinforcement element at fiber splice joint. Several reliability tests were made for the reinforced elements, and it is clarified that stresses applied to the fiber inside the element due to fiber pushing out from the plastic coatings and fiber torsion are the main factors for fiber break at the splice. Splice portion reinforced by polyethylene shrinkable tube with a steel rod and EVA adhesive resin is found to be highly endurable for these stresses. Furthermore, the loss increase is only 0.02 dB/splice even at a very low temperature of −70°C. (8 refs.)

106891 Design of rubber sealing gas-tight dam for optical fiber cable. M.Sato, T.Senmaru (Ibaraki Electrical Communication Lab., NTT, Ibaraki, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part B (Japan), vol.J66B, no.5, p.671-8 (May 1983). In Japanese.
Describes a design method for a new type gas-tight dam for pressurized optical fiber cables. Soft rubber tube shrinking force and self-sealing effect are applied to obtain efficient gas-tightening for optical fibers. The gas-tightening mechanism, reliability of rubber parts and the influence on optical loss were investigated. As a result, a gas-tight dam design with excellent performance was achieved. (14 refs.)

106892 Applications of fibre-optic waveguides in the measuring art. S.Geckeler (Res. Labs., Siemens AG, Munchen, Germany).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.3-9 vol.2
The use of fibre-optic waveguides, in conventional measuring systems for noise-immune transmission of digital data at large bit rates is first dealt with. Methods available for measuring the properties of the fibre-optic waveguides (attenuation, bandwidth, etc.), are then dealt with. Sensors of both simple and sophisticated design for measuring various physical quantities (mechanical forces, temperature, electric current, rotation, etc.) using fibre-optic waveguides are discussed. (no refs.)

106893 Fiber cable design and characterization. M.R.Santana, B.R.Eichenbaum (Bell Telephone Labs., Norcross, GA, USA).
Electro/81 Conference Record, New York, USA, 7-9 April 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.8a/2/1-9
Optical-fiber cable design differs from the design of metallic cables principally because of two factors: i) the physical properties of fibers are more limiting than those of metals, and ii) the transmission performance of a fiber can be altered by cabling operations due to a phenomenon called microbending. After reviewing these factors, methods are considered for mitigating their effects by appropriate design procedures. This leads to the consideration of different types of cable structures. In order to evaluate an optical cable design, it is necessary that its important mechanical and optical properties, and impact performance, as well as cabling added loss, temperature dependence of loss, and concatenated fiber bandwidth are then considered. The authors conclude with a discussion of long term stability of optical cables. (22 refs.)

106894 Optical fiber connectors and splices. .Bowen (AMP Inc., Harrisburg, PA, USA).
Electro/81 Conference Record, New York, USA, 7-9 April 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.8a/3/1-4
A model is proposed for fiber alignment mechanisms. This model may be used to classify optical fiber connectors and splices. Primary, modified primary, secondary, and tertiary mechanisms are defined. These mechanisms relate to direct fiber-to-fiber junctions, and are based on the use of common overlay surfaces. The mechanisms differ in the number of material layers that are used between the fibers and the overlay surfaces. The advantages and disadvantages of each mechanism are explored. An analysis of the interface between fiber and alignment surfaces illustrates the effects of fiber diameter tolerance on fiber positioning accuracy. Connector and splice configurations are used to illustrate the various mechanisms. (no refs.)

106895 Fiber optic markets: history and forecast. F.W.Dixon (Gnostic Concepts Inc., Menlo Park, CA, USA).
Electro/81 Conference Record, New York, USA, 7-9 April 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.8c/2.1-7
In 1970, the US production of fiber optic components was less than $1 million, excluding R&D. This production grew to $4 million in 1975 and $50 million in 1980. The growing market for components during that decade was largely investment, principally by the government and the telecommunication industry to develop a technology needed, and by the major manufacturers of fiber and components. With the beginning of the new decade, the industry will turn the corner and for the first time begin to earn profits for component manufacturers. It is against this background that the author presents a history and forecast of the fiber optic market. Firstly, the situation in the US is explored and then the markets in Europe and Japan are considered. (no refs.)

106896 Fiber optic line sensors. D.H.Rowe (GTE Communications Products Corp., Mountain View, CA, USA).
Proceedings 1983 Conference on Crime Countermeasures and Security, Lexington, KY, USA, 11-13 May 1983 (Lexington, KY, USA: Univ. Kentucky 1983), p.9-12
The need for a security system sensor suitable for use in an extremely hostile EMI environment has initiated the development of a fiber optic line sensor suitable for direct burial applications. This is an active system which measures the change in polarization of the laser light output that occurs when an optical fiber undergoes microbending. This polarization change is detected by comparison of the outputs of two orthogonal polarizing filters located at the output end of the optical fiber. This paper describes the system performance and the fibers, sources, detectors, and electronic processor for use in a cost-effective sensor system. (5 refs.)

4th Italian National Meeting on Applied Electromagnetics ....See Entry 105009

Measurement of transmission bandwidth for optical fibres ....See Entry 105338

Applications of fiber optics in sensors ....See Entry 105370

Continuous laser amplification in a monomode fiber longitudinally pumped by evanescent field coupling ....See Entry 106754

The efficiency of coupling light from a laser diode into an optical fiber with the aid of a lens ....See Entry 106799

Recent advances in optical fiber materials .... See Entry 106836

Waveguide properties of gradient periodic fiber lightguides ... See Entry 106861

Optical waveguide components in organic photochromic materials ....See Entry 106866

Laser bias effect on the receiver sensitivity of passive fibre optic star bus networks ....See Entry 106899

New light on fiber fabrication and materials ....See Entry 106905

Optical waveguide manufacturing techniques .... See Entry 106908

Optical fiber and cable manufacture .... See Entry 106909

Imaging system using gradient index fibers: a tutorial. [Medical imaging] ....See Entry 110144

Multi-object spectroscopy with optical fibres .... See Entry 110925

42.80Q Image detectors, convertors, and intensifiers

Use of charge injection device components in still cameras ... See Entry 105400

42.80S Optical communications devices

106897 Wide-beam atmospheric optical communication for aircraft application using semiconductor diodes. A.K.Majumdar, G.H.Fortescue (Kelly Johnson Res. & Dev. Center, Lockheed-California Co., Burbank, CA, USA).
Appl. Opt. (USA), vol.22, no.16, p.2495-504 (15 Aug. 1983).
Design considerations for atmospheric optical communication systems using wide divergent beams are described. This new approach can eliminate the need for complex gimbaled pointing and tracking mountings. Communicating systems have been designed and built using both infrared LED and CW and pulsed laser diodes operating in the wavelength range of $\lambda=0.8$-0.9 μm. Both single-channel and multichannel receivers were designed with fields of view (FOVs) ranging from 0.4 to 24°. Receiver performances were compared for a range close to 1 km under various ambient conditions. Laboratory simulation experiments were used to determine the operating margin and expected SNRs resulting from various design considerations. The need for narrow spectral bandwidth and wide-angle FOV interference filters is pointed out. The systems designed in the present work were low data rate (a few kbit/sec) communication systems and are suitable for aircraft-to-aircraft data exchange or voice communication. (22 refs.)

106898 Wavelength demultiplexing photodiode with very high isolation ration. S.Sakai, M.Umeno (Dept. of Engng. Sci., Nagoya Inst. of Technol., Nagoya, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.6, p.L338-9 (June 1983).
A new wavelength demultiplexing photodiode that utilizes a bragg reflector composed of a multi-thin crystal is proposed and its quantum efficiency and optical cross talk are calculated. It is shown that significant improvement in crosstalk can be obtained by the proposed structure without lowering the quantum efficiencies at the signal wavelengths. (6 refs.)

106899 Laser bias effect on the receiver sensitivity of passive fibre optic star bus networks. S.Moustakas, H.H.Witte (Res. Labs., Siemens AG, Munchen, Germany).
Opt. & Quantum Electron. (GB), vol.15, no.5, p.397-405 (Sept. 1983).
Examines the reduction in receiver sensitivity in passive fibre optic star bus networks due to the laser bias power transmitted by every terminal. Both transimpedance and high impedance preamplifier configurations using PIN and avalanche photodiodes are considered. The penalty in receiver sensitivity is examined as a function of bit rate, number of terminals, amplifier noise and the ratio of the launched laser bias power to average launched signal power. For PIN receivers the penalty has a maximum at low bit rates and falls off rapidly on either side of the maximum. In an example quoted the PIN receiver sensitivity penalty for networks with less than 50 terminals is less than 1 dB for all bit rates. The penalty for APD receivers increases with bit rate, and, in a further example, is shown to be less than 1 dB for networks with less than 50 terminals operating at bit rates lower than approximately 20 Mbit s^{-1}. Techniques for reducing the penalty to negligible levels are also examined. (10 refs.)

Wavelength multiplexing of 1.31-μm InGaAsP buried crescent laser arrays ....See Entry 106778

A method of calculating the efficiency for coupling light power from a LED into an optical fibre by use of a sphere lens ......See Entry 106879

42.82 INTEGRATED OPTICS

(for optical waveguides see also 42.80L)

106900 Electrooptical Fresnel lens-scanner with an array of channel waveguides. K.Takizawa (Broadcasting Sci. Res. Labs., NHK Japan Broadcasting Corp., Tokyo, Japan).
Appl. Opt. (USA), vol.22, no.16, p.2468-73 (15 Aug. 1983).
A new type of beam scanner is discussed based on 1-D Fresnel zone plate consisting of titanium-diffused channel waveguides on $LiNbO_3$. By electrooptically controlling the guided-wave phase both beam scanning and 1-D focusing are achieved without a condensing lens. It was experimentally confirmed using the scanner with twenty-one Fresnel zones that the beam spot with a diameter of ~ 50 μm at half-power level of diffraction pattern is scanned over a distance of ± 70 μm in the focal plane with an applied voltage of ± 40 V at 633 nm. (9 refs.)

Control of mutual phase locking of monolithically integrated semiconductor lasers ......See Entry 106760

Wavelength multiplexing of 1.31-μm InGaAsP buried crescent laser arrays ....See Entry 106778

Optical transmissivity of magneto-optic switching elements ... See Entry 106848

Double ion exchanged chirp grating lens in lithium niobate waveguides ....See Entry 106858

The effect of axial gradient index lens ......See Entry 106860

Optical waveguides in $LiTaO_3$ formed by proton exchange ....See Entry 106864

Expressions for the coupling coefficient of a rectangular-waveguide directional coupler ......See Entry 106865

Waveguide light modulators using the Keldysh-Franz effect in gallium arsenide ......See Entry 106867

42.85 OPTICAL TESTING AND WORKSHOP TECHNIQUES

106901 Aspheric lenses: an easier way. A.B.Nafarrate (Xerox Corp., Palo Alto Res. Center, Palo Alto, CA, USA).
Appl. Opt. (USA), vol.22, no.16, p.2400-1 (15 Aug. 1983).
Presents a near-index matching technique that can be used to make any kind of refractive optical surface that is not flat or spherical. The technique is very flexible and can be adapted to make a large variety of asphericS, from one-of-a-kind types such as a master for reference wave-front in null tests, to mass produced glass molded aspherics. Other optical components that can be made include achromats, anamorphic lenses, cylinders, axicons, off-axis, weak diffusers, Zernike, and Hilbert phase plates. A general aspheric shape in an immersion cell becomes an adjustable corrector plate by filling it with the proper fluid. It is also possible to limit this method to the correction of figure only by making the aspheric surfaces with the same quality finish that is needed in the case of exterior surfaces and assemble the pair in close proximity, leaving a uniform thin gap. An application for such aspheric will be in high power laser systems where a cooling gas may be circulated in the gap. (2 refs.)

106902 Precision molded-glass optics. R.O.Maschmeyer, C.A.Andrysick, T.W.Geyer, H.E.Meissner, C.J.Parker, L.M.Sanford (Res. & Dev. Labs., Corning Glass Works, Corning, NY, USA).
Appl. Opt. (USA), vol.22, no.16, p.2410-12 (15 Aug. 1983).
Results achieved in high-precision molding of glass lenses are reported. The work concentrated on a 0.4-N.A. 8-mm diam lens with spherical surfaces. The glass is a speciality glass composition of index (*d*-line) 1.604 and Abbe number 50. Typical design tolerances which have been achieved in the molded glass lenses include relative surface figure replication of 0.06 μm, thickness and diameter tolerances of ± 10 μm, wedge of $<10^{-3}$ rad, birefringence of less than one one-hundredth wave, and index homogeneity in the sixth decimal place. These results are directly applicable to molding precision glass aspheric lenses of similar tolerances. (11 refs.)

106903 Scatter ratio test for lens surface quality measurement. P.S.Schmitt, T.W.Webb, E.H.Barnett (Res. & Dev. Labs., Corning Glass Works, Corning, NY, USA).
Appl. Opt. (USA), vol.22, no.16, p.2416-18 (15 Aug. 1983).
The surface quality of an optical lens can be quantitatively measured using a scatter ratio test. A collimated light beam is focused by the test lens upon an opaque spot. A detector behind the spot measures light scattered past the spot. The spot is then displaced to the side so that total energy out of the lens is measured by the detector. The scatter ratio is the ratio of the two detector outputs. The test is shown to be reproducible and insensitive to operator effects. It is shown to be an effective process control tool for detecting changes in surface finish. The relationship between stylus measurements of lens surface roughness and the scatter ratios is shown. (13 refs.)

106904 *Q*-switched frequency-doubled Nd:YAG laser surface finishing of metals. C.W.Draper, A.Holliday (Western Electric Engng. Res. Center, Laser Studies Group, Princeton, NJ, USA).
Appl. Opt. (USA), vol.22, no.17, p.2521-2 (1983).
It is suggested that the concept of using laser radiation of one wavelength to treat an optical surface used in a high fluence laser environment at a different wavelength should be broadly considered. The authors illustrate that a *Q*-switched frequency-doubled Nd:YAG laser can be used to melt very shallow depths on metals frequently used in high power laser mirror applications. Rigorous damage threshold measurements have not been performed. However, it is demonstrated that some surface flaws common to conventional metal mirror preparation techniques can be locally repaired. (13 refs.)

106905 New light on fiber fabrication and materials.
Photonics Spectra (USA), vol.17, no.7, p.47-8, 50-1 (July 1983).
On every front, from technology to marketing, competition between the manufacturers of optical waveguides for communication is intensifying. Developments are concentrated in two major areas, the fabrication process itself and the materials that go into the glass perform. There are several fiber fabrication methods in the current use, but the most important for the communications field are variants of two: outside vapor-phase oxidation (OVPO) and inside vapor-phase oxidation (IVPO). These include Western Electric's proprietary version of IVPO, modified chemical vapor deposition, and the adaptation of OVPO developed at NTT laboratories in Japan and now in widespread use there, the method called vapor axial deposition (VAD). Over the years both process and fiber design improvements have reduced the attenuation marks of fibers based upon GeO_2 additions to fused silica, but researchers now feel that no further loss reductions can be expected with this glass sytem. Attention has turned to other glass systems, both oxides and nonoxides, and predictions have been made of much lower losses. To date, however, demonstrated losses are much higher than those for GeO_2-SiO_2 fibers. Chief contender seems to be fluoride glasses, especially those based on ZrF_4. (no refs.)

106906 Scaling up the neutral solution antireflection process. G.R.Wirtenson, N.J.Brown (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA), L.M.Cook.
Opt. Eng. (USA), vol.22, no.4, p.450-5 (July-Aug. 1983).
The neutral solution process (NSP) for chemically producing antireflection coatings has been scaled up from 24 cm and used successfully to treat components as large as 90 cm diameter. Since the process is primarily determined by diffusion through the surface, it has proven to be relatively insensitive to fluid flow effects which influence the chemical concentration buildup at the surface. Large parts visually appear more uniform than small parts processed in model tanks. The major problems encountered have been associated with using plastic support components beyond their normal temperature limits and with handling parts to the required cleanliness outside a clean room environment. (8 refs.)

106907 Method for subaperture testing interferogram reduction. W.W.Chow, G.N.Lawrence (Dept. of Phys. & Astron., Univ. of New Mexico, Albuquerque, NM, USA).
Opt. Lett. (USA), vol.8, no.9, p.468-70 (Sept. 1983).
Subaperture testing provides an attractive alternative to large monolithic test optics for evaluation of large optical systems. The authors present a method for reducing subaperture testing data that requires no a prior knowledge of the relative piston and tilt of the subapertures. Results of applying this method to analyze subaperture testing interferograms are presented. In particular, the behaviour of this method in the presence of data noise and for different subaperture configurations is studied. (4 refs.)

106908 Optical waveguide manufacturing techniques. M.G.Blankenship (Optical Waveguide Technol., Corning Glass Works, Corning, NY, USA).
Electro/81 Conference Record, New York, USA, 7-9 April 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.89/1/1-5
Optical fibers for communications links is a rapidly expanding technological field with many processes and materials being explored in R and D laboratories around the world. Nearly all the better performing fibers use high purity oxide glasses prepared from high purity metal halides, oxides or carbonates. The best optical performance has been obtained from vapor phase deposition of high silica glasses prepared from one of several approaches differing primarily by the geometry of deposition. The processes of outside vapor deposition, inside vapor deposition within a silica tube and axial vapor deposition followed by rod in tube processes are discussed by the author. The use of directly melted oxide glasses from a double crucible is also considered. Finally, fiber drawing and coating processes are briefly mentioned. (28 refs.)

106909 Optical fiber and cable manufacture. D.O.Jablonowski (Western Electric Co., Norcross, GA, USA).
Electro/81 Conference Record, New York, USA, 7-9 April 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.8a/4/1-7
The manufacturing techniques for optical fiber cable are fast being developed for large scale production. Basic steps of preform manufacture, draw, measurements, and cabling can be defined for the manufacturing processes. The preform is observed as an unimportant operation, since many fiber char-

acteristics are determined and production rates defined at that point. A free drawing operation using a high temperature furnace is employed for converting the preform into thin fiber; coating application is performed at the same time to ensure the retention of the intrinsic strength of the glass. Following characterization, fibers are cabled using either a stranded or a ribbon design. The cabling operations must be controlled to ensure that no stresses are placed on the fiber that would cause added loss. Improvements for efficient manufacture are evolving and refinements described by the author are expected to be made in order to reduce costs and increase volume. (20 refs.)

Cyclic interferometers for optical testing ....See Entry 105367

Recent advances in optical fiber materials .... See Entry 106836

Photoresist strongly absorbent in optical spectrum ....See Entry 106838

Optical performance of a diffraction-limited molded-glass biaspheric lens ....See Entry 106842

Double ion exchanged chirp grating lens in lithium niobate waveguides ....See Entry 106858

Fabrication of germanium-coated nickel hollow waveguides for infrared transmission ....See Entry 106859

Optical waveguides in $LiTaO_3$ formed by proton exchange ....See Entry 106864

Optical waveguide components in organic photochromic materials ....See Entry 106866

Very low-loss and highly reproducible optical fibres by a pressurized MCVD method ....See Entry 106874

Axis-alignment method for arc-fusion splice of single-mode fiber using a beam splitter .... See Entry 106882

43.00 ACOUSTICS

(for audition, see 87.34; for speech, see 87.36; for sound effects on living matter, see 87.50C)

43.20 GENERAL LINEAR ACOUSTICS

(see also 03.40K Mathematical problems in waves and wave propagation)

106910 Surface waves due to scattering by a near-surface parallel crack. J.D.Achenbach, Weichuan Lin, L.M.Keer (Dept. of Civil Engng., Northwestern Univ., Evanston, IL, USA).
IEEE Trans. Sonics & Ultrason. (USA), vol.SU-30, no.4, p.270-6 (July 1983).
Scattering of ultrasonic waves by a crack which is oriented parallel to a free surface is analyzed. Incident longitudinal and transverse body waves, as well as incident Rayleigh surface waves, are considered. The presence of a parallel subsurface crack gives rise to scattered surfaces waves whose amplitude-spectra show distinct resonance peaks, due to resonance of the layers between the crack and the free surface, particularly when this layer is thin. Scattering of body waves for normal incidence, both from the side of the free surface and from the interior of the solid, is investigated in some detail. The ratio of the amplitude spectra of the surface wave displacements for these two cases provides a measure of the distance d from the crack to the free surface. The length a of a crack can subsequently be obtained from a master curve which plots the first resonance frequency versus d/a. The amplitude spectra for scattered surface waves due to an incident surface wave also show resonance peaks, but these are part of a more complicated pattern of peaks and valleys, and they are therefore more difficult to classify. (13 refs.)

106911 Nonspecular effects for a finite incident beam modeled by an even-ordered polynomial. T.D.K.Ngoc, W.G.Mayer (Phys. Dept., Georgetown Univ., Washington, DC, USA).
IEEE Trans. Sonics & Ultrason. (USA), vol.SU-30, no.4, p.276-8 (July 1983).
The reflection of nonGaussian ultrasonic beams, expressed in terms of nth-ordered polynomials, is discussed and it is shown that at critical longitudinal and Rayleigh angles of incidence deviations from the Gaussian profile case occur, varying with the polynomial representation chosen. Examples are given for water-Plexiglas and water-stainless steel flat interfaces. (9 refs.)

106912 The field of a spherical wave reflected from a plane absorbent surface expressed in terms of an infinite series of Legendre polynomials. A.D.Rawlins (Dept. of Math., Brunel Univ., Uxbridge, England).
J. Sound & Vib. (GB), vol.89, no.3, p.359-63 (8 Aug. 1983).
The acoustic field of a spherical sound wave reflected from a locally reacting plane surface is expressed as an asymptotic expansion whose terms consist of the product of Legendre polynomials and powers of the reciprocal of the distance from the image source. (12 refs.)

106913 Note on a result of morse and Bolt [sound wave reflection]. A.D.Rawlins (Dept. of Math., Brunel Univ., Uxbridge, England).
J. Sound & Vib. (GB), vol.89, no.3, p.365-9 (8 Aug. 1983).
A result given without derivation by Morse and Bolt (Reviews of Modern Physics, vol.16, p.70, 1944) pertaining to the reflection of a spherical sound wave from an absorbent surface is investigated. It is shown that the result as given is not quite accurate. (3 refs.)

106914 On the radiation impedance of a rectangular piston. H.Levine (Dept. of Math., Stanford Univ., CA, USA).
J. Sound & Vib. (GB), vol.89, no.4, p.447-55 (22 Aug. 1983).
Single integral representations for the resistive and reactive components of the radiation impedance appropriate to a rectangular piston are established, thereby enabling a systematic refinement of estimate at both short and long wavelengths. Comparisons with previous analyses are made explicit as well as extensions and corrections thereto. (6 refs.)

106915 Nonstationary Doppler effect for waves propagating in nonhomogeneous media. V.I.Kyrlovich (Inst. of Appl. Phys., Acad. of Sci., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1120-5 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.609-15 (Oct. 1982). [received: Sept. 1983]
The theory of the frequency shift of continuous waves propagating in a medium whose properties depend on the coordinates and time is presented. (4 refs.)

106916 Superposition principle in acoustics. V.I.Krylovich (Inst. of Appl. Phys., Acad. of Sci., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1287-93 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.826-33 (Nov. 1982). [received: Sept. 1983]
Using the effect of the nonstationary frequency shift of acoustic waves in a medium with spatially and temporally varying properties, a theoretical estimate is made of the deviation from the superposition principle for an acoustic wave propagating in the field of another continuous plane wave. (9 refs.)

106917 On sound propagation above a locally reacting boundary. T.Kawai (Takenaka Tech. Res. Lab., Tokyo, Japan).
J. Acoust. Soc. Jpn. (Japan), vol.39, no.6, p.374-9 (June 1983). In Japanese.
An asymptotic solution of the scalar wave field due to a point source above a locally reacting plane surface is derived by the modified saddle-point technique and approximation of the surface wave term. The solution has a similar simple form to the Lawhead-Rudnick solution and the Ingard solution, and gives a perfectly uniform continuous field above the boundary. Numerical calculation indicates that the solution is more accurate than the Lawhead-Rudnick solution and the Ingard solution. (no refs.)

Normal-mode sound field of directional radiator ....See Entry 106919

43.25 NONLINEAR ACOUSTICS AND MACROSONICS

(see also 43.60 Acoustic signal processing; 43.88 Transduction; devices for generation and production of sound)

106918 Thermoacoustic effect in a resonant semiopen tube. R.G.Galiullin, I.P.Revva, G.G.Khalimov (V.I. Ul'yanov-Lenin Kazan State Univ., Kazan, USSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1126-32 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.615-23 (Oct. 1982). [received: Sept. 1983]
Results are given of a theoretical and experimental study of the effect of heating the walls of a semiopen tube under conditions of acoustic resonance. (7 refs.)

The responses of single degree of freedom systems with quadratic and cubic non-linearities to a subharmonic excitation ....See Entry 106921

43.30 UNDERWATER SOUND

(see also 92.10 Physics of the ocean)

106919 Normal-mode sound field of directional radiator. Zhang Ren-he, Zhu Bai-xian (Inst. of Acoustics, Acad. Sinica, Peking, China).
Acta Phys. Sin. (China), vol.32, no.4, p.490-6 (April 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)* [received: Sept. 1983]
The sound field of a more general directional radiator in a stratified medium is treated, and the concept of directivity is applied to calculation of the normal modes. The result shows that the normal-mode field of a directional radiator can be obtained by supplementing the normal-mode expression of an omnidirectional point source with the directivity-excitation-function, which is dependent on the position and directivity of the radiator. In addition, the normal-mode fields of the radiators with vertical-symmetrical, vertical-antisymmetrical, single-side and sharp directivity are calculated. For the vertical line array in a homogeneous water-layer, if the source distribution is proportional to the eigenfunction of some normal mode, the zeros of the directivity-excitation-function are just corresponding to the directions of eigen-rays of other normal modes. (8 refs.)

106920 Accuracy of Doppler sonar measurements. D.A.Selivanovskii, I.A.Shereshevskii (Appl. Phys. Inst., Acad. of Sci., Ukrainian SSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.10, p.827-31 (Oct. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.10, p.1158-63 (Oct. 1982). [received: Sept. 1983]
The mathematical expectancy of the position of the center of gravity of the reverberation signal spectrum and the dispersion of this quantity are calculated for a single echo-sounding cycle with the assumption of statistical independence of the following random values: transducer translational velocity and its rate of change, direction of the transducer axis, and rotation during measurement. The scattering properties of the medium are presumed homogeneous over volume and it is assumed that sound is scattered noncoherently. Estimates of possible accuracies are obtained for various experimental conditions. (2 refs.)

Acoustic surface wave band filters with weighted fan transducers ....See Entry 106935

Measurement of volume scattering of sound in the ocean with a deep-water acoustic instrument ....See Entry 110478

Ocean acoustic tomography: rays and modes ....See Entry 110480

43.35 ULTRASONICS, QUANTUM ACOUSTICS, AND PHYSICAL EFFECTS OF SOUND

(for phonons in crystal lattices, see 63.; for plasma acoustics, see 52.35; for low-temperature acoustics and sound in liquid helium, see 67.; for acoustic properties of liquids, see 62.60; for acoustical properties of solids, see 62.65; for ultrasonic relaxation, see 62.80; for acoustic properties of thin films, see 68.60; for surface waves in solids, see 68.25; for acoustoelectric effects and acoustic wave amplification, see 72.50; for magnetoacoustic effects, oscillations and resonance, see 72.55; for acousto-optical effects and acoustic holography, see 78.20H and 43.63; for sound effects on living matter, see 87.50)

Acoustic emission due to nucleation of a microcrack in the proximity of a macrocrack ....See Entry 107070

Ultrasonic modulation of persistent spectral holes in crystals ....See Entry 108921

43.40 MECHANICAL VIBRATIONS AND SHOCK

(see also 46.30M Vibrations, aeroelasticity, hydroelasticity, mechanical waves and shocks)

106921 The responses of single degree of freedom systems with quadratic and cubic non-linearities to a subharmonic excitation. A.H.Nayfeh (Dept. of Engng. Sci. & Mech., Virginia Polytech. Inst., State Univ., Blacksburg, VA, USA).
J. Sound & Vib. (GB), vol.89, no.4, p.457-70 (22 Aug. 1983).
The response of single degreee of freedom systems with quadratic and cubic non-linearities to a subharmonic excitation is investigated. The method of multiple scales is used to derive two first order ordinary differential equations that govern the evolution of the amplitude and phase of the subharmonic. These equations are used to obtain the steady state solutions and their stability. The results indentify two critical values ζ_1 and ζ_2, where $\zeta_2>\zeta_1$, for the excitation amplitude f. The value ζ_2 is the threshold for the stability of the trivial solution. When $f>\zeta_2$, subharmonic oscillations of finite amplitude are always excited. When $f<\zeta_1$, subharmonic oscillations cannot be excited. But when $\zeta_1<f<\zeta_2$, subharmonic oscillations may or may not be excited, depending on the initial conditions. Also, the method of harmonic balance is applied to a special case of the problem considered. It is shown that, although the method seems straightforward, it can lead to erroneous results if extreme care is not taken in the ordering of the different terms. (16 refs.)

106922 Vibrations of polygonal plates due to thermal shock. S.Das (Dept. of Phys., Sonaulla H.S. School, Jalpaiguri, India).
J. Sound & Vib. (GB), vol.89, no.4, p.471-6 (22 Aug. 1983).
Vibrations of polygonal elastic plates due to thermal shock are investigated through use of complex variable theory. The numerical results are shown graphically for different polygonal plates and results for triangular, square and circular plates are compared with published results. (7 refs.)

106923 Sound radiation from rectangular plates vibrating in stripes mode. H.Yamane, Y.Ito, M.Kawamura (Coll. of Sci. & Technol., Nihon Univ., Tokyo, Japan).
J. Acoust. Soc. Jpn. (Japan), vol.39, no.6, p.380-7 (June 1983). In Japanese.
The angle dependence of radiated sound pressure and radiation ratio are investigated in the frequency range of $\lambda/\lambda_p<1$ for rectangular plates which vibrate in the stripes mode. They are calculated by introducing an angle component of the volume velocity at an elementary area on these plates whose angle component is determined by an angle between the rectangular plate and the plane containing the center axis parallel to the stripes and the observation point. The sound radiation from a surface of these plates is considered to be the radiation of sound from the bending waves in the plates which are propagated perpendicular to the stripes for the positive and negative directions. The radiation of sound from the bending wave in the one direction is approximated by the sound radiation from the rectangular piston which vibrates the maximum value of vibrational velocity of the bending waves, the dimensions of the rectangular piston are the same length of the parallel side to the stripes in width and $[1-(\lambda/\lambda_p)^2]^{1/2}$ times the original side of the plates in length. The radiation ratio of these plates is expressed as $[1-(\lambda/\lambda_p)^2]^{1/2}$. The experimental results are in good agreement with the calculated ones. (11 refs.)

In vino veritas: a study of wineglass acoustics ....See Entry 105063

On the prediction of impact noise. VI. Distribution of acceleration noise with frequency of acceleration noise with frequency with application to bottle impacts ....See Entry 106930

On the revision of JIS C 1512 'Level recorders for recording sound level and/or vibration level' ....See Entry 106946

Three-dimensional effects on the focusing of weak shock waves ....See Entry 107185

43.50 NOISE, ITS EFFECTS AND CONTROL

(see also 86.70J Environmental science)

106924 The application of barriers, enclosures and area absorption to wire stranding operations [noise control]. J.F.Yerges (Yerges Consulting Engrs., Waunakee, WI, USA), J.G.Bollinger.
Noise Control Eng. J. (USA), vol.21, no.1, p.10-20 (July-Aug. 1983).
Wire rope mills are an extreme case of a common type of industrial noise problem. Large numbers of production machines are grouped in regular arrays across the plant floor, producing noise levels in excess of 100 dB(A). A study was undertaken dealing with the application of conventional, or traditional, noise control methods to wire stranding operations. These methods include area absorption, partial-height barriers, and partial and complete enclosures. The authors judged these methods in light of the working definition of 'feasibility' that has evolved during the process of federal regulation of workplace noise and subsequent legal review. By this definition, a feasible noise control method must produce a significant noise reduction without causing an unacceptable production penalty. Limits are set on the feasible cost per affected worker. Area absorption and partial height barriers appear to meet all of these tests of feasibility when applied in the rope mill. Retrofit partial and complete enclosures, however, appear to exceed the feasible cost limitations. (10 refs.)

106925 Noise characteristics of large wind turbine generators. H.H.Hubbard (Coll. of William & Mary, Newport News, VA, USA), F.W.Grosveld, K.P.Shepherd.
Noise Control Eng. J. (USA), vol.21, no.1, p.21-9 (July-Aug. 1983).
The authors summarize the noise characteristics of three representative large wind turbine generators. The main noise sources are identified along with state of the art noise prediction methods. Loading noise components are a characteristic of downwind machines and are usually confined to frequencies below 100 Hz. Broadband components extend throughout the audible frequency range and are observed for both upwind and downwind machines. (28 refs.)

106926 Evaluation of human exposure to the noise from large wind turbine generators. K.P.Shepherd (Bionetics Corp., Hampton, VA, USA), F.W.Grosveld, D.G.Stephens.
Noise Control Eng. J. (USA), vol.21, no.1, p.30-7 (July-Aug. 1983).
The authors have developed a procedure to evaluate human exposure to the noise from large wind turbine generators. The evaluation is based on the noise at the receiver location, which is measured directly or inferred from a knowledge of the noise at the turbine site along with an estimate of the atmospheric propagation effects. The evaluation involves a comparison of the noise and any noise induced building vibration with the human perception thresholds which have been developed for wind turbine noise. (13 refs.)

106927 Aspects regarding the behaviour of double circuit 400 kV OHEL three phase conductors from the point of view of corona discharges. D.Cristescu, M.Ungureanu, P.Postolache, G.Magureanu.
Energetica (Rumania), vol.31, no.5, p.235-8 (May 1983). In Rumanian.
The paper considers the radioelectric perturbatory level of double circuit 400 kV OHEL with three phase conductors and Donau-type crowns. The predetermination calculus as well as the experiments carried out at the High Voltage Techniques Laboratory of the Polytechnical Institute of Bucharest are presented. The experimental determination of the acoustic noise at these types of OHEL are presented as well as the noise standardization criteria. Connected to the radioelectric perturbatory level of conductors, the experimental determinations of the radioelectric perturbatory level of insulator chains is also shown, for three phase conductors which are to be used for the future 400 kV double circuit OHEL. (5 refs.)

106928 A halt to sound pollution!. E.Catier.
Electron. Ind. (France), no.55, p.59-67 (15 June 1983). In French.
Following a brief review of the sources of noise (N.B. acoustic not electronic!) in the modern world and its 'nuisance-value', its nature, as distinct from harmonic sounds is analysed, and the harmful effects of loud noise examined. The physiology of hearing and of deafness are examined, and the principles of noise measurement and surveying are summarized. (no refs.) *J.S.*

106929 Prony's method applied to estimate noise source locations and their sound powers. K.Inomoto, S.Hatori (Dept. of Electrical Engng., Mie Univ., Tsu City, Japan).
J. Sound & Vib. (GB), vol.89, no.4, p.509-17 (22 Aug. 1983).
An application of Prony's method for evaluating the acoustic power and location of sound sources from spatially sampled data is described. A sound source considered as a point source has an intensity proportional to the inverse square of the distance between source and observation point. The Fourier transform of this intensity function is an exponential function with a real exponent. The shift property of the Fourier transform results in a spectral change in the phase angle, which is expressed in the transform domain by a multiplicative exponential function of pure imaginary exponent. In this paper the usual time axis of the Fourier pair of time and frequency is treated as a variable denoting the location of the sound source. Accordingly, each spectral component of spatially sampled sound intensity generated by n point sources can be expressed as a linear combination of n complex exponentials. By applying Prony's method to the spectral data, these unknown exponents can be calculated numerically. This paper deals with an estimation procedure to find the location and power of a noise source. The estimation is done by minimizing the sum of the squares of the errors between the model and measured data. The proposed method has general applicability to problems where the so-called inverse square law for intensity can be assumed to be valid. (5 refs.)

106930 On the prediction of impact noise. VI. Distribution of acceleration noise with frequency of acceleration noise with frequency with application to bottle impacts. E.J.Richards, A.Lenzi, J.Cuschieri (Inst. of Sound & Vibration Res., Univ. of Southampton, Southampton, England).
J. Sound & Vib. (GB), vol.90, no.1, p.59-80 (8 Sept. 1983).
For pt. V see ibid., vol.88, p.333 (1983). The spectral distribution of the acceleration noise is obtained using both the pressure waveform expression and the spatial averaged velocity on the surface of the body, together with a radiation efficiency associated with the rigid body movement of the object. This distribution with frequency is shown to be mainly dependent on the size of the body and the duration of the transient and is independent of the body shape detail and the exact shape of the transient. The spectral distribution of acceleration noise is important in the case of impact of structures whose first ringing natural frequency is within the frequency range under investigation. Under such circumstances, it is important to estimate the response of the structure below this resonant frequency. This is investigated to show that the response, and hence the noise radiated from a structure below the first ringing frequency, is low and the noise in this frequency range is mostly due to acceleration noise. These results are verified in the case of bottle clashes. (8 refs.)

106931 Prediction of the noise propagation in a city area composed of randomly distributed buildings. S.Ieda, H.Ma, K.Kuno, K.Ikegaya (Dept. of Electrical Engng., Nagoya Univ., Nagoya, Japan).
J. Acoust. Soc. Jpn. (Japan), vol.39, no.4, p.239-46 (April 1983). In Japanese.
A new method of prediction for the noise propagation in a city area is proposed. In this method, buildings in a city area are assumed to be randomly distributed. Therefore, the characteristics of the noise propagation are easily given. By using the average height of the buildings and the perspective distance among them, the propagation losses are predicted without solving the wave-equation subject to the complex boundary conditions. In order to examine the results, the random distribution of the buildings is produced by the computer simulation, and the properties of the noise propagation are calculated. In addition, the scale model experiments are made on the distribution of the buildings. From the results of the computer simulation and the model experiments, the prediction method is proved to be appropriate. (14 refs.)

Noise loudness level calculation ....See Entry 106947

An experiment on the noise source strengths in coaxial double jets ....See Entry 107209

The Fifteenth Sir Richard Fairey Memorial Lecture: The quieter airport ....See Entry 109943

A new on-line estimation method of representative statistics of environmental random noise and vibration based on actual digital measurement ....See Entry 109944

The spectral factor in noise-induced hearing loss: a case for retaining the A-weighting ....See Entry 110056

43.55 ARCHITECTURAL ACOUSTICS

An efficient algorithm for measuring the impulse response using pseudorandom noise ....See Entry 106943

Delta stereophony—a sound system with true direction and distance perception for large multipurpose halls ....See Entry 106954

43.60 ACOUSTIC SIGNAL PROCESSING

106932 Developments in acousto-optic signal processing. D.Casasent (Carnegie-Mellon Univ., Pittsburgh, PA, USA).
Trends & Perspect. Signal Process. (USA), vol.3, no.2, p.1-6 (June 1983).
Discusses electronic warfare and radar; the Chirp z-transform spectrum analyzer; commercial wideband optical spectrum analyzers; types of optical signal processors; reliability of SAW devices in optical processing; integrated

acousto-optic SAW devices; fabrication of SAW dispersive delay lines; bulk acousto-optic devices; space-integrating AO systems; time-integrating AO systems; general-purpose OSP systems; matrix-vector; iterative processors, and systolic array optical processors. (no refs.)

106933 A new approach to high-speed digital signal processing based on microprogramming. K.Sekiguchi, K.Ishizaka, T.K.Matsudaira, N.Nakajima (Sony Corp., Tokyo, Japan).
J. Audio Eng. Soc. (USA), vol.31, no.7-8, p.517-22 (July-Aug. 1983).
A microprogrammed high-speed signal processor is presented. Bipolar bit-slice arithmetic logic units (ALU) combined with high-speed parallel multipliers permit the processing programs, such as digital filters and reverberation simulations requiring many additions and multiplications, to be executed rapidly and efficiently. Microinstructions and the microprogram development system, designed for this machine, are also described. (4 refs.)

106934 A restoration procedure for (non-stationary) signals from moving sources. H.P.Verhas.
J. Sound & Vib. (GB), vol.89, no.4, p.487-97 (22 Aug. 1983).
Moving sources, such as trains, cars and airplanes, provide non-stationary sound and vibration signals in situations where the receiver is not moving with the source. For non-stationary signals there are strong limitations on the use of computerized analysis techniques based on Fourier transformation. For instance, it is not possible to compute reliably either power spectral density functions of coherence functions. A procedure has been developed, and is discussed in this paper, that restores non-stationary signals into stationary ones, thus enabling one to apply the analysis techniques mentioned above to moving source data with a reliable outcome. (1 ref.)

106935 Acoustic surface wave band filters with weighted fan transducers. E.A.Nelin, I.M.Grankin, V.V.Kiselev, D.V.Karpeev, S.N.Kondrat'ev, V.V.Praporshchikov (Polytech. Inst., Kiev, Ukrainian SSR).
Sov. Phys.-Tech. Phys. (USA), vol.28, no.2, p.242-3 (Feb. 1983). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.53, no.2, p.390-2 (Feb. 1983). [received: Sept. 1983]
Acoustic surface wave (ASW) band filters are widely employed in diverse radioengineering systems and must satisfy increasingly stringent requirements. In the past, the performance of ASW filters has been improved by reducing the effects of second-order phenomena and fabrication errors. This approach is limited because of computational difficulties and attainable fabrication accuracy. Because of residual second-order effects, the side lobes are usually not attenuated by more than −50 dB, particularly when the amplitude-frequency (AF) characteristic is highly rectangular. The authors propose a novel approach based on shaping the frequency characteristic of an ASW filter. They examine shaping of the frequency characteristic of a filter consisting of two identical fan transducers. (5 refs.)

Relation between cross-correlation coefficient of two-channel acoustic signals and sound image quality. .... See Entry 110057

43.63 ACOUSTIC HOLOGRAPHY

Photoresist strongly absorbent in optical spectrum ....See Entry 106838

43.70 SPEECH COMMUNICATION

(inc. speech perception, speech intelligibility, and speech synthesis; see also 87.36 Speech)

106936 A connected spoken word or syllable recognition algorithm by pattern matching. S.Nakagawa (Faculty of Engng., Toyohashi Univ. of Technol., Toyohashi, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part D (Japan), vol.J66D, no.6, p.637-44 (June 1983). In Japanese.
A constant time delay dynamic programming (DP) matching algorithm and $O(n)$ DP-matching algorithm are proposed for connected spoken word recognition. The algorithms are based on the same principle of two level DP, level building DP and clockwise DP matching methods. The algorithms are computationally more efficient than the conventional methods. In particular, $O(n)$ DP matching algorithm requires only the DP-matching of n times for the connected word recognition in the vocabulary size of n words. This amount of computation is the same order of that of isolated word recognition. The author also proposes an algorithm of Japanese phonetic typewriter based on syllable to syllable matching by using these algorithms. (11 refs.)

106937 Coding allophones for speech synthesis. J.G.May (General Instrument Corp., Microelectronics Div., Hicksville, NY, USA).
Midcon/82 Conference Record, Dallas, TX, USA, 30 Nov.-2 Dec. 1982 (El Segundo, CA, USA: Electron. Conventions 1982), p.6/4/1-5
Starting from a discussion of how the different classes of speech sounds are produced in the vocal tract, the author proceeds to an explanation of the resulting acoustic characteristics of these articulations and their consequences for synthesis. She considers the segmentation problems which arise from coarticulation along with a description of the items in the General Instrument allophone set. (10 refs.)

On semantic information in a speech recognition system for Japanese sentences ....See Entry 110060

43.75 MUSIC AND MUSICAL INSTRUMENTS

106938 Normal modes of the modern English church bell. R.Perrin, T.Charnley (Dept. of Phys., Loughborough Univ. of Technol., Loughborough, England), J.DePont.
J. Sound & Vib. (GB), vol.90, no.1, p.29-49 (8 Sept. 1983).
Experimental measurements of the frequencies and nodal patterns of all the partials of a good quality 214 kg English church bell up to about 9 kHz have been made. By matching these with the results of finite element calculations an understanding of the physical mechanisms generating the various partials has been achieved. This has made possible the production of a classification scheme for the partials with a firm physical basis, and has given considerable new insight into church bell design. In particular it is now clear just how crucial to the production of the bell's characteristic timbre is the thick ring near its rim. (9 refs.)

106939 Violin acoustics. C.M.Hutchins.
J. Acoust. Soc. Jpn. (Japan), vol.39, no.3, p.204-13 (March 1983). In Japanese.
Describes the development process of eight types of violins capable of providing well-balanced sound. Modern violins are provided with their respective strings tightened with a tensile force of approximately 27 kg weight. To provide the best-performance violin, its plate vibration modes should be measured to find the most suitable resonance frequencies and patterns. The Helmholtz air resonance should be at approximately 294 Hz. (74 refs.) *K.B.*

Instructional laboratory experiment on the sound field of a small ultrasonic transducer ....See Entry 105077

43.85 ACOUSTICAL MEASUREMENTS AND INSTRUMENTATION

(for acoustic noise measurement, see also 43.50; for photoacoustic spectroscopy, see 07.65)

106940 Acoustic parameters of commercial plastics. Bing-Nan Hung (Dept. of Biomedical Engng., Chung-Yuan Christian Univ., Chung Li, Taiwan), A.Goldstein.
IEEE Trans. Sonics & Ultrason. (USA), vol.SU-30, no.4, p.249-54 (July 1983).
Density, acoustic velocity, impedance, and attenuation measurements have been performed on representative samples of commercial plastics using a variation of the Papadakis technique (1973). A detailed description of the analysis of the measurement data and calculation of the estimated measurement uncertainties are presented. In some cases the measurement results are found to disagree with those of others. These differences are ascribed to real differences of these parameters due to material variations during manufacture. The results suggest that ultrasonic measurement techniques can be used by the plastics industry for quality assurance and material identification purposes. (17 refs.)

106941 Apparatus for measuring the velocity of acoustic waves in solids. A.I.Korobov, Yu.A.Brazhkin, S.G.Buga (State Univ., Moscow, USSR).
Instrum. & Exp. Tech. (USA), vol.25, no.6, pt.2, p.1490-2 (Nov.-Dec. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.6, p.158-60 (Nov.-Dec. 1982).
An apparatus is described for measuring small variations in the velocity of acoustic waves in solids with the application of external electric fields. The apparatus operates on a modulation measurement technique and can be used to measure directly the derivative of the acoustic wave velocity with respect to the electric field. the sensitivity to relative variations of the acoustic wave velocity is $(1\text{-}3)\times10^{-8}$. (4 refs.)

106942 A portable microprocessor-controlled instrument for measuring the moments of an amplitude histogram [acoustic measurement application]. I.G.Rees, C.G.Don (Dept. of Appl. Phys., Chisholm Inst. of Technol., Caulfield East, Victoria, Australia).
J. Phys. E (GB), vol.16, no.9, p.832-5 (Sept. 1983).
A microprocessor-controlled instrument has been constructed to permit field studies involving skewness and kurtosis. A 1024 channel amplitude histogram is formed within the memory by sampling an applied voltage at rates up to 10 kHz. The first four moments of the distribution are computed and, for acoustical studies, selected noise indices are also calculated. The advantage of a field portable instrument is demonstrated by comparing results taken directly from a tape recording of some common acoustic sounds. (5 refs.)

106943 An efficient algorithm for measuring the impulse response using pseudorandom noise. J.Borish, J.B.Angell (Dept. of Music, Stanford Univ., Stanford, CA, USA).
J. Audio Eng. Soc. (USA), vol.31, no.7-8, p.478-87 (July-Aug. 1983).
The impulse response of a linear system can be determined by exciting the system with white noise, and cross-correlating the input and output. As contrasted with the straightforward technique using an impulsive excitation, this approach is capable of providing vastly superior dynamic range. In order to minimize the amount of computation required by the cross-correlation step, the system can be excited by a binary maximal length sequence and the cross correlation performed using the fast Hadamard transform. By this means, only additions are required, and the number of additions is approximately $2.5n \log_2 n$, where n is the length of the sequence. (17 refs.)

106944 A selective two microphone acoustic intensity method. J.Bucheger (Cummins Engine Co., Columbus, IN, USA), W.Trethewey, H.A.Evensen.
J. Sound & Vib. (GB), vol.90, no.1, p.93-101 (8 Sept. 1983).
A multiple input, two output model is proposed which enables the two microphone acoustic intensity method to decompose the intensity vector into contributions from individual sources, even when they are coupled and in close proximity within the measurement surface. By treating characteristic signals from each source as the inputs, and the sound pressure signals from the two closely spaced microphones as the outputs, the model's frequency response functions are developed from a least squares approximation. The cross spectrum between the two microphones can then be expressed as a function of the input signal spectra and the model's frequency response functions. By manipulating the model terms the selective cross spectrum associated with the radiation from each individual source can then be estimated. The selective cross spectrum is then processed via standard methods to obtain the acoustic intensity vector from each source. A series of laboratory experiments is summarized which demonstrated that the technique can accurately decompose the acoustic intensity vector from highly coherent sources ($\gamma_{12}^2>0.9$) buried in background noise is a semireverberant environment, to within 1 dB of the directly measured intensities. (20 refs.)

106945 Methods of measurement and description of A-weighted sound pressure level. J.Igarashi (Kobayashi Inst. of Phys. Res., Kokubunji, Japan).
J. Acoust. Soc. Jpn. (Japan), vol.39, no.3, p.191-6 (March 1983). In Japanese.
An amendment of JIS Z 8731 Methods of Measurement and Description of A-weighted Sound Pressure Level was made according to ISO recommendations. Sound pressure is transformed into voltage by a microphone, an A-weighted weighting network shapes the voltage to account for the frequency response of the ear, and the weighted voltage is integrated over a specified time period. For practical purposes the equivalent continuous A-weighted sound pressure level L_{AeqT} is determined by the equation $L_{\mathrm{AeqT}}=10 \log [(1/N)\ 10^{L_i(t)/10}]$ where N is the number of samples during the time $T=(N\text{-}1)\Delta t$, and L_i is the i-th instantaneous A-corrected noise level in the time intervals Δt. (1 ref.) *K.B.*

106946 On the revision of JIS C 1512 'Level recorders for recording sound level and/or vibration level'. H.Miura (Electrotech. Lab., Ibaraki, Japan).
J. Acoust. Soc. Jpn. (Japan), vol.39, no.3, p.197 (March 1983). In Japanese.
JIs C 1512, 'Level recorders for recording sound level and/or vibration level', was partially amended. The RMS detector circuits were specified both for sound level recorders and for vibration level meters. The RMS value of the signal from the sound or vibration level meter shall be applied to the level recorder. (1 ref.) *K.B.*

106947 Noise loudness level calculation. Yu.A.Indlin.
Tekh. Kino & Telev. (USSR), no.6, p.20-3 (June 1983). In Russian.
A procedure for calculating noise loudness level is proposed, based on these measured parameters: the sound pressure level and spectrum width. For complex noise the latter is measured from data of the third-octave spectrum at 24 dB below the noise level. The procedure gives more exact approximation to

the subjectively assessed loudness levels as compared to the calculations according to Zwicker (1958) and Stevens (1961). (13 refs.)

106948 Trends in improving sound signal level meters. B.V.Nekrasov, A.V.Nikonov, T.M.Fedorova.
Tekh. Kino & Telev. (USSR), no.6, p.37-43 (June 1983). In Russian.
Considers trends in sound signal level meter designing. The results of subjective-statistical tests are given, based on the criterion of preferential use of various indicating instruments using pointers, gas-discharge devices, LED, and mirrors. Analog-digital and digital level meters are discussed. (24 refs.)

106949 Sounding-rocket flight test of an acoustic mixer by manufacture of a lead zinc emulsion alloy in microgravity. P.F.Clancy (ESA/ESTEC, Noordwijk, Netherlands), W.Heide, D.Langbein.
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.99-104
An acoustic mixer system capable of mixing immiscible alloys, powder/metal and fibre/metal melts in microgravity has been developed and successfully test flown on the TEXUS 5 rocket flight with a lead-zinc immiscible alloy system. The results obtained have shown that the mixer has performed as planned giving thorough mixing of the melt both before and during the microgravity cooling phase. The particle size distributions obtained in microgravity are different to those obtained in 1-g. A further experiment to elaborate this effect is planned for the TEXUS 7/8 campaign in 1983. (11 refs.)

Accuracy of Doppler sonar measurements ....See Entry 106920

PRIZ-1 set of ultrasonic measurement transducers ....See Entry 106955

The many benefits of ultrasonic flowmeters ....See Entry 107275

Analysis of ultrasonic correlation flowmeters for pulp suspension ....See Entry 107278

Sources of error and their minimisation in ultrasonic cross correlation flowmeters ....See Entry 107298

Measuring the velocity distribution of particles dispersed in a flow by an ultrasonic Doppler anemometer ....See Entry 107302

Ultrasonic measurement of volume flow independent of velocity distribution ....See Entry 107307

Ultrasonic modulation of persistent spectral holes in crystals ....See Entry 108921

Polar-Scan, a nondestructive test method for the inspection of layer orientation and stacking order in advanced fiber composites ....See Entry 109639

Measurement of the acoustical properties of plastics ....See Entry 109677

Acoustical characteristics of some polymers used as test specimens ....See Entry 109678

Effect of heat treatment conditions on the form of the scattered pulse and the mean level of structural noise for steels with a homogeneous structure ....See Entry 109679

Characteristics of acoustic measurements in highly absorptive media ....See Entry 109681

Absolute sensitivity of series-produced ultrasonic defectoscopes ....See Entry 109690

Effect of delay in contact layers on accuracy of measurement of ultrasound propagation time ....See Entry 109691

Detection of a corner reflector with insonification at angles greater than 45° ....See Entry 109693

The spectral factor in noise-induced hearing loss: a case for retaining the A-weighting ....See Entry 110056

43.88 TRANSDUCTION; DEVICES FOR THE GENERATION AND REPRODUCTION OF SOUND

106950 Analysis of the high-field losses of polyvinylidene fluoride transducers. Wen-Hsien Chen (Dept. of Phys., Chung Cheng Inst. of Sci. & Technol., Tashi, Taoyuan, Taiwan).
IEEE Trans. Sonics & Ultrason. (USA), vol.SU-30, no.4, p.238-49 (July 1983).
A general theory, based on the impedance matrix model, for predicting the performance of an acoustic transducer made from a piezoelectric material with nonnegligible dielectric loss and mechanical loss has been formulated and expressed in terms of an equivalent electric series circuit. Computer programs were designed to predict the electrical input impedance as a function of frequency of PVF_2 transducer, and to model the radiated acoustic power as a function of input electric field, and the temperature rise and the efficiency of the PVF_2 film under high electric field, as high as 30 V/μm operation. The dielectric loss, and dielectric permittivity in oriented PVF_2 film were measured from 0.5 MHz to 100 MHz. The measured loss tangent and permittivity as functions of frequency were used to model the dielectric and acoustic losses in the theoretical calculation. Measurements on the electrical input impedance of loaded PVF_2 piezofilms show good agreement to that of theoretical calculations. (10 refs.)

106951 Optoacoustic transducers with intensity-modulated inputs. B.Noorbehesht, V.Arat (Electrical Engng. Dept., Univ. of Houston, Houston, TX, USA).
IEEE Trans. Sonics & Ultrason. (USA), vol.SU-30, no.4, p.255-64 (July 1983).
The use of intensity-modulated optical input has been suggested to improve the acoustic switching ratio in optoacoustic transducer (OAT) transmitters and receivers. The results of a comprehensive theoretical and experimental study of a prototype OAT operated in the transmitter mode and illuminated by intensity-modulated light are presented. The device under these conditions can be regarded as a linear temporal system with one time-varying element. It is shown, using an electrical equivalent circuit, that when sinusoidally intensity-modulated light is used to activate selected regions of the OAT, additional signals are generated in the illuminated regions which do not exist in the dark regions. These signals are at different frequencies than those in the dark regions. Therefore, in principle, infinite switching ratio may be realized at these frequencies. The effectiveness of this scheme depends on such characteristics as response time and degree of photoconductivity of the photoconductor, frequency of the electrical signal, and modulation frequency of the optical input. Experimental results from a prototype OAT demonstrate the feasibility of intensity-modulation techniques. Switching ratios as high as 50 dB have been obtained in the laboratory. Experiments have verified some of the predictions of the theoretical model. (11 refs.)

106952 An extended model of the ultrasonic transducer. M.G.Silk (Materials Phys. Div., Nondestructive Testing Centre, AERE, Harwell, England).
J. Phys. E (GB), vol.16, no.9, p.879-87 (Sept. 1983).
The linear model of the ultrasonic transducer has been extended to allow for the effects of diffraction, poor bonding and the various shapes of calibration reflectors. In this way the predictions of the model are brought closer into line with the practical results which would be obtained when transducers are calibrated. All of the common calibration targets are included in the model while, within the limitations outlined, the response of transducers to some natural defects could also be predicted. (10 refs.)

106953 Satisfying louspeaker crossover constraints with conventional networks—old and new designs. R.M.Bullock,III (Dept. of Math. & Statistics, Miami Univ., Oxford, OH, USA).
J. Audio Eng. Soc. (USA), vol.31, no.7-8, p.489-99 (July-Aug. 1983).
Conventional crossovers are realized using passive all-pole filters. Consequently the constraints which can be imposed on their behavior are severely limited. In loudspeaker applications constant power, constant voltage amplitude, and linear phase are highly desirable. It is argued that while linear phase cannot be achieved, some phase control is possible, and the constraints of constant power and constant voltage amplitude can be satisfied. However, tradeoffs must be made since conventional crossover satisfies all three properties. It is shown that constant power and amplitude require the Butterworth and all-pass crossovers. If phase control is paramount, a new crossover is introduced which allows a selectable variation in power and amplitude, while maintaining a fixed phase behavior. (5 refs.)

106954 Delta stereophony—a sound system with true direction and distance perception for large multipurpose halls. G.Steinke (Rundfunk- und Fernsehtech. Zentralamt der Deutschen Post, Berlin, Germany).
J. Audio Eng. Soc. (USA), vol.31, no.7-8, p.500-11 (July-Aug. 1983).
The Delta stereophony system designed for the Palace of the Republic in Berlin, GDR, is described. The system provides coincidence of optical and acoustical directional impressions and overcomes the shortcomings of some other methods. It consists of a multichannel arrangement of microphones or other sound-signal sources, a multichannel mixing console, a special delay unit, and a multichannel arrangement of several loudspeaker groups. These groups are arranged above and beneath the stage edge so that they radiate in the direction nearly normal to the stage edge and into the auditorium. The distribution and the exact arrangement of the loudspeaker groups are intended to obtain uniform and satisfactory sound coverage of the auditorium as well as a differentiation of the directional projection from different sound sources. For technical-economic reasons, the number of channels will seldom exceed six to eight. With small halls, the number will be smaller. (7 refs.)

106955 PRIZ-1 set of ultrasonic measurement transducers. A.F.Mel'kanovich, G.V.Pyabus (All-Union Sci.-Res. Inst. for Dev. of Nondestructive Methods & Means of Materials Quality Control, Kishinev, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.10, p.837-9 (Oct. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.10, p.94-6 (Oct. 1982). [received: Sept. 1983]
The PRIZ-1 set of wideband transducers is designed for measuring and monitoring the spectral and temporal characteristics of acoustic pulses radiated by ultrasonic instruments in the frequency range 0.2-30 MHz. To enhance the quality of nondestructive testing facilities and impart reliability to the interpretation of results, it is important to generate, in the testpiece, acoustic pulses that meet definite requirements. The pressure transfer ratio, the modulus of the electrical impedance at the lower limit of the working frequency range and the diameter of the active element are given for each transducer. The amplitude-frequency responses of the ultrasonic transducers are displayed. (5 refs.)

Instructional laboratory experiment on the sound field of a small ultrasonic transducer ....See Entry 105077

Diffraction of the surface light wave in a planar surface-acoustic-wave lightguide ....See Entry 106862

Developments in acousto-optic signal processing ....See Entry 106932

Acoustic surface wave band filters with weighted fan transducers ....See Entry 106935

43.90 OTHER TOPICS IN ACOUSTICS

106956 Experiments on the degenerate parametric source in air. S.Aoki, Y.Nakashima, T.Kamakura, K.Ikegaya (Dept. of Electrical Engng., Nagoya Univ., Nagoya, Japan).
J. Acoust. Soc. Jpn. (Japan), vol.39, no.4, p.247-52 (April 1983). In Japanese.
Describes the experimental results of degenerate parametric amplification which are performed in free field. The amplitude and phase controlled sound source consists of twelve tweeters, which radiates a 10 kHz powerful pump wave and a 5 kHz weak signal wave synchronously and collinearly. SPLs of both waves are 142 dB and 122 dB *re* 20 μPa at 1 m, respectively. The pump level is not so high as shock is formed. The obtained data confirm that the amplification really exists and the parametric signal periodically varies in amplitude with the initial phase of the weak signal having a period of π. These results are in identical fashion with the plane progressive wave in a tube except fo $\pi/4$ phase difference. Changes in beam pattern with the phase are also observed. The authors discuss the far-field behavior of the parametric signal by using the modified Pestorius' algorithm (1973). (9 refs.)

106957 Development of an acoustic levitation device with a mirror furnace. Y.Ikegami (Res. Inst., IHI, Tokyo, Japan), E.Mori, M.Saito.
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.121-5
A mirror furnace with a heating tube is effective for the heating of a small sample which is acoustically levitated in the tube. The authors describe experiments on the acoustic levitation in a transparent quartz tube with a mirror furnace. Several experiments were conducted in a terrestrial environment, and the authors found that a sample of (glass balloon, max. 500 mg) was levitated at stable conditions up to a temperature of about 600°C, and that a sample was continuously levitated during the increase and decrease of temperature by about 150°C, or pressure change of 250 Pa. by controlling the reflector position and gas components, using a microcomputer. (3 refs.)

44.00 HEAT FLOW, THERMAL AND THERMODYNAMIC PROCESSES

44.10 HEAT CONDUCTION (MODELS, PHENOMENOLOGICAL DESCRIPTION)

106958 On the heat conduction of two associated bodies with moving boundary. V.A.Barvinok, V.I.Bogdanovich.
Power Eng. (J. Acad. Sci. USSR) (USA), vol.20, no.2, p.160-6 (1982). Translation of: *Izv. Akad. Nauk SSSR Energ. & Transp.,* vol.20, no.2, p.173-9 (1982).
A solution is obtained for the nonlinear problem of heat conduction in a system of two associated bodies with uniformly moving boundary; a perturbation-theory method is employed. The substitution of a linear system of equations for a non-linear system is evaluated with respect to the calculation of temperature fields in certain specific materials. (8 refs.)

106959 Nonstationary problem of heat conduction with arbitrary moving boundary. V.A.Barvinok, V.I.Bogdanovich.
Power Eng. (J. Acad. Sci. USSR) (USA), vol.20, no.6, p.101-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Energ. & Transp.,* vol.20, no.6, p.128-35 (1982).
A small parameter is introduced in order to obtain a solution to the nonstationary problem of heat conduction for a system of two bodies with boundary moving in accordance with an arbitrary law for boundary conditions of the first, second, and third kinds. The given solution is used to determine the distribution of temperatures and the law governing the motion of the condensation boundary in production of coatings by the ion-plasma method. The reports given make it possible to obtain fairly complete information about the features of the thermal regime and the influence of the principal parameters on the rate of growth of the coating. (12 refs.)

106960 On one approach to finding an approximate solution of axisymmetric problem of unsteady heat conduction. M.M.Sidlyar, A.I.Lobanov.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.8, p.38-41 (1983). In Ukrainian.
The method of reducing a boundary value problems to ordinary differential equations is extended to an unsteady heat conduction problem. The first and second approximations for a finite length cylinder are considered as an example. (5 refs.)

106961 Steady heat conduction from an infinite row of holes in a half-space or a uniform slab. D.A.Caulk (Engng. Mech. Dept., General Motors Res. Labs., Warren, MI, USA).
Int. J. Heat & Mass Transfer (GB), vol.26, no.10, p.1509-13 (Oct. 1983).
A special boundary integral equation is used to analyze steady heat conduction from an infinite row of circular holes located below the surface of a half-space or along the midplane of a uniform slab. Numerical results show that standard handbook approximations for the total heat flux from any one hole can give sizable errors in both problems, even for modest values of the problem parameters. An alternative approximation proposed recently for the half-space problem is shown to offer a substantial improvement in accuracy. (6 refs.)

106962 Optimisation of homogeneous thermal insulation layers. J.P.Curtis (British Aerospace Dynamics Group, Bristol, England).
Int. J. Solids & Struct. (GB), vol.19, no.9, p.813-23 (1983).
The rate of heat loss from a body surrounded by a layer of homogeneous insulation is minimised by use of the Calculus of Variations. This optimisation is with respect to variation of the outer surface of the insulation layer, subject to the isoperimetric constraint that its volume remains fixed. Both Dirichlet and mixed boundary conditions for the temperature field on the outer surface are considered. Regular perturbation solutions in the case of small layer thickness are presented. (4 refs.)

106963 Question of constructing Tikhonov regularizing algorithms for non-one-dimensional inverse problems of heat conduction. V.B.Glasko, E.E.Kondorskaya (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1139-44 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR),* vol.43, no.4, p.631-7 (Oct. 1982). [received: Sept. 1983]
Tikhonov regularizing algorithms are formulated and given a foundation for the multidimensional problem of determining the density of a finite heat source. Uniqueness of the solution is studied for one of the formulations of the problem. (13 refs.)

106964 Solution of the inverse coefficient problem of heat conduction. A.A.Goryachev, V.M.Yudin.
J. Eng. Phys. (USA), vol.43, no.4, p.1148-54 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR),* vol.43, no.4, p.641-8 (Oct. 1982). [received: Sept. 1983]
An effective algorithm is developed for solving the inverse coefficient problem of heat conduction. Methods are proposed for improving the nonuniform convergence of the solution at the domain boundaries. (11 refs.)

106965 Computers in analysis and design [of heat transfer]. R.H.Pletcher (Dept. of Mech. Engng., Iowa State Univ., Ames, IA, USA), S.V.Patankar.
Mech. Eng. (USA), vol.105, no.6, p.73-9 (June 1983).
In the computational approach, a mathematical description of the transfer phenomenon is retained, and the governing equations—usually in partial differential forms—are solved numerically. This process may be viewed as a 'computer simulation' of the physical processes. (8 refs.)

Solution to diffusion equations in space distribution problems .... See Entry 105280

Analysis of temperature fields of bodies in the shape of shells .... See Entry 106982

Thermal conductivities of a cracked solid .... See Entry 108084

44.25 CONVECTIVE AND CONSTRAINED HEAT TRANSFER

(see also 47.25Q Convection and heat transfer)

Cold stress at high altitudes .... See Entry 106974

Theoretical and experimental investigation of the absorption coefficient of different blackbody models .... See Entry 107142

Method of making heat-engineering calculations for a passive solar heating system (nonsteady conditions) .... See Entry 109910

44.30 HEAT TRANSFER IN INHOMOGENEOUS MEDIA AND THROUGH INTERFACES

106966 A finite-element front-tracking enthalpy method for Stefan problems. Chin Hsien Li (Oxford Univ. Computing Lab., Oxford, England).
IMA J. Numer. Anal. (GB), vol.3, no.1, p.87-107 (Jan. 1983).
A finite-element front-tracking method, which avoids explicit treatment of the jump condition on the phase boundary, is proposed. This method is based on the discretization of a weak enthalpy formulation with isoparametric space-time finite elements. A one-dimensional two-phase problem and a two-dimensional one-phase problem are solved by this method. Then the method is applied to a generalized Stefan problem—the spot-welding problem and extended to the alloy-solidification problem. Numerical experiments show that this method is convergent and unconditionally stable and that second-order convergence can be expected if the biquadratic elements are used for one-dimensional problems. The effectiveness of this method is, in particular, shown in solving the last two problems. (18 refs.)

106967 Effects of stepwise variation of albedo on reflectivity and transmissivity of an isotropically scattering slab. T.B.Clements, M.N.Ozisik (Dept. of Mech. & Aerospace Engng., North Carolina State Univ., Raleigh, NC, USA).
Int. J. Heat & Mass Transfer (GB), vol.26, no.10, p.1419-26 (Oct. 1983).
The reflectivity and transmissivity of an isotropically scattering plane-parallel slab with stepwise variation of the single scattering albedo within the medium are determined for an isotropically incident radiation. Tabulated results, covering a wide range of albedos, are presented. (8 refs.)

106968 Heat transfer characteristics of in-ground heat exchangers. O.J.Svec, L.E.Goodrich, J.H.L.Palmer (Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
Int. J. Energy Res. (GB), vol.7, no.3, p.265-78 (July-Sept. 1983).
Most in-ground heat storage installations use a system of horizontal or vertical plastic pipes to carry heat exchanger fluid. In designing these systems it is generally assumed that the thermal effects of the plastic pipe can be neglected. This paper reports a laboratory study of the pattern of heat flow around fluid-carrying plastic pipe buried in clay soil. Heat flow measurements as well as estimated contact resistances are presented for a number of configurations. In addition, numerical model computations are given for steady-state, transient and cyclic behaviour of several configurations, and it is shown that substantially reduced heat flows are obtained when plastic pipe is used. (18 refs.)

106969 Effect of parameters of metal fiber capillary structures on maximum heat transport by heat pipes. M.G.Semena, A.N.Gershuni (Kiev Polytech. Inst., Kiev, Ukrainian SSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1116-20 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR),* vol.43, no.4, p.604-9 (Oct. 1982). [received: Sept. 1983]
The effect of the parameters of metal fiber capillary structures on the maximum heat transported by heat pipes is analyzed. (3 refs.)

106970 Mathematical model of the electrocontact heating of a steel bar in the region of current-conducting electrodes. V.K.Kapustkin (All-Union Sci.-Res. Inst. of Metall. Thermoengng., Sverdlovsk, USSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1160-3 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR),* vol.43, no.4, p.656-60 (Oct. 1982). [received: Sept. 1983]
A mathematical model of the electrocontact heating of a steel bar is developed, allowing the temperature fields in any cross section to be calculated. The adequacy of the model is verified by comparison with experiment. (8 refs.)

106971 Measurement of the thermophysical characteristics by the method of the regular cooling regime for a limited cylinder with a shell. M.Marich, B.Bachlich.
J. Eng. Phys. (USA), vol.43, no.5, p.1280-3 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR),* vol.43, no.5, p.817-22 (Nov. 1982). [received: Sept. 1983]
An analytic expression is used for the nonstationary temperature field of a limited circular cylinder with a shell to measure the thermal diffusivity by the method of the regular regime. The influence of a shell is taken into account by the first roots of the characteristic equations for an infinite sandwich plate and an infinite cylinder with a shell. (3 refs.)

106972 Real-time control of the free boundary in a two-phase Stefan problem. K.-H.Hoffmann, J.Sprekels (Naturwissenschaftliche Fakultat, Univ. Augsburg, Augsburg, Germany).
Numer. Funct. Anal. & Optimiz. (USA), vol.5, no.1, p.47-76 (1982).
A two-phase Stefan-problem is considered where the progress of the free boundary is observed by fully automatic real-time controls (thermostats or photoelectric cells). The heat flux at both fixed boundaries can be determined by heaters which respond to the signals of the controls, possibly with a certain time lag. The corresponding mathematical model leads to a two-phase Stefan problem with nonlinear and discontinuous boundary conditions with delays at the fixed boundaries. The problem is transformed into a set-valued fixed point equation, and the existence of a solution is shown with the aid of a theorem due to Bohnenblust-Karlin. The consequence of this result is that a free boundary with the well-known smoothness properties develops under the impact of a fully automatic real-time control via thermostats or photo-electric cells. Some numerical experiments are given. They indicate that the model is realistic. (11 refs.)

106973 The cooling of a low-heat-resistance stretching sheet moving through a fluid: a rejoinder. N.Afzal (Aligarh Muslim Univ., Aligarh, India).
Waerme- & Stoffuebertrag. (Germany), vol.17, no.4, p.217-19 (1983).
Deals with the comments of Kuiken (ibid., vol.16, p.101, 1982) disputing the accuracy of the solutions of an earlier work on the cooling of a low heat resistance stretching sheet moving through a fluid. It is shown that there is no loss of accuracy in the higher order perturbations, as claimed by Kuiken. Further, a comparison of the results of Euler transformation with those of Kuiken (based on direct and inverse series) show the agreement to four places of decimal for all values of steamwise distances. The results for heat transfer not considered in earlier papers are also presented. (4 refs.)

Heat transfer in the supercritical region at low pressure and mass velocity .... See Entry 106081

Optimisation of homogeneous thermal insulation layers .... See Entry 106962

Procedure for calculating a conductive heat exchanger .... See Entry 107243

On the determination of the heat-insulating characteristics of transparent film shielding for solar hothouses .... See Entry 109855

Problem of accumulation of solar energy in the form of heat .... See Entry 109857

Method of making heat-engineering calculations for a passive solar heating system (nonsteady conditions) .... See Entry 109910

Prediction of heat losses by conduction and radiation from total heat loss data for degraded evacuated collectors .... See Entry 109917

44.40 RADIATIVE HEAT TRANSFER

106974 Cold stress at high altitudes. N.C.Majumdar (Defence Inst. of Physiology & Allied Sci., Delhi Cantt, India), P.C.Gupta.
Def. Sci. J. (India), vol.33, no.2, p.147-58 (April 1983). [received: Aug. 1983]
The problem of cold at high altitudes has been analysed from a purely physical standpoint. It has been shown that Siple's Wind-Chill Index is not reliable because (i) it does not make use of the well established principles governing the physical processes of heat transfer by convection and radiation and (ii) it assumes that the mean radiant temperature of the surroundings is the same as the ambient dry bulb temperature. A Cold Stress Index has been proposed which is likely to be a more reliable guide for assessing the climatic hazards of high altitude environments. The Index can be quickly estimated with the help of two nomograms devised for the purpose. (13 refs.)

106975 Evaluation of spectrally-integrated radiative fluxes of molecular gases in multi-dimensional media. M.F.Modest (Dept. of Mech. Engng., Univ. of Southern California, Los Angeles, CA, USA).
Int. J. Heat & Mass Transfer (GB), vol.26, no.10, p.1533-46 (Oct. 1983).
A new multidimensional model has been developed which makes it possible to calculate the spectrally-integrated total radiative flux for a molecular-gas band based on the solution of two simple differential equations. The new model employs the exponential-wide-band model and makes it unnecessary to evaluate the spectral flux for a large number of wavenumbers with subsequent spectral integrations, thus considerably reducing the numerical effort required. Comparison with spectrally-integrated results from the differential (*P*-1) approximation, on which the present method is based, and with some exact results, shows excellent agreement for all situations. (16 refs.)

106976 Radiative heat transfer through opacified fibers and powders. K.Y.Wang, C.L.Tien (Dept. of Mech. Engng., Univ. of California, Berkeley, CA, USA).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.30, no.3, p.213-23 (Sept. 1983).
Radiative heat transfer through opacified (metallic or matallized) cylindrical fibers and spherical powders is investigated theoretically. The radiative properties of these packed particles are evaluated by using the solutions of electromagnetic theory. The large optical constants and large particle size parameters required an improved numerical scheme for evaluation of these properties. The results show that fine metal fibers provide excellent thermal radiation resistance. For the packed spheres, the high solid volume fraction restricts the present model to the geometric scattering regime. The results in this regime indicate better radiation resistance for smaller spheres. It is also interesting to note that, relative to unopacified spheres, the opacified spheres have higher thermal radiation resistance only at high temperatures. (16 refs.)

106977 The generalized exponential-integral $V(x,y)=\int 1\infty \exp(-xt)\ln(t+y)dt/t$ and computer algorithms for $y=0,1$. D.G.Hummer (NBS, Univ. of Colorado, Boulder, CO, USA).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.30, no.3, p.281-7 (Sept. 1983).
The generalized function exponential-integral function $V(x, y)$ defined here includes as special cases the function $E_1^{(2)}(x)=V(x, 0)$ introduced by van de Hulst (1980) and the functions $M_0(x)=V(x, 1)$ and $N_0(x)=V(x, -1)$ introduced by Kourganoff (1952) in connection with integrals of the form $\int E_n(t)E_m(t\pm x)$, which play an important role in the theory of monochromatic radiative transfer. Series and asymptotic expressions are derived and, for the most important special cases, $y=0$ and $y=1$, Chebyshev expansions and rational approximation are obtained that permit the function to be evaluated to at least 10 sf on $0<x<\infty$ using 16 sf arithmetic. (9 refs.)

106978 Radiative transfer in size-limited bodies. G.Brussaard (European Space Res. & Technol. Centre, Noordwijk, Netherlands).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.371-7
The paper studies radiative transfer through raincells of limited extent, in order to estimate the limitations of radiometric measurements of rain attenuation on slant paths. Results are given for model cells of cylindrical shape. It is shown that the errors caused by scattering are much larger in the case of a raincell occurring on the path and away from the radiometer site than in the classical case of a stratified rain medium of infinite horizontal extent. The accuracy obtainable for radiometric measurements in the 20 and 30 GHz band is shown to be severely limited by scatter effects. The effective medium temperature to be used in the classical radiometer equation will be a function of spatial characteristics of the rain medium. (7 refs.)

Effects of stepwise variation of albedo on reflectivity and transmissivity of an isotropically scattering slab .... See Entry 106967

Theoretical and experimental investigation of the absorption coefficient of different blackbody models .... See Entry 107142

Reduction of surface mixing in solar ponds by floating rings .... See Entry 109915

Prediction of heat losses by conduction and radiation from total heat loss data for degraded evacuated collectors .... See Entry 109917

44.50 THERMAL PROPERTIES OF MATTER (PHENOMENOLOGY, EXPERIMENTAL TECHNIQUES)

(see also 07.20 Thermal instruments and techniques)

106979 Boiling of a superheated liquid on the presence of a metallic surface under isothermal conditions. E.N.Sinitsyn, V.S.Uskov (Acad. of Sci., Sverdlovsk, USSR).
J. Eng. Phys. (USA), vol.44, no.1, p.13-15 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.19-21 (Jan. 1983). [received: Sept. 1983]
Measurements are made of the temperature dependences of the mean times before the boiling, at atmospheric pressure, of superheated n-pentane and n-hexane in a glass capillary tube, and with the introduction of a metal wire into the tube. (13 refs.)

106980 Temperature profiles induced by strip heaters. M.L.Burgemer, R.E.Reedy (Naval Ocean Systems Center, San Diego, CA, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.613-18
Presents a model based on analytic solutions to the heat equation that calculates the temperature profiles induced by line shaped heat sources. The sensitivity of isotherms to various heating conditions including the effect of tailoring power profiles in both curved and straight sources is discussed. Conditions are presented that result in 'dogbonded' shaped isotherms. Also shown is the effect that inhomogeneities (e.g., power density fluctuations or defects in the material) have on the ideal temperature profiles. (5 refs.)

Remote method for measuring the temperature of objects irradiated by lateral sources .... See Entry 105374

Thermoacoustic effect in a resonant semiopen tube .... See Entry 106918

44.60 THERMODYNAMIC PROCESSES (PHENOMENOLOGY, EXPERIMENTAL TECHNIQUES)

(see also 05.70 Thermodynamics, 07.20 Thermal instruments and techniques)

106981 Solution of Stefan problem for melting bodies. A.A.Shmukin.
Power Eng. (J. Acad. Sci. USSR) (USA), vol.20, no.2, p.154-9 (1982). Translation of: *Izv. Akad. Nauk SSSR Energ. & Transp.*, vol.20, no.2, p.167-72 (1982).
A solution of the symmetric Stefan problem for melting bodies of simple form (plate, cylinder, sphere) is obtained in closed form (the heating and melting regimes are covered) and reduced to a standard procedure, integration of a system of ordinary differential equations. (9 refs.)

106982 Analysis of temperature fields of bodies in the shape of shells. N.M.Belyaev, V.I.Zavelion, A.A.Ryadno (Dnepropetrovsk State Univ., Dnepropetrovsk, USSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1144-8 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.637-41 (Oct. 1982). [received: Sept. 1983]
The temperature fields in axisymmetric thick-walled shells with different middle surface shape are investigated. (4 refs.)

106983 Numerical calculation of the temperature field of a one-step magnetofluid sealing unit. T.M.Krivonosova, A.K.Sinitsyn, V.E.Fertman (A.V. Lykov Inst. of Heat & Mass Transfer, Acad. of Sci., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1164-7 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.660-4 (Oct. 1982). [received: Sept. 1983]
The temperature distribution in a cooled magnetofluid sealing unit is investigated numerically. The dependence of the maximum temperature in the sealing layer of magnetic fluid on the rate of axle rotation is obtained for various conditions of cooling. (5 refs.)

106984 Mathematical modeling of the heating of long steel cylindrical parts under tempering in an inductor with a transverse magnetic field. V.B.Glasko, M.K.Trubetskov (Dept. of Math., Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.5, p.17-22 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.5, p.17-22 (1982).
On the basis of Tikhonov regularization theory, the problem of the heating of cylindrical samples under tempering in an inductor with a transverse magnetic field is considered. The a priori requirements on the resulting characteristics of the heating process are determined by the time dependence of the current strength needed for their determination. (7 refs.)

Mathematical model of the electrocontact heating of a steel bar in the region of current-conducting electrodes .... See Entry 106970

46.00 MECHANICS, ELASTICITY, RHEOLOGY

46.10 MECHANICS OF DISCRETE SYSTEMS

(see also 03.20 General mathematical aspects)

106985 Analysis of vibration by component mode synthesis method. III. Application to cylinder block of 4 cylinders. M.Ookuma (Tokyo Inst. of Technol., Tokyo, Japan), A.Nagamatsu.
Bull. JSME (Japan), vol.26, no.215, p.812-17 (May 1983).
For pt.II see ibid., vol.25, p.1093 (1982). A cylinder block of 4 cylinders is analyzed by the component mode synthesis method. The component mode synthesis method is a general method of analysis of the vibration of a complex mechanical structure using the natural modes of the components. A structure is divided into some components. All components are classified into master components and branch ones. The natural modes of each component are determined by the finite element method. The natural modes of all components are synthesized to form the generalized system coordinates. The equation of motion under these system coordinates is solved to know the vibration of the total structure. (11 refs.)

106986 On the reduction of the order of equations of motion of gyrostat in an axisymmetric field. H.M.Yehia (Dept. of Math., Mansoura Univ., Mansoura, Egypt).
J. Mec. Theor. & Appl. (France), vol.2, no.3, p.451-62 (1983).
The problem of motion of a gyrostat about a fixed point in a field of force with axisymmetric potential is reduced to a single second order differential equation in two of the direction cosines of the axis of symmetry with respect to the principal axes of the gyrostat at the fixed point. This equation is used in the study of stability of the pendulum-like motions of a heavy gyrostat. (21 refs.)

106987 A periodically forced piecewise linear oscillator. S.W.Shaw, P.J.Holmes (Dept. of Theoretical & Appl. Mech., Cornell Univ., Ithaca, NY, USA).
J. Sound & Vib. (GB), vol.90, no.1, p.129-55 (8 Sept. 1983).
A single-degree of freedom nonlinear oscillator is considered. The nonlinearity is in the restoring force and is piecewise linear with a single change in slope. Such oscillators provide models for mechanical systems in which components make intermittent contact. A limiting case in which one slope approaches

infinity, an impact oscillator, is also considered. Harmonic, subharmonic, and chaotic motions are found to exist and the bifurcations leading to them are analyzed. (29 refs.)

106988 Nonlinear induced oscillations of vibroshock systems. V.A.Bazhenov, V.I.Gulyaev, G.S.Kondakov, P.P.Lizukov (Kiev Engng. Building Inst., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.8, p.1138-43 (Aug. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.8, p.121-6 (Aug. 1982).
Considers a mechanical system whose position is determined by values of n independent generalized coordinates q_1, q_2, ..., q_n satisfying a relationship for a linkage on one side $f(q) \geq 0$. Let a force acting on the system have a force function U which may clearly depend on time t. The kinetic energy of the system is denoted in terms of K. (3 refs.)

106989 Determination of the dynamic characteristics of nonlinear vibrating systems by the measured motion. N.P.Plakhtienko (Inst. of Mech., Acad.of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.10, p.1368-74 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.72-7 (Oct. 1982). [received: Sept. 1983]
Explains the method of determining the dynamic characteristics of mechanical vibrating systems taking into account the factors of nonlinearity. The data obtained in computer simulation are also presented. (10 refs.)

Damped nonlinear oscillations modeled by a 3-dimensional differential system . ...See Entry 105101

Damping estimation method using the spectral analysis technique based on the auto-regressive model fitting ....See Entry 105103

Flutter loads of a Timoshenko beam-column under a follower force gorverned by two variants of equations of motion ....See Entry 107029

46.20 CONTINUUM MECHANICS

(see also 03.40 General mathematical aspects)

106990 On volume fraction theories for discretized materials. A.Bedford (Univ. of Texas, Austin, TX, USA), D.S.Drumheller.
Acta Mech. (Austria), vol.48, no.3-4, p.173-84 (1983).
Materials which are in discretized form, such as granular materials or a distribution of bubbles, can exhibit microstructural effects associated with the local deformations of the microelements. A theory in which new kinematical variables are introduced to model the dilational motions of the microelements is called a volume fraction theory. It is argued that two types of local motion should be considered—dilatation of the microelements and their dilatational motion relative to one another—and that two of the three variables volume fraction, partial density and density, are necessary to model them. As an example, the theory of granular materials due to Goodman and Cowin is generalized by modeling the local dilatational motions in terms of the partial density and the density of the material. (25 refs.)

106991 Dynamic formulation of heterogeneous rectangular section rod. M.Touratier.
J. Mec. Theor. & Appl. (France), vol.2, no.3, p.307-24 (1983). In French.
Proposes a dynamic formulation for rectangular cross-section heterogeneous rods. The rod is composed of nine homogeneous rods, of rectangular sections and different orthotropic materials. The model is constructed from basic elements and uses a variational method (stress and displacements) with a view to satisfying interface continuity conditions for the basic elements, and boundary conditions for the heterogeneous rod. The stress equations for stress movement and the constitutive equations are established in the general case for the nine elements. For the two axes of geometrical and material symmetry, the longitudinal motion is uncoupled, while flexion and torsion motions are always coupled. (9 refs.)

106992 Numerical determination of limit loads for an axisymmetrical orthotropic material in plane strain. J.Pastor, S.Turgeman.
J. Mec. Theor. & Appl. (France), vol.2, no.3, p.393-416 (1983). In French.
Presents a limit analysis study of an axisymmetrical orthotropic material system which obeys a Boehler and Sawczuk (1970) yield criterion. In order to obtain a numerical approach for the load limits of the system under study, an extension of the static and kinematic programmes previously elaborated for an isotropic medium is advanced. The programmes derived are applied to the problem of the bearing capacity of a strip footing. The influence of the variations of the anisotropic parameters is also investigated, as is the position of the orthotropic axis and the nature of the soil-foundation interface. (18 refs.)

106993 Shallow shell with a rigid linear inclusion along the curvature line. D.V.Grilits'ku, V.K.Opanasovich, I.P.Shats'ku.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.8, p.28-30 (1983). In Ukrainian.
A problem concerning the stress distribution in the vicinity of the rigid linear inclusion oriented along the principal curvature line of the shallow shell is solved using the singular integral equations. Asymptotic analytical expressions are obtained for the stress intensity factors. (1 ref.)

106994 A method of special weight functions in the problem of parametric identification of mechanical systems. N.P.Plakhtienko.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.8, p.31-5 (1983). In Ukrainian.
A method of parametric identification of nonlinear mechanical systems is suggested. It is based on the integral transformation of motion equations with special weight functions. The weight functions are selected in such a way that if the system is nonlinear in displacements (velocity, accelerations), its identification is performed on the basis of information delivered by the displacement (velocity, accelerations). Results of computer-aided simulation are presented showing that the identification algorithms do not increase errors of experimental data measurement. (6 refs.)

106995 On point spectrum of one class of open cylindrical structures. A.E.Poedinchuk.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.8, p.53-7 (1983). In Ukrainian.
The quasinatural frequencies of a nonclosed circular cylindrical surface are shown to form a countable isolated subset of a complex plane without finite limit points. (9 refs.)

106996 Variational approach by means of adjoint systems to structural optimization and sensitivity analysis. I. Variation of material parameters within fixed domain. K.Dems (Lodz Tech. Univ., Lodz, Poland), Z.Mroz.
Int. J. Solids & Struct. (GB), vol.19, no.8, p.677-92 (1983).
For a linear elastic structure, the first variation of an arbitrary stress, strain and displacement functionals corresponding to variation of material parameters within specified domain is derived by using the solution for primary and adjoint systems. This variation is of fundamental importance in sensitivity analysis, optimal design and identification problems. Simple examples of optimal stiffness design and identification of stiffness parameters in beams are presented. (8 refs.)

106997 The effective moduli of short-fiber composites. J.Aboudi (Dept. of Solid Mech., Materials & Structures, Tel-Aviv Univ., Ramat-Aviv, Israel).
Int. J. Solids & Struct. (GB), vol.19, no.8, p.693-707 (1983).
A first order continuum theory with microstructure is developed for aligned short-fiber composites. The fibrous material is modeled by a triply periodic array of rectangular parallelpiped elastic fibres which are embedded in an elastic matrix. A proper reduction of the theory, by which the microstructure variables are eliminated, yields the effective moduli of the short-fiber composite. The overall elastic constants of the three specific situations of long-fiber composites, particulate composites and periodically bilaminated media, are obtained as special cases. The reliability of the predicted effective moduli is verified by numerous comparisons with available experimental results in various cases. (17 refs.)

106998 Optimal plastic design of stiffened shells. C.Cinquini (Dept. of Structural Mech., Univ. of Pavia, Pavia, Italy), M.Kouam.
Int. J. Solids & Struct. (GB), vol.19, no.9, p.773-83 (1983).
Deals with the variational formulation of the optimum design of plastic cylindrical shells with stepwise varying thickness and stiffeners at joints (sections between two contiguous elements). The optimality criterion is attained by using a variational formulation. The saving achieved by using stiffeners is shown by means of an example. (19 refs.)

106999 A singular hybrid finite element analysis of boundary-layer stresses in composite laminates. S.S.Wang, F.G.Yuan (Dept. of Theoretical & Appl. Mech., Univ. of Illinois, Urbana, IL, USA).
Int. J. Solids & Struct. (GB), vol.19, no.9, p.825-37 (1983).
The laminate elasticity basis and the fundamental solution structure for the boundary-layer field are briefly reviewed first. Formulation of a singular composite-edge element is based on the recently developed boundary-layer theory and the variational principle of a modified hybrid functional. The singular hybrid element is used conveniently in conjunction with displacement-based conventional elements. Numerical solutions for the well-known Pipes-Pagano problem are presented for illustraton. Comparisons of the present solution with the laminate elasticity solution and conventional finite element results are made to demonstrate the accuracy and efficiency of the present approach. Influences of eigenfunction truncation, size and aspect ratio of the singular hybrid element as well as mesh configuration are studied. (29 refs.)

107000 On the static and kinetic methods of conservative system stability and Rayleigh's principle: a reexamination. J.G.Papstavridis (School of Engng. Sci. & Mech., Georgia Inst. of Technol., Atlanta, GA, USA).
J. Sound & Vib. (GB), vol.90, no.1, p.51-8 (8 Sept. 1983).
The relation between the static and kinetic variational methods of the stability of equilibrium analysis of conservative systems and the corresponding static and kinetic Rayleigh's principles is reexamined. Specifically made explicit are the connections between (i) the virtual work principle (for the adjacent equilibrium configuration) and Rayleigh's principle of extremum critical loads and buckled modes, and (ii) Hamilton's principle (for the adjacent nonequilibrium configuration) and Rayleigh's principle of extremum frequencies and mode shapes, through simple familiar examples. These connections are found by considering, in addition to the familiar mode amplitude variations, variations of the load which in turn produce variations in the space (i) and time (ii) domain lengths, respectively; one is thus led to a variable endpoints variational problem (instead of the customary fixed endpoints one) which, by invoking the energetics of these adjacent configurations, is simplified and finally brought to the standard Rayleigh's principle form. (11 refs.)

Elastic media with microstructure I. One-dimensional models ....See Entry 105051

Coupled fields and nonclassical continuous media ....See Entry 105110

Homogenization with Fourier series ....See Entry 105111

Application of the boundary value integral equations method to the investigation of press working of metals ....See Entry 109329

Size effects and micromechanics of a porous solid ....See Entry 109376

46.30 MECHANICS OF SOLIDS AND RHEOLOGY

(see also 62.20 Mechanical properties of solids, as related to microscopic structure)

107001 Three dimensional stress state in an internally-pressurised hollow cylinder with a reinforcing ring. H.Kasano, K.Aoyagi, H.Matsumoto, I.Nakahara (Tokyo Inst. of Technol., Tokyo, Japan).
Bull. JSME (Japan), vol.26, no.215, p.700-7 (May 1983).
An internally-pressurized hollow cylinder with a reinforcing ring is studied within the framework of the three dimensional elasticity theory, and the effects of the ring width and the cylinder thickness on the stresses and deformations as well as contact pressure are examined. It is assumed that there are no shear stresses in the contact zone. The use of Dougall's stress function and method of Fourier transforms then leads to a dual integral equation, which is reduced to simultaneous algebraic equations by use of a series expansion method. (7 refs.)

107002 Thermal stress concentrations in the transient two-dimensional temperature field. II. Plate with a semi-elliptic notch. M.Furukawa (Kobe Univ. of Mercantile Marine, Kobe, Japan), M.Hamada, H.Kitagawa, T.Fukuoka.
Bull. JSME (Japan), vol.26, no.215, p.708-15 (May 1983).
The transient thermal stress concentration of a notched semi-infinite plate is analysed numerically. The plate which is initially in a uniform temperature state is assumed to be heated along the straight and notched boundaries through a fluid touching directly on it. The notch shapes are semi-elliptic with various radius ratios. A finite-difference method is used both for temperature and stress analyses. The finite-difference mesh is formed on basis of the equi-potential and flow lines in the potential flow around an elliptic cylinder. It is found by this method that the thermal stress concentration increases with time and the Biot number of heat convection. An approximate method, by which the stress concentration factor of a semi-elliptically notched strip with finite width can be estimated, is proposed. (10 refs.)

46.30C Static elasticity

107003 A note on the solution of two finite plain strain problems. C.Perdikis (Univ. of Ioannina, Ioannina, Greece).
Acta Mech. (Austria), vol.48, no.3-4, p.203-8 (1983).
Previously (see ibid., vol.43, p.159, 1982) the solution of the boundary-value problems for finite plane deformation of compressible isotropic hyperelastic materials of harmonic type with an elliptical hole was found in integral form.

The author gives a solution of these problems which is more explicit, and not in integral form. To do this, it is necessary to choose particular forms of the functions Ψ^{-1} and Φ^{-1} which agree with known expressions of these functions in the limit $x \to 2$. (2 refs.)

107004 Use of initial parameters method in calculations of nonlinear behaviour of shells of revolution. A.V.Korovaitsev.
Izv. VUZ Mashinostr. (USSR), no.7, p.148-50 (1983). In Russian.
The axisymmetric problems of the deformation of elastic shells when subject to large displacements are considered. When the problems are solved by means of parametric differentiation it is shown to be possible to use the initial parameters method to investigate the behaviour of the shell over a wide range of nonlinearity. (3 refs.) *L.M.H.*

107005 Transient thermal stresses in a rectangular plate due to variation of heat-transfer coefficients on upper and lower surfaces. Y.Sugano (Dept. of Mech. Engng., Univ. of Osaka Prefecture, Osaka, Japan).
Int. J. Eng. Sci. (GB), vol.21, no.10, p.1203-14 (1983).
Presents a method for the determination of the transient temperature and thermal stresses in a thin finite rectangular plate subjected to the distinct thermal boundary conditions of the third kind at the four edges and allowing the variation of heat transfer coefficients on the upper and lower surfaces of the plate. (4 refs.)

107006 An energy estimate for the biharmonic equation and its application to Saint-Venant's principle in plane elastostatics. J.K.Knowles (Div. of Engng. & Appl. Sci., California Inst. of Technol., Pasadena, CA, USA).
Indian J. Pure & Appl. Math., vol.14, no.7, p.791-805 (July 1983).
A new energy estimate is given for a boundary value problem for the biharmonic equation. The result is applied to the estimation of stresses in a plane elasticity problem. (15 refs.)

107007 Interfacial matrix stresses in composites due to misfitting cylindrical constituents. P.J.Fritz, R.A.Queeney (Dept. of Engng. Sci. & Mech., Pennsylvania State Univ., University Park, PA, USA).
J. Compos. Mater. (USA), vol.17, no.3, p.224-30 (May 1983).
Examines the matrix stress fields at the interface between the matrix and hexagonal arrays of misfitting cylinders. Stresses were analyzed using the photoelastic method, wherein the matrix was the photoelastic material. As the nearest-neighbor cylindrical inclusions first approach each other, there is a tendency for both radial compression and tensile hoop stress components to increase beyond values predicted for single, isolated inclusions. At nearest-neighbor separations less than 40% of the cylindrical inclusion diameter, however, the contact pressure between reinforcement and matrix decreases. At the same time, the tensile hoop component increases markedly, less so in the hexagonal array than for two inclusions. The physical positioning and arraying of the reinforcement will clearly determine the local stress induced by processing, which, in turn, will influence composite response and service endurance. (6 refs.)

107008 Response of an orthotropic cylindrical shell to sudden heating. H.Ray (Dept. of Mech. & Aerospace Engng., Rutgers Univ., New Brunswick, NJ, USA).
Nucl. Eng. & Des. (Netherlands), vol.74, no.3, p.309-16 (1982).
The parametric resonance of thin elastic orthotropic cylindrical shells in plane strain to suddenly developed uniform temperature is investigated. The shells are fabricated from laminated fiber-reinforced composite materials. The short-term analysis identifies the excitation of particular unstable modes. The long-term analysis shows that the initially unstable circumferential flexural modes exchange energy with the circular mode in a cyclic manner. If the flexural motion is excited, the resulting displacements and stresses are substantially larger than the initial membrane values. The effects of temperature applied as a step function, shell geometry, number of layers, and fiber orientation are shown. (9 refs.)

107009 Maximum strength/stiffness design of structural members in presence of self-weight. B.L.Karihaloo, W.S.Hemp (Dept. of Engng. Sci., Univ. of Oxford, Oxford, England).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1796, p.119-32 (8 Sept. 1983).
Presents the maximum strength/stiffness design of tension/compression and flexural members under the influence of their self-weight as well as given external forces. In the maximum strength design, all cross sections of the member attain the maximum allowable stress for the material; the design is therefore also referred to as the uniform or constant maximum strength design. In the maximum stiffness design, the maximum longitudinal or transverse displacement is minimized. It is assumed that the location of the maximum displacement is known. In this sense, the paper considers only strict minimization problems. In several cases analytical solutions are obtained. Where this was not possible, solutions derived by successive approximation are given. The variational problem corresponding to this optimization problem has several unique features which are not commonly encountered in the absence of self-weight. (14 refs.)

107010 Approximate closed solutions of the axisymmetric problem of deformation of an inhomogeneous disk of arbitrary profile. M.L.Kozlov (Inst. of Appl. Problems of Mech. & Math., Acad. of Sci., L'vov, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.8, p.1124-9 (Aug. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.8, p.110-14 (Aug. 1982).
A disk (a round thin plate of radius R_2 with a central circular hole of radius R_1) made of a material inhomogeneous with respect to the radius r is loaded by stresses σ_2 and σ_1 uniformly distributed respectively on the outside surface and the surface of the hold. Rotating with a constant angular velocity ω, the disk is located in an axisymmetric temperature field. The variable cross section of the disk of thickness H(r) is symmetric relative to the middle plane. The temperature T(r) and, as a consequence of the loading conditions, the radial and circumferential stresses σ_r, σ_θ are constant over the thickness of the disk. The unit forces $n_r = H(r)*\sigma_r$, $n_\theta = H(r)*\sigma_\theta$ are continuous along the radius, whereas the stresses can change markedly at places of a substantial change in the thickness of the disk. (9 refs.)

107011 A note on elastic plates fixed in position along a knife edge. P.Hagedorn (Inst. fur Mech., Tech. Hochschule Darmstadt, Darmstadt, Germany).
Z. Angew. Math. & Mech. (Germany), vol.63, no.7, p.326-9 (1983). In German.
An application of Reissner's extension (1945) of Kirchhof's treatment. The deformation is calculated from the sum of three solutions to Kirchhof problems. Further work will deal with other end conditions. (8 refs.) *N.C.*

Elastic media with microstructure I. One-dimensional models ....See Entry 105051

Coupled fields and nonclassical continuous media ....See Entry 105110

Homogenization with Fourier series ....See Entry 105111

Thermoelasticity problems ....See Entry 105112

Construction of a working model in the finite-element method for solution of three-dimensional problems of elasticity theory ....See Entry 105113

Variational approach by means of adjoint systems to structural optimization and sensitivity analysis. I. Variation of material parameters within fixed domain ....See Entry 106996

The effective moduli of short-fiber composites ....See Entry 106997

A singular hybrid finite element analysis of boundary-layer stresses in composite laminates ....See Entry 106999

Stress-strain state of multiple-layered structures subject to pulsed loading ....See Entry 107013

The existence of regions of divergence instability for nonconservative systems under follower forces ....See Entry 107027

On the behaviour of shock waves in deformable dielectric materials ....See Entry 107032

An annular crack in microelasticity ....See Entry 107062

Probability of failure of thermoelastic reinforced shells ....See Entry 107073

Contact stresses in two elastic bodies. Elastic bodies are finite hollow cylinders ....See Entry 107075

Compression of an elastic cylinder between two rigid planes. Application of the indirect fictitious-boundary integral method to a contact problem ....See Entry 107076

46.30J Viscoelasticity, plasticity, viscoplasticity, creep, and stress relaxation

(inc. rheology of solids)

107012 Mathematical modelling of a flexible beam under gravity. F.Janssens (Math. Support Div., ESTEC, Noordwijk, Netherlands).
ESA J. (Netherlands), vol.7, no.2, p.195-208 (1983).
The differential equations describing the static deflections of a Bernouilli beam under gravity and a concentrated tip load are derived and solved. The solutions are used to predict tip deflections as a function of bending stiffness for a constant tip load. This relationship is then applied to the results of the static bending tests performed on the ISPM satellite's axial antenna to determine its bending stiffness. The results show clearly the importance of modelling gravity as a distributed load, even for light structural elements. (6 refs.)

107013 Stress-strain state of multiple-layered structures subject to pulsed loading. V.P.Sizov, S.I.Shumarin.
Izv. VUZ Mashinostr. (USSR), no.7, p.13-17 (1983). In Russian.
The pulsed loading of a multiple-layered structure is considered which is capable of concentrating stress at its internal points. Some ways of designing structure capable of reducing the concentration of the stress are shown. (4 refs.) *L.M.H.*

107014 Calculating shell of rotation by finite element method when material operates beyond limit of elasticity. A.P.Nikolaev, N.G.Bandurin.
Izv. VUZ Mashinostr. (USSR), no.7, p.17-21 (1983). In Russian.
The theory of plastic flow is used as the basis for proposing an algorithm for the creation of a matrix rigidity of a curvilinear rectangular finite element when a material is operating beyond the limit of elasticity. (4 refs.) *L.M.H.*

107015 Riemann and Goursat problems for one-dimensional classical plasticity. C.Faciu (Dept. of Math., Nat. Inst. for Sci. & Tech. Creation, Bucharest, Rumania).
Int. J. Eng. Sci. (GB), vol.21, no.10, p.1215-29 (1983).
One-dimensional motions for a class of rate independent elastic-plastic materials are considered. Goursat and Riemann problems are investigated by means of similarity solutions. Uniqueness of the solution for both problems is ensured by adopting a physical principle stated by Suliciu (see Stud. Cerc. Mat., vol.25, p.53, 1973); moreover the solution itself is constructed in all the cases considered. (6 refs.)

107016 Large strain inelastic behaviour of cylindrical tubes. E.Chater, K.W.Neale (Faculte des Sci. Appliquees, Univ. de Sherbrooke, Sherbrooke, Quebec, Canada).
Int. J. Solids & Struct. (GB), vol.19, no.8, p.709-24 (1983).
The finite strain behaviour of thin-walled circular cylinders fixed at their ends and subjected to uniform internal pressure is examined. General transversely isotropic inelastic properties are assumed, and both time-independent plastic (elastoplastic) and rate-sensitive inelastic (viscoplastic) material response are considered. Flow theory and deformation theory-type constitutive laws are employed. The influence of constitutive properties and tube geometry on maximum pressure and localized necking instabilities is determined through finite element computations for selected types of anisotropy. Simple relations are developed for the pressure-deformation response and instability of general transversely isotropic materials, and these are shown to be very accurate for long tubes. The accuracy of elementary formulae commonly used in experimental investigations of constitutive relations is also discussed. (17 refs.)

107017 Evaluation of a uniaxial, nonlinear, second-order differential overstress model for rate-dependence, creep and relaxation. E.P.Cernocky (Dept. of Mech. Engng., Univ. of Colorado, Boulder, CO, USA), E.Krempl.
Int. J. Solids & Struct. (GB), vol.19, no.9, p.753-66 (1983).
The properties of a second-order differential equation linear in the first and second time derivatives of stress and strain but nonlinear in the overstress are investigated. The extension to second-order time derivatives in this nonlinear constitutive equations follows similar methods in linear viscoelasticity. The behavior of the second-order equation is compared with that of the first-order equation. Phase-plane analysis and Poincare-linearization are used to show that the first and second-order equations exhibit the same long time limits for constant stress(strain)-rate loading. Numerical integration involving strain(stress)-rates differing by four orders of magnitude and strain(stress)-rate jumps demonstrates that the limits are rapidly attained and that the transient behavior of the second-order equation can be different from that of the first-order equation. Strong and mild oscillatory behavior as well as monotonic behavior is possible in strain control. Stress control always results in monotonic behavior. For creep and relaxation the inelastic strain is a functional of the overstress history and the large time limit corresponds to that of the first-order equation. (25 refs.)

107018 Plane strain extrusion studies by finite element method. A.K.Tayal (Delhi Coll. of Engng., Delhi, India), R.Natarajan.
J. Inst. Eng. (India) Mech. Eng. Div., vol.63, pt.ME1, p.31-4 (July 1982). [received: Aug. 1983]
The metal flow under plane strain conditions through square, wedge shaped and unsymmetric dies in direct extrusion and also in inverted extrusion through a square die were studied using a viscoplastic model finite element method. Extrusion pressures were calculated, and strain rate contours, velocity vectors and hydrostatic pressure distribution were evaluated. This additional information brings out distinctly the many features of plane strain extrusion. Agreement of the results with practical observations of other investigators is

also reported besides the general agreement with the theoretical predictions. This has been done as a part of the broader assessment of the finite element technique for the solution of metal flow problems. (15 refs.)

107019 Determining the critical number of revolutions for a disk equal in strength during creep. A.f.Nikitenko (Inst. of Hydrodynamics, Acad. of Sci., Novosibirsk, USSR).
Strength Mater. (USA), vol.14, no.8, p.1012-15 (Aug. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.8, p.15-18 (Aug. 1982).
In some cases it is possible to obtain equality in strength of a design element of specified geometry by the proper selection of external loads and temperature. This problem is solved for the case of a nonuniformly heated disk of variable thickness with a hole. For it a system of equations decribing all three stages of creep of a material with simultaneous taking into consideration of the process of accumulation of damages in it is used. A disk of constant thickness and a uniformly heated disk are considered as particular cases. (7 refs.)

107020 Phenomenological model of the description of deformation and failure and metals under complex nonisothermal loading. G.N.Kuvyrkin (N.E. Bauman Higher Tech. School, Moscow, USSR).
Strength Mater. (USA), vol.14, no.8, p.1034-6 (Aug. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.8, p.35-7 (Aug. 1982).
A phenomenological model of failure is given. In constructing the determining relationships it was assumed that the 'lifetime' of the structure depends mainly on the time of accumulation of dispersed damages of the pore and microcrack type. The form of these damages was not taken into account, nor were extreme cases of purely ductile and purely brittle fracture investigated. (9 refs.)

107021 Elastoplastic behavior of a laminar-fibrous material. V.P.Bagmutov (Volgograd Polytech. Inst., Volgograd, USSR).
Strength Mater. (USA), vol.14, no.10, p.1397-404 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.96-102 (Oct. 1982). [received: Sept. 1983]
The method of layered sectioning is used to examine the elastoplastic behaviour and strength of a laminar-fibrous composite (LFC) with allowance for temperature effects. (9 refs.)

107022 On the motion of a viscoelastic solid in presence of a rigid wall. I. Darboux and general Cauchy problems for a third-order hyperbolic operator: explicit Riemann function and maximum principles. B.D'Acunto, A.D'Anna, P.Renno (Istituto di Meccanica Razionale, Univ. di Napoli, Napoli, Italy).
Z. Angew. Math. & Phys. (Switzerland), vol.34, no.4, p.421-38 (July 1983).
This is the first of two papers whose aim is the analysis of a unilateral problem related to the unidimensional motion of a viscoelastic standard linear solid $\mathcal{B}$ in presence of a rigid rectilinear wall. The line of influence of the wall, which represents the free boundary of the problem, plays an essential role. To construct the solution, the explicit Riemann function of the third-order hyperbolic operator which characterizes the motions of $\mathcal{B}$ is determined. Therefore the Darboux problem and the general Cauchy problem with initial data prescribed on arbitrary curves $t=t(x)$ of the xt-plane are explicitly solved. Furthermore, appropriate maximum theorems, necessary to verify the inequality of the constraint and to conjecture an admissible dynamic of the impact for the viscoelastic case dealt with, are stated. (27 refs.)

107023 Flexure of beams with certain curvilinear cross sections. S.A.Obaid (Div. of Maths. & Computer Sci., Univ. of Texas, San Antonio, TX, USA).
Z. Angew. Math. & Phys. (Switzerland), vol.34, no.4, p.439-49 (July 1983).
Special complex variables techniques are used to obtain the six flexure functions (one of which is the torsion function) of a certain isotropic cylinder under flexure. The cross section is bounded by the closed curve $r=a \sin^4(\theta/4)(-\pi<\theta\leq\pi)$. The torsional rigidity, moment integrals, and the associated twist are also evaluated for this beam. It is worthy to mention that these techniques work successfully when they are applied to any of the cross sections bounded by $r=a|\sin(\theta/n)|^n.(-\pi<\theta\leq\pi)$, where n is a positive integer $(n>1)$. (8 refs.)

Interfacial operators in the mechanics of composite media ....See Entry 105109

On wave propagation in random particulate composites ....See Entry 105120

Optimal plastic design of stiffened shells ....See Entry 106998

Buckling by progressive plastic deformation under cyclic additional loading ....See Entry 107024

Stability of plastic extension of anisotropy hardened bodies ..See Entry 107026

On axial and lateral buckling of end-loaded anisotropic cantilever beams ....See Entry 107028

Forced vibrations and their damping ....See Entry 107045

Interference effect of notches. II. An experimental investigation on interference effect of notches on strengths and deformation properties of notched bar with double U-notches ....See Entry 107051

Extremum principles for the energy-release problem of elastic-perfectly plastic body subjected to prescribed change of material properties ... See Entry 107064

Dynamic crack-tip field in rate-sensitive solids ....See Entry 107066

A viscoplastic analysis of rapid crack propagation experiments in steel ....See Entry 107067

Stress, dilatancy and fabric in granular materials .... See Entry 107077

Forces on conical-nosed penetrators into targets with constant shear strength .. ..See Entry 107078

Theoretical experimental study of the ploughing of a rigid-plastic semi-infinite body by a rigid pyramidal indenter ....See Entry 107079

An analogy between rectilinear flow of plastic solids and Saint-Venant torsion ....See Entry 107192

Theory for saturation stress difference in torsion versus other types of deformation at low temperatures .... See Entry 107810

Creep in transforming polycrystalline materials ....See Entry 107813

Analysis of plane elastic-plastic shock-waves from the fourth-order anharmonic theory ....See Entry 107829

Size effects and micromechanics of a porous solid ....See Entry 109376

Study on elastic-plastic deformation analysis using a cyclic stress-strain curve ....See Entry 109401

Drawability of sheet material ....See Entry 109434

Behavior of shells of various types in internal explosive loading ....See Entry 109508

Stress-strain curves for high-temperature monotonic loading . See Entry 109663

46.30L Static buckling and instability

107024 Buckling by progressive plastic deformation under cyclic additional loading. Q.S.Nguyen, G.Gary (Lab. de Mecanique des Solides, Ecole Polytech., Palaiseau, France).
J. Mec. Theor. & Appl. (France), vol.2, no.3, p.351-73 (1983). In French.
The interaction between buckling and ratchetting under cyclic additional loading is discussed for elastic-plastic structures. It is shown that the risk of progressive plastic deformation is greater in the presence of prestresses and this phenomenon can lead to the buckling of a structure as a consequence of the resulting additional displacements. This interaction has been studied in the literature only very recently; it is particularly strong in perfect plasticity. For positive strain hardening materials, an estimate of the primary loading is given in order to evaluate the possibility of ratchetting. When the primary load is smaller than the smallest critical load of tangent modulus, elastic and plastic shake-down conditions are established. (19 refs.)

107025 On fibre stability in the die under nonuniform precritical deformations. I.N.Garashchuk.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.8, p.24-7 (1983). In Ukrainian.
An elastic fibre with a circular cross-section in the unbounded elastic medium is studied for its stability. The investigations were made within the second version of a three-dimensional linearized stability theory under small deformations with regard for the material structure. (9 refs.)

107026 Stability of plastic extension of anisotropy hardened bodies. G.D.Del', D.V.Khvam, A.N.Balakirev.
Izv. VUZ Mashinostr. (USSR), no.7, p.8-9 (1983). In Russian.
An account of plastic extension-compression is given to provide the argument to support the theoretical possibility of increasing the critical strain, up to which the plastic deformation is stable, given that the plastic deformation processes are non-monotonic. Experimental data obtained by extension-torsion-extension etc. testing of specimens are shown to confirm the existence of an increase in the critical strain in the loading cycle under investigation compared with simple extension. (no refs.) *L.M.H.*

107027 The existence of regions of divergence instability for nonconservative systems under follower forces. A.N.Kounadis (Nat. Tech. Univ. of Athens, Athens, Greece).
Int. J. Solids & Struct. (GB), vol.19, no.8, p.725-33 (1983).
In this investigation, the existence of regions of divergence instability for an elastically restrained column under a follower compressive force at its end is discussed. Necessary and sufficient conditions for the existence of regions of divergence instability are established. The boundary between flutter and divergence instability passes always through a double critical point, where the first and second static (buckling) eigenmodes coincide. The eigenvalues (buckling loads) of nonself-adjoint problems of this type are positive and distinct for the entire region of divergence instability, except at its boundary, where the first and second eigenvalues coincide. At this boundary, where the buckling mechanism changes from divergence to flutter and vice-versa, a sudden increase in the critical load occurs with the flutter load always being higher than the corresponding divergence load. (11 refs.)

107028 On axial and lateral buckling of end-loaded anisotropic cantilever beams. E.Reissner (Dept. of Appl. Mech. & Engng. Sci., Univ. of California, San Diego, La Jolla, CA, USA), J.E.Reissner.
Z. Angew. Math. & Phys. (Switzerland), vol.34, no.4, p.450-7 (July 1983).
Obtains results for axial and lateral buckling loads in accordance with Euler and Michell-Prandtl for a cantilever acted upon by end bending moments, and by a combination of axial and transverse end forces. The nonconventional aspects of the solutions are that the authors assume anisotropy, in the sense that bending strains as well as twisting strains are taken to be linear combinations of bending and twisting moments acting over the cross section of the beam. (2 refs.)

Static and buckling analysis of a cryostat outer wall (Bell-Jar) for the whole magnetic system of the INTOR-NET fusion reactor .... See Entry 106167

Large strain inelastic behaviour of cylindrical tubes ....See Entry 107016

Vibration and stability analysis of polar orthotropic uniform discs subjected to peripheral hydrostatic loading ....See Entry 107037

Vibration and stability of a circular plate of unidirectionally varying thickness ....See Entry 107044

Finite element analysis of the magnetomechanical behavior of a toroidal coil with magnetic mirrors .... See Entry 107424

46.30M Vibrations, aeroelasticity, hydroelasticity, mechanical waves, and shocks

(see also 43.40 Mechanical vibrations and shock)

107029 Flutter loads of a Timoshenko beam-column under a follower force gorverned by two variants of equations of motion. J.T.Katsikadelis, A.N.Koundadis (Nat. Tech. Univ. of Athens, Athens, Greece).
Acta Mech. (Austria), vol.48, no.3-4, p.209-17 (1983). (17 refs.)

107030 Vibrations of noncircular cylindrical shells. K.Suzuki, S.Tamura, T.Kosawada, S.Takahashi (Faculty of Engng., Yamagata Univ., Yonezawa, Japan).
Bull. JSME (Japan), vol.26, no.215, p.818-26 (May 1983).
The authors describe a method for analyzing free vibrations of thin cylindrical shells with noncircular cross sections which have been used in chemical plants, atomic plants, flight structures and so on. This method is a general one applicable to various noncircular cylindrical shells. As the first step, an exact solution is obtained for a noncircular cylindrical shell with freely supported ends. By the numerical calculations, natural frequencies and mode shapes of elliptical cylindrical shells are derived and their characteristics, are clarified. (9 refs.)

107031 Torsional impact response of a penny-shaped crack lying on a bimaterial interface. S.Ueda, Y.Shindo, A.Atsumi (Dept. of Mech. Engng. II, Tohoku Univ., Sendai, Japan).
Eng. Fract. Mech. (GB), vol.18, no.5, p.1059-66 (1983).
The torsional impact response of a penny-shaped crack lying on a bimaterial interface is considered in this study. Laplace and Hankel transforms are used to reduce the problem to the solution of a pair of dual integral equations. The solution to the dual integral equations is expressed in terms of a Fredholm integral equation of the second kind with a finite integral kernel. A numerical Laplace inversion routine is used to recover the time dependence of the solution. The dynamic stress intensity factor is determined and its dependence on time and material constants is discussed. (5 refs.)

107032 On the behaviour of shock waves in deformable dielectric materials. B.Collet (Lab. de Mecanique Theorique, Univ. Pierre et Marie Curie, Paris, France).
Int. J. Eng. Sci. (GB), vol.21, no.10, p.1145-55 (1983).
Examines the behaviour of plane shock waves propagating in elastic dielectrics. The differential equation governing the amplitude of wave and formulae concerning the polarization changes across the shock are deduced. Some particular situations are studied in detail. (18 refs.)

107033 Variational estimates for dispersion and attenuation of waves in random composites. III. Fibre-reinforced materials. D.R.S.Talbot, J.R.Willis (School of Math., Bath Univ., Bath. England).
Int. J. Solids & Struct. (GB), vol.19, no.9, p.793-811 (1983).
For pt.II see ibid., vol.18, no.8, p.685 (1982). The variational approach developed in Parts I and II is applied to some two-dimensional problems of waves propagating transversely to the fibres in a unidirectional fibre-reinforced composite. Estimates of wave speeds (both bounds and self-consistent estimates) and associated estimates for the attenuation of the mean wave are given for long waves. They are studied in detail for the case of SH waves propagating through materials reinforced by aligned elliptic cylinders. All of the results are sensitive to the statistics of the medium. This is illustrated by considering two distinct pair distribution functions. Simple closed-form expressions are given for the limiting cases of a body weakened by aligned cracks and a body strengthened by aligned rigid plates. By-products of the analysis include a new representation for the two-dimensional dynamic Green's function for an anisotropic medium and an expression in the Rayleigh limit for the scattering cross-section of a single elliptic cylinder in a uniform matrix, both of which may be anisotropic. (18 refs.)

107034 Free vibration of a circular plate elastically restrained along some radial segments. T.Irie, G.Yamada, K.Tanaka (Dept. of Mech. Engng., Hokkaido Univ., Sapporo, Japan).
J. Sound & Vib. (GB), vol.89, no.3, p.295-308 (8 Aug. 1983).
An analysis is presented for the free vibration of a circular plate restrained against deflection along radial segments. With the reaction forces acting on the segments regarded as unknown harmonic loads, the stationary response of the plate to these loads is expressed by the use of the Green function. The force distributions along the segments are expanded into Fourier series with unknown coefficients, and the homogeneous equations for the coefficients are derived by restraint conditions on the supports. The natural frequencies and the mode shapes of the plate are determined by calculating the eigenvalues and eigenvectors of the equations. The method is applied to circular plates supported along several radial segments located at equal angular intervals, the natural frequencies and the mode shapes of the plates are calculated numerically and the effect of the supports is discussed. (17 refs.)

107035 Frequency average loss factors of plates and shells. M.F.Rank, B.L.Clarkson (Inst. of Sound & Vibration Res., Univ. of Southampton, Southampton, England).
J. Sound & Vib. (GB), vol.89, no.3, p.309-23 (8 Aug. 1983).
Describes a thorough investigation of the measurement of frequency band average loss factors of structural components for use in the statistical energy analysis (SEA) method of computation of vibration levels. The 'traditional' method of measurement is to excite the structure by a random force having a flat spectral density in the frequency band of interest. The force is then cut off and the decay of the modes excited in the band is noted. The average loss factor is deduced from the decay curve. The alternative energy method is the subject to this study. In this test the power input from the band limited random force is measured and the spatial average vibration level of the structure is estimated from several surface accelerometers. It is shown that when the modes in the band have similar loss factors (as is usually the case) the energy method gives a result which is very close to that obtained from the decay method. These in turn are close to the arithmetic average of the loss factors of the individual modes in the band. It is shown that only when the band contains one or two very lightly damped modes amongst several more heavily damped modes is there a difference between the two methods. In this case it is better to use the energy result in the SEA calculations. (3 refs.)

107036 Free vibration of annular sector plates by an integral equation technique. R.S.Srinivasan, V.Thiruvenkatachari (Dept. of Appl. Mech., Indian Inst. of Technol., Madras, India).
J. Sound & Vib. (GB), vol.89, no.3, p.425-32 (8 Aug. 1983).
A numerical method is presented for the free vibration analysis of polar orthotropic clamped annular sector plates. The results are compared with analytical and experimental values of other investigators. A parametric study has been done by varying the sector angle and radii ratio. The frequencies for isotropic and orthotropic cases are presented in the form of graphs. (13 refs.)

107037 Vibration and stability analysis of polar orthotropic uniform discs subjected to peripheral hydrostatic loading. D.G.Gorman (Dept. of Mech. Engng., Queen Mary Coll., London, England).
J. Sound & Vib. (GB), vol.89, no.4, p.477-86 (22 Aug. 1983).
An analysis based upon the annular finite element method is carried out of the transverse vibration and stability of uniform polar orthotropic discs subjected to peripheral hydrostatic loading. Both the axi- and anti-symmetrical modes are considered for both clamped and simply supported at the outer peripheral radius. By separation of the flexural and geometric (membrane) components, the effect on both with respect to the degree of orthotropy is plotted and subsequently both components can be easily combined to produce the natural frequencies of the loaded disc. A simple relationship is derived to determine whether the lowest critical buckling mode is that containing zero nodal diameters and circles or some higher mode. (14 refs.)

107038 Large amplitude vibration of an initially stressed moderately thick plate. L.-W.Chen, J.-L.Doong (Dept. of Mech. Engng., Nat. Cheng-Kung Univ., Tainan, Taiwan).
J. Sound & Vib. (GB), vol.89, no.4, p.499-508 (22 Aug. 1983).
Non-linear equations of motion for a transversely isotropic moderately thick plate in a general state of non-uniform initial stress where the effects of transverse shear and rotary inertia included are derived. The large amplitude flexural vibration of a simply supported rectangular moderately thick plate subjected to initial stress is investigated. The initial stress is taken to be a combination of pure bending stress plus an extensional stress in the plane of the plate. These equations are used to solve the vibrations problem by the Galerkin method. The effects of various parameters on the non-linear vibration frequencies are studied. (16 refs.)

107039 Beam vibrations with time-dependent boundary conditions. D.A.Grant (Dept. of Mech. Engng., Univ. of Maine, Orono, ME, USA).
J. Sound & Vib. (GB), vol.89, no.4, p.519-22 (22 Aug. 1983).
A procedure is outlined for the solution of the vibration problem of a Bernoulli-Euler beam with time-dependent boundary conditions. The solution is greatly simplified if the dependent variable in the original partial differential equation can be changed to produce homogeneous boundary conditions and at the same time maintain a homogeneous differential equation. A method for making such a change is given and illustrated by solving a cantilever beam problem with a time-dependent tip displacement. (7 refs.)

107040 Effect of an impact damper on a multi-degree of freedom system. M.M.Nigm, A.A.Shabana (Dept. of Mech. Engng., Ain Shams Univ., Abbasia, Cairo, Egypt).
J. Sound & Vib. (GB), vol.89, no.4, p.541-57 (22 Aug. 1983).
Theoretical analysis of the steady state vibrational motion of a multi-degree of freedom system equipped with an impact damper is presented. The analysis is based on the assumption that two generally distributed impacts occur in each cycle. The theory is applied to the special case of a single degree of freedom main system and the effects of various parameters are investigated. The theoretically possible modes of steady state behaviour of the damper is manifested by the existence of as many as three modes of steady state motion for a given exciting frequency. The conditions leading to more or less than two impacts/cycle are predicted although the system response under such conditions is not studied. Experimental results are presented and compared with theoretical prediction. (10 refs.)

107041 Vibration reduction over a frequency range. L.Kitis (Dept. of Mech. Engng., Worcester Polytech. Inst., Worcester, MA, USA), B.P.Wang, W.D.Pilkey.
J. Sound & Vib. (GB), vol.89, no.4, p.559-59 (22 Aug. 1983).
An efficient optimal design algorithm for minimizing the vibratory response of a multi-degree of freedom system under sinusoidal loading over several excitation frequencies is presented. The method is applicable to large scale dynamic systems because it incorporated an effective time-saving reanalysis approach to compute cost function and cost function derivatives. In particular, the efficiency of the method is demonstrated by applying it to the problem of designing two dynamic vibration absorbers simultaneously applied to an undamped cantilever beam. (30 refs.)

107042 A recursive approach to Prony parameter estimation. P.Davies (Inst. of Sound & Vibration Res., Univ. of Southampton, Southampton, England).
J. Sound & Vib. (GB), vol.89, no.4, p.571-83 (22 Aug. 1983).
The Prony series method of fitting a series of complex exponentials to a time series can be applied to many acoustic and vibration signals. For example, in the analysis of a structure's response to transient excitation the Prony series method can be used to find the natural frequencies, damping ratios, amplitudes and relative phases of the modes of the structure. One of the main problems with this method is the need to calculate and invert matrices. In this paper an algorithm that combines the Prony series method with the recursive least squares algorithm is described. This eliminates the need to invert any matrices and also requires only part of the data to be available at one particular time. The method is applied to analyze a simulated structure's response and also to analyze the response of a beam to transient excitation. (8 refs.)

107043 Coupled flexural-longitudinal wave motion in a periodic beam. D.J.Mead (Dept. of Aeronautics & Astronautics, Univ. of Southampton, Southampton, England), S.Markus.
J. Sound & Vib. (GB), vol.90, no.1, p.1-24 (8 Sept. 1983).
Periodic structure theory is used to study the interactions between flexural and longitudinal wave motion in a beam (representing a plate) to which offset spring-mounted masses (representing stiffeners) are attached at regular intervals. An equation for the propagation constants of the coupled waves is derived. The response of a semi-infinite periodic beam to a harmonic force or moment at the finite end is analyzed in terms of the characteristic free waves corresponding to these propagation constants. Computer results are presented which show how the propagation constants are affected by the coupling, and how the forced response varies with distance from the excitation point. The spring-mounted masses can provide very high attenuation of both longitudinal and flexural waves when no coupling is present, but when coupling is introduced the two waves combine to give very low (or zero) attenuation of the longitudinal wave. The influence of different damping levels on spatial attenuation is also studied. (7 refs.)

107044 Vibration and stability of a circular plate of unidirectionally varying thickness. T.Irie, G.Yamada, M.Kitayama (Dept. of Mech. Engng., Hokkaido Univ., Sapporo, Japan).
J. Sound & Vib. (GB), vol.90, no.1, p.81-91 (8 Sept. 1983).
An analysis is presented for the vibration and stability of an elastically restrained circular plate of unidirectionally varying thickness subjected to an in-plane force. For this purpose, the transverse deflection of a circular plate of variable thickness is written in a series of the deflection functions of a uniform circular plate without the action of a force. The dynamical energies of the plate are evaluated analytically, and the frequency equation of the plate is derived by the Ritz method. The analysis is applied to circular plates of unidirectionally tapered or stepped thickness: the natural frequencies and the divergence loads are calculated numerically, and the effects of the varying thickness and edge conditions on the vibration and stability are studied. (18 refs.)

107045 Forced vibrations and their damping. F.Ziegler.
Sitzungsber. Oesterr. Akad. Wiss. Math.-Naturwiss. Kl. Abt. II (Austria), vol.191, no.4-7, p.233-9 (1982). [received: Sept. 1983]
Knowing the elastic frequency response function in analytical form allows the application of the classical elastic-viscoelastic correspondence principle. Substitution of the complex viscoelastic moduli renders the viscoelastic frequency response function. For bodies with irregular shape only numerical solutions are possible and only a discrete frequency response spectrum within a finite band of forcing frequencies can be calculated (e.g. by FEM). Using an alternative quadrature type of the analogy together with data-fitting of a modal form of analytical series solution at resonances renders an approximate viscoelastic solution. Precision of the method is outlined for a test example of a hinged-beam in forced vibration. A complicated form of dampening law can be built into the procedure by the choice of an appropriate frequency dependent complex viscoelastic modulus. (5 refs.)

107046 Small transverse vibrations of layered circular plates. E.I.Grigolyuk, V.N.Kassikhin (Moscow Automech. Inst., Moscow, USSR).
Strength Mater. (USA), vol.14, no.10, p.1359-64 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.65-8 (Oct. 1982). [received: Sept. 1983]
Considers small transverse axisymmetric free vibrations of thin circular three-layer plates. The packet is assumed to be noncompressible in the transverse direction and consist of different thicknesses of isotropic dissimilar supporting layers and a transversely isotropic filter. The outer layers operate in bending and tension, and, in addition, the inner layer experiences shear. The filler follows the broken line hypothesis. (5 refs.)

Thermoelasticity problems .... See Entry 105112

The responses of single degree of freedom systems with quadratic and cubic non-linearities to a subharmonic excitation .... See Entry 106921

Vibrations of polygonal plates due to thermal shock .... See Entry 106922

Sound radiation from rectangular plates vibrating in stripes mode .... See Entry 106923

Analysis of vibration by component mode synthesis method. III. Application to cylinder block of 4 cylinders .... See Entry 106985

On point spectrum of one class of open cylindrical structures .... See Entry 106995

Experimental determination of frequencies and shapes of natural oscillations of small bracket plate using holographic interferometry .... See Entry 107083

Three-dimensional effects on the focusing of weak shock waves .... See Entry 107185

Analysis of plane elastic-plastic shock-waves from the fourth-order anharmonic theory .... See Entry 107829

The effects of initial stress and irregularity on the propagation of SH-waves ... . See Entry 110321

46.30N Fracture mechanics, fatigue, and cracks

107047 Singular stresses in a soft ferromagnetic elastic solid with a flat annular crack. Y.Shindo (Tohoku Univ., Sendai, Japan).
Acta Mech. (Austria), vol.48, no.3-4, p.147-55 (1983).
Following a linear theory for soft ferromagnetic elastic materials, the author investigates the axisymmetric problem for an infinite body with a flat annular crack in a constant axial magnetic field. It is assumed that the soft ferromagnetic elastic solid is a homogeneous and isotropic one. Using an integral transform technique, the problem is reduced to that of solving a singular integral equation of the first kind. The solution of the singular integral equation is obtained in the form of the product of the series of Chebyshev polynomials of the first kind and their weight function. Thus the essential feature of the singular stress field near the crack is preserved and the crack tip stress-intensity factor is easily evaluated. (9 refs.)

107048 On the validity of the singular integral equations of crack problems at the crack tips. N.I.Ioakimidis (Univ. of Patras, Patras, Greece).
Acta Mech. (Austria), vol.48, no.3-4, p.185-91 (1983).
The validity of singular integral equations (with Cauchy type kernels) of the first kind and with index equal to 1 at the end-points of the integration interval is shown under mild continuity assumptions. The singular integral becomes now a divergent integral and has to be interpreted as a finite-part integral. This result is applicable to crack problems in elasticity theory and to the methods for the numerical solution of singular integral equations. As an application, the 'natural' extrapolation formula for the determination of the stress intensity factors at the crack tips is obtained. The generalization of the present results to the case of singular integral equations of the second kind is also considered. (15 refs.)

107049 A method for obtaining stress intensity factor by FEM and its application to dynamic problem. II. A treatment for mixed mode cracks. H.Wada, Y.Takagi (Daido Inst. of Technol., Nagoya, Japan), T.Nishimura.
Bull. JSME (Japan), vol.26, no.215, p.685-91 (May 1983).
For pt.I see ibid., vol.25, p.1 (1982). In Part I the authors proposed a new method for obtaining the stress intensity factors for the opening mode cracks. The same method has been extended to the calculation of the stress intensity factors for the sliding mode cracks. The usefulness of the method has been tested with a number of rectangular plates having oblique straight cracks of various inclinations and lengths, and the results have turned out to be fairly satisfactory. In addition, a static problem of a rectangular plate with a pair of oblique cracks emanating from the boundary surface of a circular hole and a dynamic problem of a rectangular plate with an oblique straight crack are investigated. (23 refs.)

107050 Growth of ring-shaped edge cracks under reversed torsional fatigue. T.Matake, Y.Imai, T.Takase (Dept. of Mech. Engng., Nagasaki Univ., Nagasaki, Japan).
Bull. JSME (Japan), vol.26, no.215, p.692-9 (May 1983).
Mode III fatigue crack growth was studied using cylindrical specimens with ring-shaped edge cracks under reversed torsion. Cracks grew locally in Mode I making small branches but their macroscopic growth direction was perpendicular to the specimen axis. The crack depth was successively estimated by the compliance calibration method and the growth rate of torsional cracks was related to the applied stress intensity factor range ΔK_{III}. In torsion, friction must be considered together with mutual sliding of prefatigue crack surfaces. Consequently, the applied torsional torque should be modified in evaluating the effective stress intensity factor. Effect of the surface friction on the stress state around the crack tip was examined by an elastic-plastic finite element analysis. (11 refs.)

107051 Interference effect of notches. II. An experimental investigation on interference effect of notches on strengths and deformation properties of notched bar with double U-notches. T.Majima, K.Watanabe (Faculty of Engng., Chiba Univ., Chiba, Japan).
Bull. JSME (Japan), vol.26, no.215, p.724-32 (May 1983).
For pt.I see ibid., vol.26, p.179 (1983). An interference effect of notches on the strengths and deformation properties of rectangular and cylindrical specimens with double U-notches is investigated experimentally. The stress at which the tensile load vs. elongation curve begins to depart from its elastic slope also reduces due to the interference effect. The magnitude of the interference effect on this stress is the same degree as that on the general yield strength and is not predicted on the basis of the interference effect on the elastic stress concentration factor although the plastic region near the notch root is much smaller at this stress level than at general yielding. The interference effect on the notch tensile strength of the material with both weak strain-hardening and small total elongation can be predicted accurately from that on the yield point load or on the general yield strength. (6 refs.)

107052 The effect of pressure fluid on bursting of brittle materials. I. Bursting of cast iron cylinder under internal pressure. F.Nagai (Tokyo Inst. of Technol., Tokyo, Japan), T.Matsukura, Y.Sato.
Bull. JSME (Japan), vol.26, no.215, p.739-46 (May 1983).
Internal pressure tests are carried out on coated and naked cylinders made of cast iron to study the effect of pressure fluid on the bursting of brittle materials, with the following conclusions: (1) In the naked cylinder the strength under internal pressure differs depending on the pressure fluid. (2) In the naked cylinder having a constant diameter ratio, there is a remarkable size effect even with the same pressure fluid. (3) There is no size effect in the coated thin-walled cylinder. (7 refs.)

107053 On the crack energy density and energy release rate for an elasto-plastic crack. K.Watanabe (Inst. of Industrial Sci., Univ. of Tokyo, Tokyo, Japan).
Bull. JSME (Japan), vol.26, no.215, p.747-54 (May 1983).
The relation between crack energy density and load-displacement curve is discussed and a method to evaluate crack energy density from load-displacement curve is established. Also, the physical meaning of so-called J_{Ic}-test is clarified. A general expression of energy release rate for an elasto-plastic crack is obtained, which is available for completely elastic fracture, fracture accompanied with small scale yielding and also fracture accompanied with large scale yielding. The behavior of an elasto-plastic crack is explained from the standpoint of energy, and an error in Orowan-Irwin theory based on energy balance is pointed out. (15 refs.)

107054 Stiffness changes in unidirectional composites caused by crack systems. N.Laws (Dept. of Math., Cranfield Inst. of Technol., Cranfield, England), G.J.Dvorak, M.Hejazi.
Mech. Mater. (Netherlands), vol.2, no.2, p.123-37 (Aug. 1983).
Considers the development of constitutive equations for fibrous composites which contain a family of longitudinal slit cracks. The general theory in which the crack length is of the same order as the fiber diameter gives rise to a three-phase model. When the fiber diameter is much smaller than the crack length, the associated two-phase model is obtained. Detailed numerical results are given for selected systems. (19 refs.)

107055 Three-dimensional elastic-plastic finite element analysis of small surface cracks. G.G.Trantina, H.G.deLorenzi, W.W.Wilkening (Corporate Res. & Dev., General Electric Co., Schenectady, NY, USA).
Eng. Fract. Mech. (GB), vol.18, no.5, p.925-38 (1983).
Three-dimensional, elastic and elastic-plastic finite element analysis of small surface cracks was performed. The elastic analysis is in good agreement with other solutions. For a round surface with a radius equal to six times the crack depth, the K at the surface is about 4% higher than the K for a flat surface. The results of the elastic-plastic analyses show a unique variation of the effective K (J-integral) along the crack front with a decrease in K at the surface due to a lack of plane strain constraint and an increase in the effective K at the maximum depth point with increasing plasticity. Similar behaviour was observed for a semielliptical crack. Increasing the strain hardening exponent from 10 to 20 produced similar results with slightly higher effective Ks for high applied strains. These results are useful in understanding the fracture behaviour of small surface cracks. (8 refs.)

107056 Recent developments of experimental fracture mechanics in Greece. E.E.Gdoutos (Democritus Univ. of Thrace, Xanthi, Greece).
Eng. Fract. Mech. (GB), vol.18, no.5, p.1037-47 (1983).
Recent developments associated with the application of the method of caustics to fracture mechanics problems in Greece are reviewed. Results from a variety of these studies including propagating cracks, cracks in composite bodies, bending of cracked plates and bodies with rigid inclusions, are summarized. (25 refs.)

107057 Brief note on the stress intensity factor of elliptical cracks. J.Schijve (Dept. of Aerospace Engng., Delft Univ. of Technol., Delft, Netherlands).
Eng. Fract. Mech. (GB), vol.18, no.5, p.1067-9 (1983).
The stress intensity factor solution for an elliptical crack is presented where the imaginary K-values ($6>a$) are calculated from a series expansion of E(h), where E(h) is a complete elliptical integral of the second kind. (5 refs.)

107058 The behaviour of fatigue cracks subject to applied biaxial stress: a review of experimental evidence. E.W.Smith (Dept. of Production Technol., Massey Univ., Palmerston North, New Zealand), K.J.Pascoe.
Fatigue Eng. Mater. & Struct. (GB), vol.6, no.3, p.201-24 (1983).
Reviews the available published data. Crack propagation behaviour under biaxial stress is dictated by three parameters: stress biaxiality itself, which is defined here as the ratio of the in-plane principal stresses, crack angle with respect to the applied principal stress directions and stress intensity factor range. Depending on the first two parameters, cracks may grow in mode I, mode II or mixed-mode. Crack growth data have been presented using these three divisions. Two short sections have been included on initiation and cyclic stress/strain behaviour under biaxial stress to emphasise the fact that crack growth cannot be fully understood without knowing something of them. The accumulated data do not lead to adequate conclusions on either the qualitative or quantitative behaviour of cracks subject to cyclic in-plane biaxial stress. Reasons for the confusion and even contradiction of independent results are put forward and some discussion given to the possible directions of future experimental work. (77 refs.)

107059 Closure behaviour of surface cracks. N.A.Fleck (Cambridge Univ. Engng. Dept., Cambridge, England), I.F.C.Smith, R.A.Smith.
Fatigue Eng. Mater. & Struct. (GB), vol.6, no.3, p.225-39 (1983).
The fatigue crack closure response was investigated for a surface crack in BS4360 50B structural steel subjected to (1) constant amplitude loading and (2) constant amplitude loading interrupted by a single peak overload. Various compliance techniques were employed to determine closure behaviour. The crack mouth gauge measured the bulk, plane strain closure load, while the near tip strain gauge indicated the surface plane stress closure response. For constant amplitude loading it was found that the surface regions of a surface crack are closed for a greater portion of the load cycle than the maximum depth point. A single peak overload caused different closure and growth rate transients at the surface of the thumbnail crack and at the maximum depth point. For growth rates above 10^{-6} mm/cycle, such behaviour agrees with the response of a through crack when subjected to constant amplitude loading, and a single peak overload. (25 refs.)

107060 Estimating initiation times of secondary fatigue cracks in damage tolerance analysis. T.R.Brussat (Advanced Structures Technol. Dept., Lockheed California Co., Burbank, CA, USA).
Fatigue Eng. Mater. & Struct. (GB), vol.6, no.3, p.281-92 (1983).
Fatigue cracking of complex structure often involves several interacting cracks developing in a sequence of crack growth, arrest and reinitiation. A 'combined' method of damage tolerance analysis is presented which employs fracture mechanics concepts to calculate crack growth and fatigue data from notched coupons with the appropriate notch radius for the crack initiation phase. The notched coupon data, plotted as peak elastic notch stress vs. cycles to crack initiation, are shown to be applicable even when limited yielding occurs at the notch root. For several practical reasons it is recommended to select the initial crack size, a_i, for the crack growth phase to be as large as possible, but in accord with two selection criteria. First, a_i must be within a notch-root region wherein the elastic stress distributions near a variety of notches are virtually identical. Secondly, a_i must be small enough not to significantly influence the stress distributions for other cracks. The Combined Method is illustrated by means of an example involving fatigue crack growth along a widthwise row of holes in 305 mm wide test panels. (15 refs.)

107061 An equivalent procedure for the evaluation of the stress intensity factors of a radial crack in a disc. C.Shangchow (Dept. of Aircraft Engng., Northwestern Polytech. Univ., Xian, China).
Int. J. Eng. Sci. (GB), vol.21, no.10, p.1247-52 (1983).
Establishes an equivalent procedure, which reduces the stress intensity problems of a finite radially cracked circular disc to those of an infinite one.

Making use of the equivalent procedure, the values of the stress intensity factors can be easily obtained with high accuracy. (6 refs.)

107062 An annular crack in microelasticity. M.Lal (School of Studies in Math., Jiwaji Univ., Gwalior, India).
Int. J. Eng. Sci. (GB), vol.21, no.10, p.1269-83 (1983).
Studies the problem of an annular crack in a transverse field of constant uniaxial tension by applying the linear theory of microelasticity. By means of Hankel transforms and tiple integral equations the problem is reduced to a set of simultaneous equations and is then solved numerically. The numerical results of physical interest are illustrated graphically and compared with those of the coupled stress theory. The classical results are presented as limiting case. (15 refs.)

107063 Dynamic kinking of a crack in plane strain. P.Burgers (Dept. of Mech. Engng. & Appl. Mech., Univ. of Pennsylvania, Philadelphia, PA, USA).
Int. J. Solids & Struct. (GB), vol.19, no.8, p.735-52 (1983).
The kinking of an initially stationary crack in a linear elastic body due to dynamic loading is solved using linear superposition to construct dual singular integral equations, which are solved numerically. The results for stress wave loading as well as loading on the crack faces only are presented, with an estimated accuracy of better than 3%. Some conclusions on crack velocity and kink angle are drawn for a fracture criterion which requires $K_{II}=0$. (20 refs.)

107064 Extremum principles for the energy-release problem of elastic-perfectly plastic body subjected to prescribed change of material properties. P.Rafalski (Reactor Engng. Dept., Inst. of Nuclear Res., Warsaw, Poland).
Int. J. Solids & Struct. (GB), vol.19, no.9, p.767-71 (1983).
Two extremum principles for the energy-release increment in an elastic-perfectly plastic body subjected to prescribed change of the material properties are established. The principles, complementary to each other, can be directly applied to numerical calculations of upper and lower bounds for the energy-release rate problems of fracture mechanics. (11 refs.)

107065 A note on the dynamic stress field near a propagating crack. K.Ravi-Chander (California Inst. of Technol., Pasadena, CA, USA).
Int. J. Solids & Struct. (GB), vol.19, no.9, p.839-41 (1983).
A simple calculation based on the asymptotic crack tip stress distribution is used to determine the stress history due to a propagating crack at points away from the prospective crack line and the results are compared with the experimental measurements made by Kinra and Bowers (see ibid., vol.17, p.175, 1981). Very good qualitative correlation is obtained. (3 refs.)

107066 Dynamic crack-tip field in rate-sensitive solids. K.K.Lo (Chevron Oil Field Res. Co., La Habra, CA, USA).
J. Mech. & Phys. Solids (GB), vol.31, no.4, p.287-305 (1983).
The asymptotic stress and strain fields near the tip of a crack which propagates dynamically in a rate-sensitive solid are obtained under anti-plane shear and plane strain conditions. The problem is formulated within the context of a small-strain theory for a solid whose mechanical behaviour under high strain rates is described by an elastic-viscoplastic constitutive relation. It is shown that, if the stresses are singular at the crack-tip the viscoplastic relation is equivalent asymptotically to an elastic-nonlinear viscous relation. Furthermore, for a certain range of the material parameter which characterizes the rate-sensitivity of the material, the elastic strain-rates near the propagating crack tip are shown to have the same asymptotic radial dependence near the propagating crack-tip as the inelastic strain-rates. This determines the order of the stress singularity uniquely. The governing equations for anti-plane shear and plane strain are then derived. (19 refs.)

107067 A viscoplastic analysis of rapid crack propagation experiments in steel. B.Brickstad (Dept. of Strength of Materials & Solid Mech., Royal Inst. of Technol., Stockholm, Sweden).
J. Mech. & Phys. Solids (GB), vol.31, no.4, p.307-27 (1983).
In order to investigate rapid Mode I crack propagation in steel under large scale yielding conditions a finite element program was developed in which the material is treated as elastic-viscoplastic, based on a theory by P. Perzyna (1966). In this model, rate effects in the plastic deformation process are accounted for. The parameters of the constitutive model were determined from ordinary tensile tests on small specimens by varying the loading rate. It was found that the strain rate can satisfactorily be related to the increase of the inelastic stress-strain relation raised to some power *n*. The FEM-program was applied to a number of crack propagation experiments on highly loaded SEN specimens of a high strength steel. For comparison some experiments were also analysed assuming linear elastic and simulated elastic-plastic material behaviour with no rate sensitivity. It was found that combined plastic and viscous effects are of great importance for an adequate description of rapid crack growth when large scale yielding is at hand. The energy flow to the crack tip region in the viscoplastic case, which is used as a fracture parameter, seems to converge to finite and non-trivial values for sufficiently small values of the element size along the crack tip. (30 refs.)

107068 The dynamic behaviour of slender structure with cross-sectional cracks. P.Gudmundson (Res. Center, Brown, Boveri & Co. Ltd., Baden-Dattwil, Switzerland).
J. Mech. & Phys. Solids (GB), vol.31, no.4, p.329-45 (1983).
A dynamic model for beams with cross-sectional cracks is discussed. It is shown that a crack can be represented by a consistent, static flexibility matrix. Two different methods for the determination of the flexibility matrix are discussed. If the static stress intensity factors are known, the flexibility matrix can be determined from an integration of these stress intensity factors. Alternatively, static finite element calculations can be used for the determination of the flexibility matrix. Both methods are demonstrated. The mathematical model was applied to an edge-cracked cantilevered beam and the eigenfrequencies were determined for different crack lengths and crack positions. These results were compared to experimentally obtained eigenfrequencies. In the experiments, the cracks were modelled by sawing cuts. The theoretical results were, for all crack lengths, in excellent agreement with the experimental data. The dynamic stress intensity factor for a longitudinally vibrating, centrally cracked bar was determined as well. The results compared very well with dynamic finite element calculations. (19 refs.)

107069 Applicability of Weibull analysis for brittle materials. K.Trustrum (School of Math. & Phys. Sci., Univ. of Sussex, Brighton, England), A.de S. Jayatilaka.
J. Mater. Sci. (GB), vol.18, no.9, p.2765-70 (Sept. 1983).
Weibull analysis for the interpretation of strengths of brittle materials was previously justified for a particular flaw size distribution. The present results show that the Weibull distribution provides a close approximation to the distribution of failure stress for all the flaw size distributions considered. However, certain reservations are noted in the interpretation of the Weibull modulus. (4 refs.)

107070 Acoustic emission due to nucleation of a microcrack in the proximity of a macrocrack. J.D.Achenbach, K.-I.Hirashima, K.Ohno (Dept. of Civil Engng., Northwestern Univ., Evanston, IL, USA).
J. Sound & Vib. (GB), vol.89, no.4, p.523-32 (22 Aug. 1983).
Acoustic emission generated by the nucleation of a microcrack in the proximity of a macrocrack is discussed in this paper. On the basis of some simple approximations the acoustic emission from a crack-opening event is directly related to its crack-opening volume as a function of time. It is shown that the nucleation of a microcrack in the immediate vicinity of a macrocrack generates additional crack-opening volumes for both the macrocrack and the microcrack, whose signals tend to be much larger than those that would emanate from a nucleating solitary microcrack. (16 refs.)

107071 Interlaminar stresses at a hole in a composite member subjected to in-plane loading. L.Carlsson (Aeronautical Res. Inst. of Sweden, Bromma, Sweden).
J. Compos. Mater. (USA), vol.17, no.3, p.238-49 (May 1983).
Presents results from a numerical and experimental study of interlaminar stresses and damage in a 28-ply graphite/epoxy composite member with a 6 mm circular hole subjected to in-plane loading. The free span length and width of the specimen investigated were both 24 mm. The numerical results of a three-dimensional finite element analysis show that high interlaminar stress gradients occur at the intersections of the ply interfaces and the free edge. The largest positive value of the interlaminar normal stress, which is about 0.3 times the mean in-plane compressive stress, occurs perpendicularly to the loading direction at the hole boundary between the second and third plies. The experimental part of the study concerned damage detection for structural members subjected to compression fatigue loading. Tetrabromoethane (TBE)-enhanced X-ray techniques combined with sectioning of the samples showed that the damage consisted of transverse matrix cracks in the 0° plies at a tangent to the hole boundary. (17 refs.)

107072 Statistical properties of hybrid composites. I. Recursion analysis. D.G.Harlow (Dept. of Mech. Engng. & Mech., Lehigh Univ., Bethlehem, PA, USA).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1796, p.67-100 (8 Sept. 1983).
An adaptation of the chain-of-bundles probability model for unidirectional intraply hybrid composites of two types of fibres is given. Local load sharing, which is sensitive to the different elastic moduli of the fibres, is assumed for the non-failed fibre segments in each bundle. A sequence of tight upper bounds is developed for the probability distribution of strength for the hybrid. The upper bounds are based upon the occurrence of *k* or more adjacent broken fibre segments in a bundle; this event is necessary but not sufficient for bundle failure. This development allows for a description of a critical crack size k^*, dependent upon the load on the hybrid, which is a characterization of the length of a crack that catastrophically propagates causing bundle failure with virtual certainty. (34 refs.)

107073 Probability of failure of thermoelastic reinforced shells. B.S.Reznikov (Inst. of Hydrodynamics, Acad. of Sci., Novosibirsk, USSR).
Strength Mater. (USA), vol.14, no.10, p.1364-8 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.69-72 (Oct. 1982). [received: Sept. 1983]
A method is suggested for investigating the failure of reinforced shells taking into account the scatter of the mechanical characteristics of the elements of the composite, the structure of the reinforcement, and the parameters of external action. (12 refs.)

Fatigue evaluation of the JT-60 vacuum vessel under the dynamic electromagnetic forces .... See Entry 106168

Maximum strength/stiffness design of structural members in presence of self-weight .... See Entry 107009

Phenomenological model of the description of deformation and failure and metals under complex nonisothermal loading .... See Entry 107020

Torsional impact response of a penny-shaped crack lying on a bimaterial interface .... See Entry 107031

Variational estimates for dispersion and attenuation of waves in random composites. III. Fibre-reinforced materials .... See Entry 107033

Forces on conical-nosed penetrators into targets with constant shear strength .... See Entry 107078

The effect of neutron and He-irradiation on the crack modes of type 316 stainless steel .... See Entry 107751

Elastomer friction .... See Entry 107817

A proposed criterion for fatigue threshold dislocation substructure approach .... See Entry 107818

Steady state vacancy concentration around a plastic crack .... See Entry 107820

Thermal conductivities of a cracked solid .... See Entry 108084

Study on elastic-plastic deformation analysis using a cyclic stress-strain curve .... See Entry 109401

Regularities of cyclic crack resistance under effect of contact stresses .... See Entry 109438

Model of fatigue crack propagation by damage accumulation at the crack tip .... See Entry 109440

Crack opening areas in pressure vessels and pipes .... See Entry 109445

The effect of water vapor on fatigue crack tip mechanics in 7075-T651 aluminum alloy .... See Entry 109448

On the transition from near-threshold to intermediate growth rates in fatigue .... See Entry 109449

Propagation of stress corrosion cracks in aligned glass fibre composite materials .... See Entry 109453

Fracture mechanics for delamination problems in composite materials .... See Entry 109458

Effect of stress biaxiality of the fatigue crack growth rate of a mild steel .... See Entry 109480

Behavior of shells of various types in internal explosive loading .... See Entry 109508

Reconsideration of the superposition model for environmentally assisted fatigue crack growth .... See Entry 109595

Estimation of fatigue curves for steel specimens subjected to bending, axial and torsion loads .... See Entry 109635

Stress-strain curves for high-temperature monotonic loading .... See Entry 109663

Stress analysis of a rotating cylinder experiment to determine crack growth in thick section steel .... See Entry 109697

46.30P Friction, wear, adherence, hardness, mechanical contacts

107074 The influence of surface dents and grooves on traction in sliding EHD point contacts. C.Cusano (Univ. of Illinois, Urbana, IL, USA), L.D.Wedeven.
ASLE Trans. (USA), vol.26, no.3, p.306-10 (July 1983).
Changes in traction, caused by dents and grooves on a highly polished ball, are investigated as these defects approach and go through sliding elastohydrodynamic (EHD) point contacts. The contacts are formed with the ball loaded against a transparent disk. The ball and thus the topographical features are held stationary at various locations in the vicinity and within the contact while the disk is rotating. It is shown that these topographical features can cause substantial changes in the traction when compared to traction obtained with smooth surfaces. (15 refs.)

107075 Contact stresses in two elastic bodies. Elastic bodies are finite hollow cylinders. Y.Minakuchi (Faculty of Engng., Yamanashi Univ., Kofu, Japan), T.Koizumi, T.Shibuya, K.Yoshimine.
Bull. JSME (Japan), vol.26, no.215, p.716-23 (May 1983).
The contact stress between two different finite hollow cylinders connected by a bolted joint is studied. The three dimensional theory of elasticity is used to analyse the contact stress and the deformation in laminated finite hollow cylinders whose both sides are compressed axisymmetrically under a local uniform pressure. By neglecting shearing stress on the contact surface, an exact solution satisfying the remaining boundary conditions is obtained. Numerical calculations are carried out for various rigidities and thicknesses of the finite hollow cylinders under various loading conditions. In order to examine the results of the theoretical analysis, the contact stress is measured experimentally by using pressure-sensitive pins attached to a finite hollow cylinder. It is confirmed that the theoretical results agree well with the experimental ones except at the vicinity of the loaded area. (14 refs.)

107076 Compression of an elastic cylinder between two rigid planes. Application of the indirect fictitious-boundary integral method to a contact problem. M.Kishida (Faculty of Engng., Hokkaido Univ., Sapporo, Japan), K.Honma.
Bull. JSME (Japan), vol.26, no.215, p.733-8 (May 1983).
Stress analysis of diametrical compression of an elastic circular cylinder between two smooth, flat and parallel rigid planes is performed by the indirect fictitious-boundary integral method. As the contact conditions, a frictionless case and a perfectly adhesive case was treated. Through the present study, an applicability of the present method to the contact problem is confirmed and the deformation process of the surface becomes clear. (9 refs.)

107077 Stress, dilatancy and fabric in granular materials. M.M.Mehrabadi (Dept. of Mech. Engng., Tulane Univ., New Orleans, LA, USA), S.Nemat-Nasser.
Mech. Mater. (Netherlands), vol.2, no.2, p.155-61 (Aug. 1983).
On the basis of a simple micromechanical model, expressions are developed for the overall stress and deformation rate measures in a granular mass which carries the applied loads through contact friction. Various measures of the granular fabric are examined, and explicit connections between a fabric measure and the stress and the deformation rate tensors are obtained. Then, from the balance of energy, a general stress-dilatancy equation is deduced, which includes the effect of fabric. Several other published dilatancy equations are discussed and compared with the new equation. (32 refs.)

107078 Forces on conical-nosed penetrators into targets with constant shear strength. M.J.Forrestal (Sandia Nat. Labs., Albuquerque, NM, USA).
Mech. Mater. (Netherlands), vol.2, no.2, p.173-7 (Aug. 1983).
A closed-form solution for forces on conical-nosed projectiles penetrating geological targets with constant shear strength is developed. The model employs the cylindrical cavity expansion approximation which idealizes the target as thin independent layers normal to the penetration direction and simplifies the analysis to one-dimensional radial wave propagation. Constitutive target description is applicable to concrete and sea ice and consists of a linear hydrostat and a Tresca yield criterion with a tension cutoff. This model has three regions of target response: an elastic region, a region with radial cracks, and a plastic region. Predictions from this theory are compared with other recently developed elastic-plastic models. (6 refs.)

107079 Theoretical experimental study of the ploughing of a rigid-plastic semi-infinite body by a rigid pyramidal indenter. P.Gilormini, E.Felder (Centre de Mise en Forme des Materiaux, Ecole des Mines de Paris, Paris, France).
Wear (Switzerland), vol.88, no.2, p.195-206 (1 July 1983).
Surface ploughing of a rigid-plastic semi-infinite body by a rigid pyramidal indenter is modelled by using a velocity field calculated by minimizing the dissipated power. The theoretical predictions are compared with the results of simulation tests using a model material. Good agreement is found for the tangential force, but the prediction of the flow pattern is less satisfactory. A simplified version of this model gives good results for forces and geometry when compared with tests on a low carbon steel. (6 refs.)

107080 The influence of tangential tractions at the surface on the stresses in contacting bodies during rolling-sliding contact. H.Krause, G.Poll (Dept. of Wear of Materials, Tech. Univ. of Aachen, Aachen, Germany).
Wear (Switzerland), vol.88, no.2, p.221-32 (1 July 1983).
It is shown that there are four parameters which govern the stresses in contacting bodies during rolling-sliding motion: the maximum hertzian pressure p_0; the coefficient of sliding friction, μ; the ratio f_x/μ of the traction coefficient to the coefficient of sliding friction; the direction of the tangential load compared with the direction of rolling, i.e. whether the body is driving or being driven. (19 refs.)

A digital instrumentation package for an improved torsion pendulum .... See Entry 107087

On prediction of wear coefficients in sliding wear .... See Entry 107821

Regularities of cyclic crack resistance under effect of contact stresses .... See Entry 109438

46.30R Measurement methods and techniques

(see also 07.10 Mechanical instruments and techniques, 81.70 Materials testing)

107081 An extensometer for axial strain measurement at high temperature. K.Motoie, M.Sakane, J.Schmidt (Dept. of Civil Engng., Northwestern Univ., Evanston, IL, USA).
Mech. Mater. (Netherlands), vol.2, no.2, p.179-82 (Aug. 1983).
Most existing strain measuring instruments, important for the investigation of the mechanical behavior of metals at high temperature, have temperature, strain range, and size limitations. The authors give the design and construction of an extensometer with sufficient dynamic range and good stability over long periods of time, for measuring the longitudinal strain of plane specimens from 0.001 to 0.1 at temperatures up to 800°C. (6 refs.)

107082 Moire interferometry for damage analysis of composites. D.Post (Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
Exp. Tech. (USA), vol.7, no.7, p.17-20 (July 1983).
The author reviews briefly the techniques of moire interferometry as they are practised in his laboratory and demonstrates their potential for revealing U and V displacement fields for analysis of damage in composites. (1 ref.)

107083 Experimental determination of frequencies and shapes of natural oscillations of small bracket plate using holographic interferometry. V.A.Smirnov, K.B.Scherbina.
Izv. VUZ Mashinostr. (USSR), no.7, p.21-4 (1983). In Russian.
The application of holographic interferometry to the study of the oscillations of a small bracket plate and a plate with an additional support is considered. It is noted that the holographic interferometry method offers and exceptionally high degree of accuracy in determining the natural oscillation frequencies. (3 refs.) *L.M.H.*

107084 Computer aided real-time determination of internal forces from tensional measurements in framed structures. II. E.Macha (Inst. fur Maschinenbau, Tech. Hochschule Opole, Opole, Poland).
Mess. & Pruef. (Germany), vol.19, no.6, p.346-51 (June 1983). In German.
The algorithms determining the internal forces and moments across thin-walled framed structures in terms of deformation measurements are considered in a form suitable for treatment by computer. The present article is concerned with the algorithms describing normal forces, bending moments, bimoments and rotational moments of structures with constant cross section. (no refs.) *S.R.*

107085 Ballistic apparatus for examining the behavior of materials under shock loading. S.G.Pasechnik (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.8, p.1148-50 (Aug. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.8, p.129-31 (Aug. 1982).
Considers the ballistic calculation for the PK-80 apparatus, which consists of a barrel of diameter 80 mm and length 2465 mm, a pressure chamber of volume 3.77 liter, and a vacuum chamber. THe latter contains the specimen mount and is joined to the barrel with flanges and pins. Air from a cylinder enters the pressure chamber up to a pressure necessary to break a diaphragm, whereupon the latter fails and the striker is accelerated along the barrel; the pressure in the chamber is monitored from a gauge. The striker of mass 230 g accelerated by compressed air at a pressure up to 147.10^4 Pa enables measures to be made at speeds up to 530 m/sec. (9 refs.)

107086 Determination of the stress state of bodies with flaws by the method of holographic photoelasticity. A.A.Ostsemin, S.A.Deniskin, L.L.Sitnikov, S.B.Maksimov, A.A.Zagrebalov.
Strength Mater. (USA), vol.14, no.10, p.1375-80 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.77-81 (Oct. 1982). [received: Sept. 1983]
It is shown experimentally that the absolute path difference bands are independent of the slope of the principal surface elements, which makes it possible to determine the stress of the entire field of the model from two patterns with equally high accuracy. On the basis of an analysis of the errors of the method, a procedure for calibrating the material is suggested which ensures higher accuracy of measurements. For the purpose of improving the effectiveness of using the experimental information, formulae were obtained for plotting the fields of stress intensity σ_i and of the rigidity of the state of stress σ_1/σ_i. (13 refs.)

107087 A digital instrumentation package for an improved torsion pendulum. R.W.Nash, A.E.Schwaneke.
Report RI-8774, Bur. Mines, Washington, DC, USA (1983), 9 pp.
Describes the design and operation of a digital instrumentation package for the Bureau of Mines improved torsion pendulum, a scientific instrument that measures the vibration damping of metallic materials. The new automated design eliminates manual analogue-to-digital conversion, reduces the data acquisition time, and increases the precision of the measurements. The digital output can be coupled directly to a microprocessor or computer to produce the final data in real time. (no refs.)

Interfacial matrix stresses in composites due to misfitting cylindrical constituents .... See Entry 107007

Recent developments of experimental fracture mechanics in Greece .... See Entry 107056

A tensile test apparatus for measurement of strain effect in high current compound superconductors .... See Entry 109610

A constant-velocity impact tester for brittle material .... See Entry 109613

Method for measuring the yielding of the testing system machine-specimen .... See Entry 109624

Evaluation of residual stresses in welded joints of thin plate by a holographic method .... See Entry 109625

Determination of mechanical characteristics of high-melting-point materials in bending .... See Entry 109627

A unit for creep testing with a capacitive strain sensor .... See Entry 109629

Device for measuring axial and circumferential deformation in tubular specimens .... See Entry 109631

A TEM method for analyzing local strain fields in irradiated materials .... See Entry 109634

Estimation of fatigue curves for steel specimens subjected to bending, axial and torsion loads .... See Entry 109635

Experimental study on accuracy of notch root strain evaluation equation of ASME B & PV C C N-47 .... See Entry 109637

Critical evaluation of double torsion tests .... See Entry 109652

Experimental equipment and method for examining damage cumulation in softening polymer composite materials .... See Entry 109661

Equipment for fatique testing large numbers of specimens .... See Entry 109662

Stress-strain curves for high-temperature monotonic loading .... See Entry 109663

Experimental determination of the stress intensity factor in bending for a cylindrical single-edge-cracked specimen .... See Entry 109667

One experimental method of determining the maximum stresses in splitting .... See Entry 109668

Stress analysis of a rotating cylinder experiment to determine crack growth in thick section steel .... See Entry 109697

46.60 RHEOLOGY OF FLUIDS AND PASTES

107088 Profile development in continuous drawing of viscoelastic liquids. R.Keunings, M.J.Crochet (Unite de Mecanique Appl., Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium), M.M.Denn.
Ind. & Eng. Chem., Fundam. (USA), vol.22, no.3, p.347-55 (Aug. 1983).
Stress, velocity and diameter profiles are computed for continuous drawing (fiber spinning) of viscoelastic liquids from the fully developed flow in the spinneret to the region of uniform extension where the asymptotic thin filament equations apply. The calculations extend to a capillary recoverable shear of 1.0 for Maxwell and Phan-Thien-Tanner fluids, and to 4.0 for an Oldroyd fluid B; spinline force levels are reached at which significant viscoelastic effects are observed. The thin filament equations generally become valid within two diameters of the spinneret exit, but downstream of the point of maximum extrudate swell. The force at which viscoelastic effects in the spinline become important is adequately estimated from asymptotic solutions to the thin filament equations. (18 refs.)

Heat transfer for elastico-viscous flow between two rotating porous discs .... See Entry 107126

Flow of polymer solutions in porous media: inadequacy of the capillary model .... See Entry 107190

The dependence of viscoelastic flow properties on the structure for styrene-butadiene copolymers .... See Entry 107195

Rectilinear oscillatory viscoelastic flow in rectangular ducts . See Entry 107196

Transition of linear flexible-chain polymers from the fluid to the high-elastic state, spurt effect, and superspurting modes of their motion . See Entry 107200

Flow of dilute suspensions of deformable ellipsoidal particles in a plane channel .... See Entry 107219

Viscoelastic properties of liquid pentachlorobiphenyl under pressure using depolarized light scattering .... See Entry 107794

Model of elastic deformation in describing the stretching of polymer solutions .... See Entry 107797

Determination of the first and second normal stress differences in the truncated-cone-and-plate apparatus. I. Measurements on a polyisobutylene/decalin solution .... See Entry 107798

46.90 OTHER TOPICS IN MECHANICS, ELASTICITY, AND RHEOLOGY

107089 Winding on circular wire with extension. B.S.Bilobran, D.P.Kras.
Izv. VUZ Mashinostr. (USSR), no.7, p.10-13 (1983). In Russian.
A proposal is made for a procedure for determining the longitudinal force and bending moment accompanying the winding on of a circular wire under extension. The results of experimental investigations into the winding of copper wire onto circular and square mandrels are presented. (2 refs.) *L.M.H.*

47.00 FLUID DYNAMICS

(for fluid dynamics of quantum fluids, see 67.; for geophysical fluid dynamics, see 92.10; for astrophysical gas dynamics, see 95.30; for biological fluid dynamics, see 87.45)

47.10 GENERAL THEORY

(see also 03.40G Mathematical aspects)

107090 A note on the asymptotic approach to boundary layers of constant thickness. J.H.Merkin (Univ. of Leeds, Leeds, England).
Acta Mech. (Austria), vol.48, no.3-4, p.241-9 (1983).
Using as an example the problem of the unsteady boundary layer on an impulsively started rotating disc, the author shows the necessity of including an outer solution and its consequent matching with the inner solution to derive the asymptotic solution. (18 refs.)

107091 Similarity solutions of the boundary-layer equations for a stretching wall. W.H.H.Banks (School of Math., Univ. of Bristol, Bristol, England).
J. Mec. Theor. & Appl. (France), vol.2, no.3, p.375-92 (1983).
A class of similarity solutions of the boundary-layer equations corresponding to the flow engendered by a stretching surface is presented. The resulting ordinary differential equation which contains a parameter β is discussed in a detailed manner by complementing the previously known special cases with new analytical and numerical solutions. Discussion is also made of certain nonsimilarity solutions. (18 refs.)

107092 Analysis of some low-order finite element schemes for the Navier-Stokes equations. M.J.P.Cullen (Forecasting Res. Branch, Meteorological Office, Bracknell, England).
J. Comput. Phys. (USA), vol.51, no.2, p.273-90 (Aug. 1983).
Various low-order finite element schemes for the Navier-Stokes equations are analysed, including the commonly used bilinear velocity, piecewise constant pressure element, and the algorithms based on the finite element analogue of the MAC stencil of Dicano and Piva (1980). By performing a truncation error analysis using a variety of different assumptions about how the nodal parameters represent the data, it is shown how a more complete picture of the behaviour of the algorithms can be obtained. In particular, differences in performance on coarse grids using algorithms which have the same asymptotic covergence rate can be explained. (20 refs.)

107093 Experiments with some low-order finite elements schemes for the Navier-Stokes equations. M.J.P.Cullen (Forecasting Res. Branch, Meteorological Office, Bracknell, England).
J. Comput. Phys. (USA), vol.51, no.2, p.291-312 (Aug. 1983).
It is shown how a consistent finite element approximation to the Navier-Stokes equations can be constructed on a general grid using an arrangement equivalent to the MAC stencil. It is known that the standard Galerkin construction does not give a consistent result unless at least quadratic velocities are used in this type of element. However, the use of either a finite difference approximation to the pressure gradient term or a Galerkin scheme equivalent to a vorticity method appears to give a consistent scheme. Both alternatives are tested, and the vorticity method is shown to be superior. (18 refs.)

107094 Fingers in a Hele-Shaw cell with surface tension. J.-M.Vanden-Broeck (Dept. of Maths., Univ. of Wisconsin, Madison, WI, USA).
Phys. Fluids (USA), vol.26, no.8, p.2033-4 (Aug. 1983).
McLean and Saffman's (1981) model for the fingering in a Hele-Shaw cell is solved numerically. The results suggest that a countably infinite number of solutions exist for nonzero surface tension. This set of solutions contains the solution previously obtained by McLean and Saffman. (3 refs.)

107095 The approach of a sphere to an interface. M.E.O'Neill (Dept. of Maths., Univ. Coll. London, London, England), K.B.Ranger.
Phys. Fluids (USA), vol.26, no.8, p.2035-42 (Aug. 1983).
A solution to the problem posed when a rigid sphere normally approaches an interface between immiscible viscous fluids is presented when the deformation of the interface is small compared with the sphere radius or its minimum clearance from the undistorted interface. The complete boundary conditions at the interface of continuity of velocity and tangential stress together with discontinuity of normal stress by the surface tension times the mean curvature are applied in the first-order analysis of a perturbation scheme in which the interface has small distortion from planar. This results in a finite force on the sphere being predicted as the sphere approaches the interface. (6 refs.)

107096 New representation of Navier-Stokes equations governing self-similar homogeneous turbulence. C.Foias (Indiana Univ., Bloomington, IN, USA), O.P.Manley, R.Temam.
Phys. Rev. Lett. (USA), vol.51, no.8, p.617-20 (22 Aug. 1983).
A new form of the Navier-Stokes equation resulting from a change of variables is presented. The new form has several advantages: It yields a new asymptotic behavior of the flow for long times and vanishingly small viscosity. In addition an interpretation of the new equation in terms of a simple random walk yields immediately not only the Kolmogorov 2/3-power law but also an intermittency exponent well within the experimental uncertainty. (10 refs.)

107097 Equilibrium fluctuations in fluid layers: effects of elastic solid boundaries. D.Gutkowicz-Krusin (Corporate Res.-Sci. Labs., Exxon Res. & Engng. Co., Linden, NJ, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1602-11 (Sept. 1983).
The hydrodynamic theory of the dynamics of equilibrium fluctuations in one-component fluid layers confined by two identical elastic solid boundaries is presented. The dynamic structure factor for a fluid layer and the interfacial modes are analyzed under assumptions of continuity of stresses (no interfacial stress) and velocities ('stick' boundary condition) across the fluid-solid interfaces. There are four interfacial modes in such a system with dispersion relations which depend on the component of the wave vector parallel to the interfaces, $k_\parallel$. In the limit of $\bar{\rho}/\rho_s \rightarrow 0$, where $\bar{\rho}$ and ρ_s are the mean densities of the fluid and solid, respectively, two of these modes are just the well-known Rayleigh waves and the remaining two are the interfacial fluid modes found previously in the case of rigid solid walls [see D. Gutkowicz-Krusin and I. Procaccia, Phys. Res. Lett. 48, 417 (1982); Phys. Rev. A 27, 2585 (1983)]. For finite small values of $\bar{\rho}/\rho_s$ the attenuation of the interfacial fluid modes is due to dissipative interfacial transport and varies as ${k_\parallel}^{3/2}\bar{\rho}/\rho_s$, provided that $c<c_t$, where c is the speed of sound in the fluid and c_t is the transverse sound speed in the solid. If, however, $c>c_t$, the energy of the interfacial fluid mode is radiated into the solid and the resulting attenuation along the interface varies as $k_\parallel(\bar{\rho}/\rho_s)^2$, for small $k_\parallel$. Since the speed of the interfacial fluid modes is less than c, the corresponding peaks in the dynamic structure factor are better separated from the unbounded fluid Brillouin peaks and thus easier to observe experimentally than would have been the case with rigid solid walls. (5 refs.)

Finite element techniques for computational fluid mechanics .... See Entry 105115

Evolution equations for dissipative bodies and hyperbolicity .. See Entry 105287

Melting and cladding motion in a cylindrical vertical channel with a gaseous counterflow .... See Entry 106116

Computation of turbulent flow over a moving wavy boundary .... See Entry 107116

Conservation laws for liquid bridges .... See Entry 108125

Constructing a flow model with accurate satisfaction of the boundary conditions at a cylindrical profile .... See Entry 110577

47.15 LAMINAR FLOWS

107098 An experimental study of gas exchange in laminar oscillatory flow. C.H.Joshi, R.D.Kamm (MIT, Cambridge, MA, USA), J.M.Drazen, A.S.Slutsky.
J. Fluid Mech. (GB), vol.133, p.245-54 (Aug. 1983).
Experiments were conducted to determine the effective diffusivity for axial transport through a tube of circular cross-section of a contaminant gas in oscillatory flow. Results were compared with the theoretical predictions of Watson (1983) and found to be in excellent agreement. The experiments differ from the theoretical situation in that the oscillations are superimposed upon a steady flow due to a constant infusion of tracer gas, and a buoyancy-induced flow associated with spatial variations in gas density. The influence of both artifacts is found to be negligible. (14 refs.)

Similarity solutions of the boundary-layer equations for a stretching wall .... See Entry 107091

Transport near a vertical ice surface melting in water of various salinity levels .... See Entry 107104

Solution of a two-dimensional conjugate problem of stabilized heat transfer in the laminar flow of a liquid in a channel .... See Entry 107143

Transient thermal entrance heat transfer in laminar pipe flows with step change in pumping pressure .... See Entry 107151

Fluid-property effects on flow-generated waves on a compliant surface .... See Entry 107176

Application of unsteady laminar triple-deck theory to viscous-inviscid interactions from an oscillating flap in supersonic and subsonic flow .... See Entry 107182

Universal equation of transient plane jet in concurrent stream .... See Entry 107207

Flow of dilute suspensions of deformable ellipsoidal particles in a plane channel .... See Entry 107219

The residence time distribution for laminar flow in an annulus with negligible diffusion .... See Entry 107245

Measurement of flow rate through a pipe by external heating .... See Entry 107258

The effect of Brownian diffusion on shear-induced coagulation of colloidal dispersions .... See Entry 109817

47.15C Laminar boundary layers

An experimental investigation of laminar axisymmetric submerged jets .... See Entry 107206

On the calculation of separation bubbles .... See Entry 107216

The effect of boundary absorption on longitudinal dispersion in steady laminar flows .... See Entry 107228

47.20 HYDRODYNAMIC STABILITY

107099 Breakdown of boundary layers: (i) on moving surfaces; (ii) in semi-similar unsteady flow; (iii) in fully unsteady flow. J.W.Elliott, F.T.Smith (Math. Dept., Imperial Coll., London, England), S.J.Cowley.
Geophys. & Astrophys. Fluid Dyn. (GB), vol.25, no.1-2, p.77-138 (1983).
The breakdown and separation or reattachment of boundary layers adjoining a mainstream are studied in the three related situations (i)-(iii) of the title. (42 refs.)

107100 The flow of a second grade fluid. P.N.Kaloni, A.M.Siddiqui (Dept. of Maths., Univ. of Windsor, Windsor, Ontario, Canada).
Int. J. Eng. Sci. (GB), vol.21, no.10, p.1157-69 (1983).
Discusses a method for studying plane steady flows of a second grade fluid. Basic equations are recast in a new curvilinear coordinate system, by employing some results from differential geometry, and the partial differential equations are derived for the coefficients E, F and G of the first fundamental form of the metric, which are taken as unknown functions. By placing certain conditions on these coefficients, a priori, flows are determined which have such a property. Some illustrations in detail are given which reflect the use of this method. (11 refs.)

107101 Dynamics of the phase variable in the Taylor vortex system. P.Tabeling (Ecole Superieure d'Electricite, Univ. Paris-VI et Paris-XI, Gif-sur-Yvette, France).
J. Phys. Lett. (France), vol.44, no.16, p.L665-72 (15 Aug. 1983).
Using a multiple scale method for the Taylor-Couette instability, the author obtains, in a suitable moving frame, a diffusion equation for the phase variable of the vortex system. The transversal diffusion coefficient $D\perp$ is found to be positive. The phase diffusion equation restricted to the one-dimensional case seems to be relevant for interpreting Snyder's experiments (1969) on the relaxation of vortex systems in the Taylor-Couette flow. (9 refs.)

107102 Time evolution of density perturbations in accelerating stratified fluids. K.O.Mikaelian (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1637-46 (Sept. 1983).
The author considers N superimposed fluids, having arbitrary initial perturbations at their $N-1$ interfaces, undergoing a Rayleigh-Taylor instability with constant acceleration. The time evolution of these perturbations is described by a sum over normal modes and in general is a combination of oscillation and exponential rise. The author derives the equation governing their growth, discusses the case $N=3$ analytically, and gives two numerical examples and plots the time evolution of the perturbations at the four interfaces of five superimposed fluids. Examples illustrate how the evolution depends on the density profile, on the wavelength of the perturbations, and on the initial conditions. (14 refs.)

Stationary and oscillatory instabilities for mixture subjected to Soret effect in vertical cylinder with axial temperature gradient .... See Entry 107121

The stability of natural convection in a vertical fluid layer with internal heat generation .... See Entry 107134

Nonsteady heat transfer in diffusing systems .... See Entry 107144

Period-doubling cascade in the Rayleigh-Benard convection ... See Entry 107145

Zigzag instability and axisymmetric rolls in Rayleigh-Benard convection: the effects of curvature .... See Entry 107147

Energy stability in the Benard problem for a fluid of second grade .... See Entry 107154

Buoyancy-thermocapillary convection: the role of interfacial deformation .... See Entry 107160

Double diffusive convection in a rotating fluid .... See Entry 107166

Parametric excitation of internal waves and convective instability in the fluid layer heated from above .... See Entry 107173

Application of unsteady laminar triple-deck theory to viscous-inviscid interactions from an oscillating flap in supersonic and subsonic flow .... See Entry 107182

Unified unsteady supersonic/hypersonic theory of flow past double wedge airfoils .... See Entry 107184

Small-disturbance stability of a non-isothermal tube flow of power law fluids. I. Derivation of the Orr-Sommerfeld equation extended .... See Entry 107187

Small-disturbance stability of a non-isothermal tube flow of power law fluids. II. Numerical solution of the problem .... See Entry 107188

Behavior of air-liquid surface moving downward in a straight pipe .... See Entry 107244

On the stability of plane Poiseuille flow to finite-amplitude disturbances, considering the higher-order Landau coefficients .... See Entry 107248

Hydrodynamic regimes of a liquid in a smooth-walled rotating heat pipe. I .... See Entry 107251

Stability of the flow during sedimentation in inclined channels .... See Entry 107255

Wave formation and growth during sedimentation in narrow tilted channels .... See Entry 107256

Experimental study of the near wall region of unsteady turbulent flow in two-dimensional duct .... See Entry 107257

Calorimetric investigation of electrohydrodynamic instabilities in liquid crystals .... See Entry 107266

Measurement of unsteady gas flow under anisothermic conditions .... See Entry 107283

A new kind of instability in the smectic-C phase of a liquid crystal .... See Entry 107541

Convection effects at solid-liquid interfaces—influence of gravity .... See Entry 107888

Boundary conditions for a rapidly rotating hydromagnetic system in a cylindrical container .... See Entry 110288

On the instability of internal Alfven-gravity waves in stratified shear flows .... See Entry 110612

On equilibrium figures for ideal fluids in the form of confocal spheroids rotating with common and different angular velocities .... See Entry 110903

47.25 TURBULENT FLOWS, CONVECTION, AND HEAT TRANSFER

107103 Multiple scale concept in turbulence modelling. I. Multiple scale model for turbulence kinetic energy and mean square of passive scalar fluctuations. R.Schiestel (Inst. de Mecanique Statistique de la Turbulence, Marseille, France).
J. Mec. Theor. & Appl. (France), vol.2, no.3, p.417-49 (1983). In French.
Multiple scale modeling is studied on the basis of spectral dynamic equations in homogeneous anisotropic turbulence. Integration between partitioning wavelengths gives the equations for evolution of partial energies, the meaning of the different terms is thus clarified. Turbulent scale equations are no longer obtained from modeling the dissipation rate equation of turbulence kinetic energy but arise directly from the choice of partitioning wavelengths which are connected to characteristic scales. The same method is then applied to passive scalar transfer (such as temperature). Interpretation in physical space is also given. (29 refs.)

107104 Transport near a vertical ice surface melting in water of various salinity levels. B.Sammakia, B.Gebhart (Dept. of Mech. Engng. & Appl. Mech., Univ. of Pennsylvania, Philadelphia, PA, USA).
Int. J. Heat & Mass Transfer (GB), vol.26, no.10, p.1439-52 (Oct. 1983).
The results of an experimental investigation of the buoyancy driven flow adjacent to a vertical ice surface melting in saline water are presented. Several ambient water salinities, s_∞, are studied, namely 14 per mille, 17 per mille, 22 per mille, 30 per mille and 35 per mille. For each salinity level, several ambient water temperatures, t_∞, are investigated, ranging from $t_\infty=-1.75°C$ when $s_\infty=35$ per mille to $t_\infty=17°C$ when $s_\infty=17$ per mille. Time exposure photographs of the flow field show that several distinctively different regimes of flow occur, depending on both the ambient water salinity level and temperature. All of the salinities considered in the present study, the flow is observed to be laminar at low ambient water temperatures. This laminar flow is either upward, at the low salinity levels, or bi-directional at the higher salinities. At intermediate ambient water temperatures the flow is observed to be bi-directional and laminar over the lower portion of the ice surface, and upward and turbulent over the top portion of the ice surface. As the ambient water temperature is further increased the flow is seen to split, with a downward moving turbulent layer over the lower portion of the ice surface, and an upward moving layer over the top portion. The complicated nature of this type of flow is due to the interaction of two buoyancy force components, namely that due to salinity gradients and that due to the thermal gradients. These forces are aiding or opposing, depending on the ambient water salinity level and temperature. Also, each of these forces exerts itself across a different thickness of the total boundary region. Velocity profiles, measured from the time exposure photographs, are presented and shown to be in good agreement with the analytical results of Carey and Gebhart [1, J. Fluid Mech., 107, 37-55, 1981]. Measured solid-liquid interface temperatures and inferred interface salinities are also presented for the different salinity levels and ambient water temperatures. (9 refs.)

107105 Kinematic, integral, and thermal characteristics of turbulent stream of gaseous suspension under nonsteady thermal conditions. A.V.Fafurin, K.R.Shangareev (S.M. Kirov Kazan Chemicotechnol. Inst., Kazan, USSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1220-4 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.748-53 (Nov. 1982). [received: Sept. 1983]
The effect of two-phasality and of thermal nonsteadiness on the characteristics of a stream of a gaseous suspension is analyzed on the basis of the solution to integral equations of energy and momentum. (9 refs.)

107106 The evolution of large-horizontal-scale disturbances in marginally stable, inviscid, shear flows. I. Derivation of the amplitude evolution equations. F.J.Hickernell (Dept. of Math., Univ. of Southern California, University Park, Los Angeles, CA, USA).
Stud. Appl. Math. (USA), vol.69, no.1, p.1-21 (Aug. 1983).
Two inviscid, stratified, shear flow models are studied. The amplitude evolution equations for large-horizontal-scale disturbances are derived. Particular attention is given to the case where the flows are marginally stable. In this case the amplitude evolution equations are second order in time. A typical example is the Boussinesq equation. (28 refs.)

107107 The evolution of large-horizontal-scale disturbances in marginally stable, inviscid, shear flows. II. Solutions of the Boussinesq equation. F.J.Hickernell (Dept. of Math., Univ. of Southern California, University Park, Los Angeles, CA, USA).
Stud. Appl. Math. (USA), vol.69, no.1, p.23-49 (Aug. 1983).
For pt.I see ibid., vol.LXIX, no.1, p.5135-83005 (1983). In part I the Boussinesq equation was found to describe large-horizontal-scale disturbances in certain marginally stable flows. In this paper the properties of the solutions of this equation are explored. Solutions that are bounded for all time and those that blow up in finite time are observed analytically and numerically. Sufficient conditions for both boundedness and blowup are given. (19 refs.)

Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191) .... See Entry 105032

Behaviour of vapour bubbles growing at a wall with forced flow .... See Entry 107240

47.25C Isotropic turbulence

107108 Empirical equations for the structure of isotropic turbulence. Y.Sato, K.Yamamoto, T.Mizushina (Dept. of Chem. Engng., Yokohama Nat. Univ., Yokohama, Japan).
Bull. Fac. Eng. Yokohama Natl. Univ. (Japan), vol.32, p.45-67 (March 1983).
For the double velocity-correlation function $f(r,t)$ in the Karman-Howarth (K-H) equation representing the dynamic behaviour of homogeneous isotropic turbulence, the empirical equation is first formulated using two parameters: the RMS fluctuation velocity u, and the turbulent Reynolds number $R_\lambda=u'\lambda/\sqrt{2\nu}$ (λ is the longitudinal microscale and ν the kinematic viscosity), in the form of $f(\psi,R_\lambda)$, where $\psi=r/\lambda$. The empirical equation is obtained by rearranging the data measured in a nearly isotropic field behind a grid with reference to other pertinent investigations which have been developed theoretically and experimentally. The validity of this empirical equation is confirmed by comparison between the calculated results and experimental data over a wide range of $R_\lambda(10\gtrsim R_\lambda\gtrsim 10^4)$. The triple correlation function $k(r,t)$ is computed numerically based on K-H equation with the known variable u'^2f, and

consequently can be expressed in the form of $k(\psi,R_\lambda,I_\lambda)$, where I_λ is introduced to describe the decay state. The calculated results are consistent with the present data of direct measurements of $k(r)$ and some relevant measurements reported previously for $10 \gtrsim R_\lambda \gtrsim 10^4$. The application of these empirical equations to grid turbulence is described. (52 refs.)

107109 The turbulent recirculating flow field in a coreless induction furnace, a comparison of theoretical predictions with measurements. N.El-Kaddah, J.Szekely (Dept. of Materials Sci. & Engng., MIT, Cambridge, MA, USA).
J. Fluid Mech. (GB), vol.133, p.37-46 (Aug. 1983).
A mathematical representation has been developed for the electromagnetic force field and the fluid-flow field in a coreless induction furnace. The fluid flow field was represented by writing the axisymmetric turbulent Navier-Stokes equations, containing the electromagnetic body-force term. The electromagnetic body force field was calculated by using a technique of mutual inductances. The k-ϵ model was employed for evaluating the turbulent viscosity, and the resultant differential equations were solved numerically. The theoretically predicted velocity fields were in reasonably good agreement with the experimental measurements reported by Hunt & Moore (1982); furthermore, the agreement regarding the turbulence intensities was essentially quantitative. These results indicate the k-ϵ model does provide a good engineering representation of the turbulent recirculating flows occurring in induction furnaces. At this stage it is not clear whether the discrepancies between measurements and the predictions, which were not very great in any case, are attributable either to the model or to the measurement techniques employed. (17 refs.)

107110 A digital technique for the simultaneous measurement of streamwise and lateral velocities in turbulent flows. J.G.Kawall, M.Shokr, J.F.Keffer (Dept. of Mech. Engng., Univ. of Toronto, Canada).
J. Fluid Mech. (GB), vol.133, p.83-112 (Aug. 1983).
A novel, digital, hot-wire anemometer technique for the simultaneous measurement of the instantaneous streamwise and lateral velocity fields in high-intensity turbulent flows is discussed. It involves the use of a three-wire probe comprising two 45° slanted hot wires and a normal hot wire. A comprehensive and systematic examination of several factors that can affect the fidelity of the streamwise and lateral velocity waveforms is developed to assess the performance of the new technique as well as hot-wire systems generally. These factors are: (i) rectification which stems from the inherent insensitivity of hot wires to the direction of the instantaneous (total) velocity vector in a turbulent flow; (ii) spanwise velocity fluctuations; (iii) axial cooling of hot wires; (iv) unpredictable variations in one of four hot-wire calibration parameters; (v) random hot-wire calibration errors; (vi) spanwise separation of the hot wires. Relevant hot-wire anemometer-response equations relating instantaneous anemometer output voltages to instantaneous flow velocities were established on the basis of extensive voltage-velocity calibration data pertaining to hot wires orientated with respect to the calibration flow velocity at various yaw and pitch angles ranging from 0° to 90°. (16 refs.)

107111 The growth of a grid-generated turbulent mixed layer in a two-fluid system. H.J.S.Fernando, R.R.Long (Dept. of Earth & Planetary Sci., Johns Hopkins Univ., Baltimore, MD, USA).
J. Fluid Mech. (GB), vol.133, p.377-95 (Aug. 1983).
Describes a laboratory experiment designed to compare measurements with published theoretical ideas of the mixed-layer growth of a two-layer system in which the turbulence is induced by an oscillating grid. Experimental results show excellent agreement with an earlier theory by Long (1978), in which the mixed-layer depth D_* measured from a virtual origin is given by $D_* \sim V_0^{-7/11} K^{9/11} t^{2/11}$, where K is action, t is time and V_0 is a characteristic velocity of the problem. The experiments also verify Long's theoretical entrainment relation $E=\alpha_2 Ri^{-7/4}$, where E is the entrainment coefficient and $Ri=D_*^3 \Delta b/K^2$, and Δb is the buoyancy difference between the two layers. The interfacial-layer thickness was observed to be proportional to the depth of the mixed layer, as also predicted by Long. After a certain depth, the entrainment law tends to deviate from Long's theory. The deviation may be due to wall effects. (47 refs.)

107112 Effect of phase velocity difference on the turbulent structure of a jet carrying heavy impurities. T.A.Girshovich, V.A.Leonov (Sergo Ordzhonikidze Moscow Aviation Inst., Moscow, USSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1062-8 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.541-8 (Oct. 1982). [received: Sept. 1983]
A model is proposed to calculate the effect of a difference in the mean velocities of particles and a gas on the turbulent structure of a jet carrying heavy impurities. The model considers the effect of all particles in a mole of the gas on the velocity of the mole at the end of its 'life'. (5 refs.)

107113 Kinematics of velocity and vorticity correlations in turbulent flow. P.S.Bernard (Dept. of Mech. Engng., Univ. of Maryland, College Park, MD, USA).
Phys. Fluids (USA), vol.26, no.8, p.2080-7 (Aug. 1983).
The kinematic problem of calculating second-order velocity moments from given values of the vorticity covariance is examined. Integral representation formulas for second-order velocity moments in terms of the two-point vorticity correlation tensor are derived. The special relationships existing between velocity moments in isotropic turbulence are expressed in terms of the integral formulas yielding several kinematic constraints on the two-point vorticity correlation tensor in isotropic turbulence. Numerical evaluation of these constraints suggests that a Gaussian curve may be the only form of the longitudinal velocity correlation coefficient which is consistent with the requirement of isotropy. It is shown that if this is the case, then a family of exact solutions to the decay of isotropic turbulence may be obtained which contains Batchelor's final period solution as a special case. In addition, the computed results suggest a method of approximating the integral representation formulas in general turbulent shear flows. (23 refs.)

107114 Variational approach to the closure problem of turbulence theory. J.Qian (Inst. of Mech., Acad. of Sci., Beijing, China).
Phys. Fluids (USA), vol.26, no.8, p.2098-104 (Aug. 1983).
A new method is proposed to solve the closure problem of turbulence theory and to drive the Kolmogorov law in an Eulerian framework. Instead of using complex Fourier components of velocity field as modal parameters, a complete set of independent real parameters and dynamic equations are worked out to describe the dynamic states of a turbulence. Classical statistical mechanics is used to study the statistical behavior of the turbulence. An approximate stationary solution of the Liouville equation is obtained by a perturbation method based on a Langevin-Fokker-Planck (LFP) model. The dynamic damping coefficient η of the LFP model is treated as an optimum control parameter to minimize the error of the perturbation solution; this leads to a convergent integral equation for η to replace the divergent response equation of Kraichnan's direct-interaction (DI) approximation, thereby solving the closure problem without appealing to a Lagrangian formulation. The Kolmogorov constant Ko is evaluated numerically, obtaining Ko=1.2, which is compatible with the experimental data given by Gibson and Schwartz. (24 refs.)

New representation of Navier-Stokes equations governing self-similar homogeneous turbulence ......See Entry 107096

Prediction of the steady surface thermal plume ......See Entry 107150

Fluid-property effects on flow-generated waves on a compliant surface ......See Entry 107176

Liquid dispersion in static in-line mixers ......See Entry 107201

Entrance section of a planar turbulent jet in transverse flow ......See Entry 107208

Mean flow in round bubble plumes ......See Entry 107217

Experimental study of the motion of solid particles in a turbulent gas flow. The transfer mechanism ......See Entry 107218

Heat transfer to turbulent stream in pipes under supercritical pressures ......See Entry 107253

Experimental study of the near wall region of unsteady turbulent flow in two-dimensional duct ......See Entry 107257

Turbulence in superfluid ^{4}He ......See Entry 108097

A note on the signal intensity of the second spin echo in Carr-Purcell-Meiboom-Gill sequence of turbulent flows ......See Entry 108831

Wave evolution over a gradual slope with turbulent friction ..See Entry 110445

Turbulence in a self-gravitating gaseous disk. II. Turbulence spectra ......See Entry 110904

47.25F Boundary layer and shear turbulence

107115 Study of binary turbulent boundary layer on permeable surface in region of screen. L.L.Kalishevskii, L.A.Kuznetsov, G.P.Nikitushkina, V.Ya.Strel'tsov.
Izv. VUZ Mashinostr. (USSR), no.7, p.48-52 (1983). In Russian.
The experimental results of a study of the influence of the structural design of the supply unit for the components of the screen in a turbulent boundary layer on a permeable surface with a homogeneous intake are presented. Recommendations are made concerning the selection of the most suitable design for the supply unit in order to ensure the maximum lengths at which the screen will operate efficiently. (4 refs.) *L.M.H.*

107116 Computation of turbulent flow over a moving wavy boundary. J.W.McLean (TRW Space & Technol. Group, Redondo Beach, CA, USA).
Phys. Fluids (USA), vol.26, no.8, p.2065-73 (Aug. 1983).
Numerical solutions via Newton's method of the Reynolds-averaged Navier-Stokes equations for steady flow over a two-dimensional wavy surface indicate that by using a simple algebraic eddy-viscosity model the distribution of wall pressure and shear stresses and the corresponding drag coefficients can be predicted. Computations are compared with experimental results over rigid wavy surfaces and moving flexible boundaries. For small-amplitude wavy surfaces, computed values of the wall stresses agree well with the experimental measurements. For larger-amplitude waves, regions of reverse flow in the trough of the wave are predicted. (25 refs.)

107117 On the structure of wall-bounded turbulent flows. J.Kim (NASA, Ames Res. Center, Moffett Field, CA, USA).
Phys. Fluids (USA), vol.26, no.8, p.2088-97 (Aug. 1983).
The variable-interval time-averaging (VITA) technique developed by Blackwelder and Kaplan [J. Fluid Mech. 76, 89 (1976)] is applied to data obtained from large-eddy simulation of turbulent channel flow in an investigation of the organized structures associated with the bursting phenomenon in the near-wall region. Conditionally average velocities, shear stress, pressure, and vorticity are discussed in conjunction with the bursting phenomenon detected by the VITA technique. The conditionally averaged pressure reveals that the ejection process is associated with a localized adverse pressure gradient. In the plane perpendicular to the flow direction, the conditionally averaged vorticity field indicates that a pair of counterrotating streamwise vortices is being lifted through the ejection process. (18 refs.)

107118 Spectral relationships between velocity and temperature fluctuations in turbulent shear flows. L.Fulachier (Inst. de Mecanique Statistique de la Turbulence, Marseille, France), R.A.Antonia.
Phys. Fluids (USA), vol.26, no.8, p.2105-8 (Aug. 1983).
The frequency dependence of a turbulent Prandtl number, defined using the Reynolds shear stress and normal heat flux co-spectra, in various turbulent shear flows accentuates the inadequacy of the Reynolds analogy from a spectral point of view. For the same flows, the analogy between spectral distributions of the kinetic energy and the temperature variance is validated over a significant frequency domain. This analogy suggests a spectral parameter which is very close to unity in this frequency range for all the flows considered. (17 refs.)

107119 Spectral analysis of turbulent intermittency functions. T.Koso, Y.Senoo, H.Ohashi.
Rep. Res. Inst. Ind. Sci. Kyushu Univ. (Japan), no.74, p.149-57 (1983). In Japanese.
Walsh spectral analysis of turbulent intermittency functions is introduced and proved to be useful in studying large-scale organized motions in free turbulent shear layers. The analysis is applied to a three-dimensional turbulent wall jet. (7 refs.)

Kinematics of velocity and vorticity correlations in turbulent flow ......See Entry 107113

How rapidly is a passive scalar mixed within closed streamlines? ......See Entry 107120

Flow around turbulence promoters in parallel channels. II. Shedding vortex around cylinder ......See Entry 107165

Effect of large-scale turbulence on the structure of the boundary layer in a density flow ......See Entry 107212

On the calculation of separation bubbles ......See Entry 107216

Effects of rotation and shear on doubly diffusive instability ..See Entry 110446

47.25J Turbulent diffusion

107120 How rapidly is a passive scalar mixed within closed streamlines?. P.B.Rhines (Woods Hole Oceanographic Instn., Woods Hole, MA, USA), W.R.Young.
J. Fluid Mech. (GB), vol.133, p.133-45 (Aug. 1983).
The homogenization of a passive 'tracer' in a flow with closed mean streamlines occurs in two stages: first, a rapid phase dominated by shear-augmented diffusion over a time $\approx P^{1/3}(L/U)$, where the Peclet number $P=LU/\kappa$ (L,U and κ are lengthscale, velocity scale and diffusivity), in which initial values of

the tracer are replaced by their (generalized) average about a streamline; second, a slow phase requiring the full diffusion time $\approx L^2/\kappa$. The diffusion problem for the second phase, where tracer isopleths are held to streamlines by shear diffusion, involves a generalized diffusivity which is proportional to κ, but exceeds it if the streamlines are not circular. Expressions are also given for flow fields that are oscillatory rather than steady. (23 refs.)

107121 Stationary and oscillatory instabilities for mixture subjected to Soret effect in vertical cylinder with axial temperature gradient. D.Henry (Univ. de Lyon I, Villeurbanne, France), B.Roux.
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.145-52
The authors consider a binary mixture subjected to Soret effect in a confined vertical cylinder, with a constant temperature gradient imposed along its axis. An accurate Galerkin method is used to compute marginal stability for stationary and oscillatory perturbations of axi-symmetric and asymmetric modes. Some 'universal' new results are given in terms of the thermal diffusion parameter ψ, specially for an aspect ratio of 1/6, corresponding to an apparatus to be used in microgravity environment to measure the Soret coefficient of a AgI-KI mixture. (11 refs.)

Thermodynamics of irreversible processes in molten salts: problems of interdiffusion measurements under microgravity .... See Entry 108003

47.25M Noise (turbulence generated)

107122 Separated flow noise of a flat plate at large attack angles. Y.Maruta (Res. Lab., Ebara Corp., Fujisawa-shi, Kanagawa, Japan), S.Kotake.
J. Sound & Vib. (GB), vol.89, no.3, p.335-57 (8 Aug. 1983).
Flow noise associated with separated flow of a flat plate with large attack angles was studied experimentally to obtain its acoustic characteristics and to understand its generation mechanism. The acoustic features show that the separated flow noise could be attributed to acoustic dipole sources associated with the wall-pressure fluctuations on the plate surface. The time derivative of the fluctuating wall-surface pressure is highly correlated with the associated acoustic pressure. The noise intensity source strength is proportional to the mean-square time derivative of the fluctuating surface pressure and its correlation area, being proportional to the sixth power of the oncoming flow velocity and distributed uniformly over the plate surfaces. The associated acoustic intensity is well predicted by these noise source strength distributions. (6 refs.)

47.25Q Convection and heat transfer

(see also 44.25 Convective and constrained heat transfer)

107123 An experimental investigation of convection patterns in flow past an obstacle. M.S.Ouraishi, T.Z.Fahidy, M.S.E.Abdo (Dept. of Chem. Engng., Univ. of Waterloo, Waterloo, Ontario, Canada).
Chem. Eng. Sci. (GB), vol.38, no.8, p.1271-9 (1983).
The propagation of liquid flow in a cylindrical tube past solid obstacles of various shapes and sizes has been studied at Reynolds numbers up to about 6600 via a direct electrochemical flow visualization technique, where the obstacles were connected as cathodes and the colour change of a suitable analytical indicator was employed for the marking of convecting flow. Typical propagation patterns are shown by photographs and the effect of the obstacle on local velocities at the core of tube is analyzed. (14 refs.)

107124 Methods of solving certain inverse problems of heat and mass transfer. A.A.Aleksashenko.
Power Eng. (J. Acad. Sci. USSR) (USA), vol.20, no.2, p.148-53 (1982). Translation of: *Izv. Akad. Nauk SSSR Energ. & Transp.*, vol.20, no.2, p.161-6 (1982).
Methods are given for the solution of certain inverse problems of heat and mass transfer. Calculation formulas are obtained on the basis of a method of direct integration, together with self-similar solutions for a semi-bounded region. Sample calculations are shown. (10 refs.)

107125 Intensification of heat exchange in banks of twisted tubes in transverse flows. L:A.Ashmantas, Yu.V.Vilemas, B.V.Dzyubenko, G.A.Dreitser, N.V.Paramonov, V.Yu.Survila.
Power Eng. (J. Acad. Sci. USSR) (USA), vol.20, no.6, p.93-100 (1982). Translation of: *Izv. Akad. Nauk SSSR Energ. & Transp.*, vol.20, no.6, p.120-7 (1982).
Results are reported for an experimental investigation into heat exchange and hydraulic resistance for a bank of tightly packed twisted tubes of oval profile in a transverse flow. Criterial dependences are proposed for calculating the heat-transfer coefficients and the hydraulic resistance. It has been found that in banks of twisted tubes in a transverse flow the nonuniformity of the distribution of the heat-transfer coefficient over the perimeter of a tube is less by a factor of 2-3 than for a smooth-tube bank. The effectiveness of a heat-exchange unit with transverse flow past twisted tubes is evaluated. it is shown that for a certain mutual orientation of the twisted tubes in the bank there may be a 25% reduction in the volume of heat-exchange units as compared with round tubes. (7 refs.)

107126 Heat transfer for elastico-viscous flow between two rotating porous discs. P.R.Sharma, P.D.Verma (Dept. of Math., Univ. of Rajasthan, Jaipur, India).
Def. Sci. J. (India), vol.33, no.2, p.137-46 (April 1983). [received: Aug. 1983]
The problem of temperature distribution and heat transfer for elastico-viscous fluid flow between two rotating porous discs is studied. The equations of motion and energy are solved by a regular perturbation method for small Reynolds number. The effects of the elasticity of the fluid, suction/injection parameter, rotation parameter, Prandtl number and Eckert number on Nusselt numbers at the two discs have been discussed numerically and compared with Newtonian fluid case. (8 refs.)

107127 Long rolls generated by natural convection in an inclined, rectangular enclosure. H.Ozoe, K.Fujii (Okayama Univ., Tsushima, Okayama, Japan), N.Lior, S.W.Churchill.
Int. J. Heat & Mass Transfer (GB), vol.26, no.10, p.1427-38 (Oct. 1983).
The three-dimensional velocity and temperature fields, are in turn the average Nusselt number and representative streaklines were computed by a finite-difference method for a cellular element with a length-to-height ratio of 7 and several postulated width-to-height ratios near unity in a rectangular enclosure heated from below, perfectly insulated on the lateral surfaces, and inclined about the long dimension. Calculations were carried out for $Ra=4000$, $Pr=10$ and a single grid spacing (non-uniform in the long dimension) for cells with dragless lateral boundaries and for those with one dragless and one rigid. Computations such as these have previously been utilized to develop a simple, theoretically based method for the prediction of Nu in horizontal enclosures of arbitrary aspect ratios. Further calculations are necessary to support such a method of prediction for inclined enclosures and to define its limits of applicability. (24 refs.)

107128 Evaporative convection in minute drops on a plate with temperature gradient. N.Zhang, Wen-Jei Yang (Dept. of Mech. Engng. & Applied Mech., Univ. of Michigan, Ann Arbor, MI, USA).
Int. J. Heat & Mass Transfer (GB), vol.26, no.10, p.1479-88 (Oct. 1983).
Thermal convection in a minute drop evaporating on a plate surface is visualized through two methods: solid suspension and laser shadow graphs. The plate is partially heated to create a temperature field on the test so that the Marangoni effect may be induced on the drop surface. Through altering plate inclination, the evaporating drop may stay at rest at the same spot or move on the plate. The observation of flow patterns in a stationary drop reveals that the presence of both surface tension and buoyancy forces lead to four distinct flow regimes in the drop with the buoyancy-driven convection on the warm side and the surface tension driven instability on the cold side. The effects of drop motion, liquid properties and air-liquid interfacial geometry on both the interfacial and internal flow structures are determined and the consequences of the evaporation rate are discussed. (6 refs.)

107129 Mechanism for transition to turbulence in buoyant plume flow. S.Kimura, A.Bejan (Dept. of Mech. Engng., Univ. of Colorado, Boulder, CO, USA).
Int. J. Heat & Mass Transfer (GB), vol.26, no.10, p.1515-32 (Oct. 1983).
Reports a theoretical and experimental study of the fundamental mechanism responsible for transition in natural convection plume flow. Theoretically, it is argued that the transition occurs when the time of viscous penetration normal to the plane becomes comparable with the minimum time period with which the plume can fluctuate as an unstable inviscid stream. It is also argued that at transition the plume wavelength must always scale with the local plume diameter. The experimental part of the study focused on transition in the axisymmetric air plume above a point heat source. Smoke visualization of the plume shape at transition led to extensive observations that support strongly the transition mechanism proposed theoretically. The transitional plume is seen to meander in a plane (two-dimensionally) and with a wavelength which scales with the plume diameter. If excited externally by many such wavelengths, the plume has the property to select the natural wavelength proposed theoretically. The equivalence between the present transition mechanism and the transition predicted by the buckling theory is discussed. (21 refs.)

107130 Local heat transfer rates from two adjacent spheres in turbulent flow. D.C.T.Pei, G.Hayward (Univ. of Waterloo, Waterloo, Ontario, Canada).
Int. J. Heat & Mass Transfer (GB), vol.26, no.10, p.1547-56 (Oct. 1983).
The interactions between a pair of spheres in a crossflow orientation was studied in a vertical wind tunnel. The flow Reynolds number was approximately 10^4 with a turbulence intensity of 1.1%. The spacing between the sphere centres was varied from 1.04 to 2 diameters. Both the local surface pressures and heat transfer coefficients were measured. The measurement technique allowed the fluctuating component of the heat transfer to be measured as well as the time averaged values. The present results indicate the formation of a jet-like flow between the spheres. At close spacing, this jet remained attached to one of the spheres giving rise to crossflow forces. At very close spacings, the increased shear stress in the region between the spheres resulted in a decrease in the strength of the jet and the magnitude of the crossflow forces. (23 refs.)

107131 Second-order boundary-layer flow past sharp cones. M.N.Mathur (Inst. fur Experimentelle Stromungsmechanik, Deutsche Forschungs-und Versuchsantstalt fur Luft-und Raumfahrt eV, Gottingen, Germany).
Int. J. Heat & Mass Transfer (GB), vol.26, no.10, p.1557-70 (Oct. 1983).
Second-order boundary-layer effects of displacement thickness, transverse curvature, wall slip and temperature jump have been investigated in detail for flow past sharp cones of 5°, 10° and 15° semi-vertex angles. Similar solutions of the non-dimensional first- and second-order boundary-layer equations exist and numerical solutions of the resulting systems of ordinary-differential equations have been obtained using the finite-difference technique with variable step size. The second-order effects have been computed for different values of Mach number, wall temperature, and injection parameter. Some of the first-order results for wall heat transfer have been compared with the available experimental results at DFVLR. (26 refs.)

107132 Free convective viscous flow past a hot vertical porous plate with periodic temperature. B.P.Acharya, S.Padhy (Dept. of Maths., Utkal Univ., Bhubaneswar, India).
Indian J. Pure & Appl. Math., vol.14, no.7, p.838-49 (July 1983).
An analysis of a free convective flow of a viscous liquid past a hot vertical porous wall is presented under the assumptions that the suction velocity is constant and normal to the wall and the wall temperature is spanwise cosinusoidal. Approximate solutions of the equations of motion and energy have been obtained by the method of regular perturbation. The effects of the different flow parameters on the functions affecting the mean velocity, temperature, skin-friction and rate of heat transfer have been presented. (4 refs.)

107133 A numerical study of mixed convection flow in enclosures. Y.Jaluria (Mech. & Aerospace Engng., Rutgers Univ., New Brunswick, NJ, USA), S.K.Gupta.
Int. J. Energy Res. (GB), vol.7, no.3, p.201-10 (July-Sept. 1983).
A numerical study of the velocity and temperature distributions that arise in a water body due to a thermal discharge such as that in a heat rejection or sensible energy storage system, has been carried out. The time-dependent distributions, as well as the steady-state solutions, have been obtained by the use of the alternating direction implicit method for the coupled vorticity transport and energy equations. The numerical procedure employed is outlined, indicating some of the salient features and problems that arise. The numerical scheme is employed for the study of various flow configurations and the dependence of the flow on the governing parameters, particularly on the mixed convection parameter, is determined. The results obtained are discussed in terms of the physical mechanisms involved. The uncoupled problem for an unheated discharge, is also considered and the coupled nature of the equations is evident in the results obtained for heated discharges. The relevance of the results obtained to the recirculating flow of interest in heat rejection and energy storage is discussed. (15 refs.)

107134 The stability of natural convection in a vertical fluid layer with internal heat generation. M.Takashima (Dept. of Phys., Osaka City Univ., Osaka, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2364-70 (July 1983).
Linear stability theory is applied to the problem of the stability of natural convection which occurs in a vertical fluid layer with uniformly distributed internal heat sources. The two parallel bounding plates are assumed to be maintained at constant and equal temperature. The power series method is adopted to obtain essentially exact values of the critical Reynolds number R_c, the critical wavenumber α_c and the critical wave speed c_c for ten finite values

of the Prandtl number P ranging from 0.01 to 1000. It is shown that the power series method is a powerful tool for linear stability problems when the values of αRM and αRPM are both less than about 8000, where M is the maximum value of $|W-c|$, W being the dimensionless velocity profile of the base flow.

107135 Double-diffusive plumes in unconfined and confined environments. T.J.McDougall (Res. School of Earth Sci., Australian Nat. Univ., Canberra, Australia).
J. Fluid Mech. (GB), vol.133, p.321-43 (Aug. 1983).
The author addresses two aspects of the influence of double diffusion on convection from point buoyancy sources (plumes). First he considers a double-diffusive convention acting in conjunction with buoyancy from an isolated source in an unconfined environment, and he studies the problem of when fluxes of properties occur in the opposite direction to that of the initial buoyancy. A simple dimensional analysis is in good agreement with the experimental data for these 'counterbuoyant' fluxes of properties. Secondly, the author considers a double-diffusive plume discharging into a confined environment. The plume now does not always reach the bottom (or top) of the confined environment, but can spread out into the environment at intermediate depths. Double-diffusive interfaces form, and he describes their development and the evolution of the density profile in the confined environment. A quantitative measure of the importance of double-diffusive convection in relation to the normal filling-box mechanism is obtained in the experiments by using the measured density profile, and this correlates well with a theoretically derived parameter B_ρ. (23 refs.)

107136 Effect of configuration of a confined space on the parameters of convective flows for symmetric temperature fields. S.N.Osipov, M.G.Pshonik (Belorussian Polytech. Inst., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1073-8 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.554-9 (Oct. 1982). [received: Sept. 1983]
The authors present a simplified method for calculating the parameters of convective flows in a confined space of various configurations. (7 refs.)

107137 Regenerative heat exchangers with periodic time variation of coolant temperature. V.M.Liventsov (A.A. Blagonravov Inst. of Machine Sci., Acad. of Sci., Moscow, USSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1158-60 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.653-5 (Oct. 1982). [received: Sept. 1983]
Analytic expressions are derived for the temperatures of a heat-exchanger solid and coolant. The author considers a heat exchanger whose heat-retaining elements have such characteristics that the temperature gradient in elements of the solid can be assumed negligibly small. In addition, they assume that the gas or liquid (from now on for brevity we refer only to a gas) moves through the free space of the heat exchanger of length L in such a way that the temperature of the gas or solid is the same at all points of a cross section of the heat exchanger perpendicular to the direction of gas flow. (2 refs.)

107138 Heat exchange and hydrodynamics during boiling on a horizontal tube bundle in a fluidized bed of solid particles. M.I.Berman, O.A.Chulkin (Odessa Polytech. Inst. of Refrigeration Industry, Odessa, USSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1195-202 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.718-27 (Nov. 1982). [received: Sept. 1983]
The results are given on the experimental study of heat transfer and hydrodynamics with boiling on a horizontal tube bundle located in a dispersed bed of solid particles and of this process hydrodynamics simulation by gas bubbling within the fluid filtration rate variation via the bed (0-3.5)$v_{\mathrm{i.f.}}$. An analysis and correlation of experimental results are presented. (16 refs.)

107139 Experimental investigation of heat transfer in a centrifugal heat pipe with an optimized layer on heat-transfer agent. B.N.Krivosheev, M.P.Kukharskii, V.D.Portnov.
J. Eng. Phys. (USA), vol.43, no.5, p.1242-6 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.775-80 (Nov. 1982). [received: Sept. 1983]
Describes a technique and gives results of experimental investigations of special features of heat transfer in the evaporator and condenser sections of a centrifugal heat pipe with optimized thickness of the layer of heat transfer agent. (8 refs.)

107140 Conjugate problem of free convection of a non-Newtonian fluid in a vertical channel. Vu Zui Kuang, Z.P.Shul'man (A.V. Lykov Inst. of Heat & Mass Transfer, Acad. of Sci., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1247-50 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.780-3 (Nov. 1982). [received: Sept. 1983]
Considers a conjugate problem of free convection of a non-Newtonian fluid with a power law in a plane vertical channel. The authors discuss the general formulation of the problem, give an analysis of particular cases, and show the effect of the parameters of the problem on convection. (6 refs.)

107141 Measurement of pulsations in heat flow on thermally loaded surfaces. N.V.Pilipenko, V.M.Klyuchev (Inst. of Precision Mech. & Optics, Leningrad, USSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1271-4 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.808-11 (Nov. 1982). [received: Sept. 1983]
Pulsations in heat flow on a surface, washed by a fluidized bed, are measured with the help of a sensor. (10 refs.)

107142 Theoretical and experimental investigation of the absorption coefficient of different blackbody models. S.B.Kiselev, O.A.Kraev (All-Union Sci.-Res. Inst. of Physicotech. & Radiotech. Measurements, USSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1283-6 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.822-6 (Nov. 1982). [received: Sept. 1983]
Numerical computations are performed and results are presented of an experimental investigation of the effective absorption coefficient of radiant heat flows of cavities of complex configuration. (8 refs.)

107143 Solution of a two-dimensional conjugate problem of stabilized heat transfer in the laminar flow of a liquid in a channel. Yu.N.Akkuratov, V.N.Mikhailov.
J. Eng. Phys. (USA), vol.44, no.1, p.32-4 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.41-4 (Jan. 1983). [received: Sept. 1983]
A two-dimensional problem of conjugate heat exchange is solved by the method of integral boundary-value equations. Heat exchange in a body with cylindrical channels is studied. (6 refs.)

107144 Nonsteady heat transfer in diffusing systems. T.N.Abramenko, I.Mashtovskii, E.A.Shashkov, A.F.Zolotukhina (Inst. of Appl. Phys., Acad. of Sci., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.44, no.1, p.91-6 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.108-14 (Jan. 1983). [received: Sept. 1983]
By the methods of the thermodynamics of irreversible processes and molecular-kinetic theory, it is shown that the effective thermal conductivities of mixtures measured by steady and nonsteady methods are not equal, which is confirmed by experimental data. (7 refs.)

107145 Period-doubling cascade in the Rayleigh-Benard convection. H.Yahata (Dept. of Phys., Hiroshima Univ., Hiroshima, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1802-5 (June 1983).
Time evolution of convection in a rectangular box heated from below is studied using a 48-mode system which involves nonlinear temperature dependent density. For a certain set of the model parameter values, the motion undergoes a transition to chaos through successive period-doubling bifurcations with the increase of the Rayleigh number. (7 refs.)

107146 Heat and mass exchange of a droplet in a polyatomic gas. H.Lang (Max Planck Inst. fur Stromungsforschung, Gottingen, Germany).
Phys. Fluids (USA), vol.26, no.8, p.2109-14 (Aug. 1983).
Lee's method, combined with a generalized Grad's moment procedure, is used to calculate the heat and mass transport to and from a droplet in a polyatomic gas. A near-equilibrium and quasisteady situation is assumed. The results are represented by the transport coefficients of a symmetric Onsager matrix. The coefficients depend on the collision numbers of the internal degrees of freedom. Simple results are obtained by performing approximations analogous to the Mason and Monchick analysis for the case of the heat conductivity. (15 refs.)

107147 Zigzag instability and axisymmetric rolls in Rayleigh-Benard convection: the effects of curvature. P.Manneville, J.M.Piquemal (Div. de la Phys., CEA, CENS, Gif-sur-Yvette, France).
Phys. Rev. A (USA), vol.28, no.3, p.1774-90 (Sept. 1983).
Using a formalism adapted to slow spatio-temporal evolutions of phase perturbations to a perfect roll pattern, the authors show that 'zigzags' which relax in a diffusive way for the case with 'no-slip' (or 'rigid') boundaries are replaced by Busse's oscillatory mode for the case with 'stress-free' boundaries. The diffusion coefficient $D_\perp$ for zigzags, which is determined analytically using a perturbation expansion, has the form $D_\perp=\xi_0^2/\tau_0[(q-q_c)/q_c+N(\mathcal{P})(\mathcal{R}-\mathcal{R}^c)/R_2(\mathcal{P})\mathcal{R}^c]$ where $\mathcal{R}[=\mathcal{R}^c+R_2(\mathcal{P})\varepsilon^2+\ldots]$ is the Rayleigh number, $\mathcal{P}$ is the Prandtl number, ξ_0 is the coherence length, and τ_0 is the relaxation time; $\xi_0^2/\tau_0=5.685/(1.95+\mathcal{P}^{-1})$, $N(\mathcal{P})=0.166+23.04\mathcal{P}^{-1}+6.196\mathcal{P}^{-2}$, $R_2(\mathcal{P})=10.76-0.073\mathcal{P}^{-1}+0.128\mathcal{P}^{-2}$, and $\mathcal{R}^c-1707.8$ at the critical wave vector $q_c=3.116$ for no-slip boundaries. The curvature is seen to induce a large-scale flow which tends to convect the roll pattern. This flow is forbidden for concentric rolls in cylindrical geometry. This leads to a new wavelength-selection criterion which no longer corresponds to $D_\perp=0$. The corrected criterion is calculated for both no-slip and stress-free boundaries and is seen to behave in a similar way at the limit $\mathcal{P}\to 0$ in the two cases. The findings are in quantitative agreement with earlier numerical results and also with more recent approaches using the amplitude-equation formalism. (29 refs.)

107148 Neutron scattering study of convection in a double-diffusive system. T.Riste, K.Otnes (Inst. for Energy Technol., Kjeller, Norway).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.376-82 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Nonequilibrium systems with two or more order parameters and competing relaxation mechanisms display bifurcations and phase diagrams resembling equilibrium systems with multicritical properties. One example is a convecting nematic crystal in a vertical magnetic field. The authors' neutron scattering data give the time-averaged order parameters as a function of field (H) and temperature gradient (ΔT). They also investigate the time behaviour of the order parameters of different values of H and ΔT, and find steady, oscillatory and aperiodic states. They study the co-existence and transition between these states, and search for critical scattering. Some information is obtained on the evolution of the frequency spectrum and of the phase trajectory as ΔT is changed. (17 refs.)

107149 A theoretical analysis for laminar free convection: heat transfer from a vertical surface with arbitrary temperature distribution to a fluid with arbitrary temperature stratification. T.Fujii, S.Koyama, M.Koganei.
Rep. Res. Inst. Ind. Sci. Kyushu Univ. (Japan), no.74, p.129-34 (1983).
A theoretical analysis by means of an approximate integral method is presented for laminar free convection heat transfer from a vertical surface with vertically arbitrary temperature distribution to a fluid with arbitrary temperature stratification. An analytical solution of the local Nusselt number is presented. (no refs.)

107150 Prediction of the steady surface thermal plume. A.O.Demuren (Univ. of Karlsruhe, Karlsruhe, Germany).
Waerme- & Stoffuebertrag. (Germany), vol.17, no.4, p.193-200 (1983).
Presents a two-dimensional numerical procedure which employs finite-difference techniques to solve the partial-differential equations governing the steady flow and heat transfer of a surface thermal plume in the near field. The profiles of the velocities and temperature are assumed to be nearly uniform in the vertical direction. The rates of turbulent entrainment of ambient fluid are calculated from empirical relations, which take the influence of buoyancy in damping turbulent fluctuations into consideration. Computations of the lateral and longitudinal profiles of the velocities, temperature and layer depth are compared with laboratory measurements in heated discharges at densimetric Froude numbers in the range 1-4 and initial aspect ratios varying from 1 to 3. The agreement between the computations and the measurements is fairly good in most cases. (24 refs.)

107151 Transient thermal entrance heat transfer in laminar pipe flows with step change in pumping pressure. T.F.Lin, K.H.Hawks, W.Leidenfrost (Purdue Univ., West Lafayette, IN, USA).
Waerme- & Stoffuebertrag. (Germany), vol.17, no.4, p.201-9 (1983).
Analysis is made for the transient heat transfer phenomena in the thermal entrance region of laminar pipe flows. The transient results from both the change in flow field, a step change in pressure gradient from zero to a fixed value, and the change in thermal field, a step change in the inlet temperature. An exponential scheme has been employed to solve the energy equation with the presence of axial heat conduction in the fluid. In order to demonstrate the results more clearly, a modified Nusselt number is introduced. The unsteady axial variations of conventional Nusselt number, modified Nusselt number, bulk fluid temperature and pipe wall temperature are presented for water and air over a wide range of outside heat transfer coefficients. It is observed that the outside heat transfer coefficient has a significant influence on the transient heat transfer processes. The results can be comprehensively interpreted by the interactions among the axial convection, axial diffusion, and radial diffusion. (24 refs.)

107152 Convective heat transfer in a parallel plate channel with porous lining. M.N.Channabasappa, K.G.Umapathy, I.V.Nayak (Karnataka Regional Engng. Coll., Karnataka, India).
Waerme- & Stoffuebertrag. (Germany), vol.17, no.4, p.211-16 (1983).
Proposes a theoretical model for the study of flow and heat transfer in a parallel plate channel, one of whose walls is lined with non-erodible porous material, both the walls being kept at constant temperatures. The analysis uses Brinkman model in the porous medium and employs the velocity and temperature slips at the interface (the so called nominal surface). The influence of the thickness as well as the permeability of the porous medium on the flow field and Nusselt numbers at the walls is investigated. (7 refs.)

107153 Boiling heat transfer in a vertical tube with Freon 114. N.-E.Fagerholm, A.R.Ghazanfari, K.Kivioja (Helsinki Univ. of Technol., Espoo, Finland).
Waerme- & Stoffuebertrag. (Germany), vol.17, no.4, p.221-32 (1983).
Test results for boiling heat transfer coefficients for R114 in vertical stainless tubes are reported both for upflow and downflow direction. Results are compared with different formulas given in the literature. A recommendation of the numerical value of C_{sf} in Rohsenow's formula for fully developed nucleation boiling for R114/stainless steel combination is given. (26 refs.)

107154 Energy stability in the Benard problem for a fluid of second grade. B.Straughan (Forschungsinst. fur Math., Swiss Federal Inst. of Technol., Zurich, Switzerland).
Z. Angew. Math. & Phys. (Switzerland), vol.34, no.4, p.502-9 (July 1983).
The critical Rayleigh number for stability of convection in a fluid of second grade is obtained by means of the energy method. If the thermodynamic restrictions derived by Dunn and Fosdick (1974) are adopted the nonlinear energy boundary is shown to be the same as that of linear theory, and the nonexistence of subcritical instabilities is deduced. (19 refs.)

107155 Heat transfer in a MHD flow between eccentric disks rotating at different speeds. P.Raghupathi Rao, A.Ramachandra Rao (Dept. of Appl. Maths., Indian Inst. of Sci., Bangalore, India).
Z. Angew. Math. & Phys. (Switzerland), vol.34, no.4, p.550-5 (July 1983).
Heat transfer in a MHD flow between two infinite eccentric disks rotating with different speeds is considered when the plates are maintained at different temperatures. The results for the corresponding nonmagnetic case presented wrongly by Banerjee and Borkakati (1982) are corrected. It is observed that the eccentric rotation reduces the heat transfer on the disks. (7 refs.)

107156 The fluid physics module—new possibilities and applications. A.Gonfalone, H.Martinides (ESA/ESTEC, Noordwijk, Netherlands).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.95-7
A number of studies have shown that it is possible to enhance the performance of the measuring techniques used on the Fluid Physics Module. After a brief review of the present capabilities, possible improvements of the visualisation system the fluid management system and the new interfaces are discussed. In conclusion, the objectives of a new set of experiments are presented. (4 refs.)

107157 The influence on the Marangoni effect of a surface tension minimum as a function of temperature in microgravity conditions. J.C.Legros, G.Petre, M.C.Limbourg-Fontaine (Univ. Libre de Bruxelles, Brussels, Belgium).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.201-3
Microgravity experiments have been proposed to observe the influence of a surface tension minimum on the Maragoni convection. An experiment to be realized in the Texus 8 flight is described. The results of performed ground tests are given. (3 refs.)

107158 Influence of geometry on oscillatory Marangoni flows. R.Monti, L.G.Napolitano, G.Russo (Inst. of Aerodynamics 'U. Nobile', Univ. of Naples, Naples, Italy).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.219-28
A series of on ground experiments have been performed in the computerized microgravity simulation facility of the Institute U. Nobile to study the influence of geometry and ambient parameters on oscillatory Marangoni flows. In particular, the dependence of the oscillation onset on the aspect ratio and shape factor of the floating zone has been found and evaluated for different Prandlt number Silicon Oils. The performance of the floating zone have been studied and the relationship among the different governing quantities has been tested and validated for the different regimes occurring during the heating and the cooling processes. The heat transfer efficiency decrease, in oscillatory Maragoni motion, has been experimentally demonstrated. (10 refs.)

107159 Influence of surface minimum on surface and buoyancy driven flows in Stokes regime. L.G.Napolitano, C.Golia (Istituto 'U. Nobile', Univ. di Napoli, Napoli, Italy).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.229-33
Presents a theoretical analysis of Marangoni/Buoyant flows in liquids having a surface tension that exhibits a temperature dependence with a minimum. By assuming that the flow regime is of the Stokes type, a solution for the case of a liquid-gas system is given in terms of the stream function expressed as a sum of infinite series of complex-biorthogonal eigenfunctions. (6 refs.)

107160 Buoyancy-thermocapillary convection: the role of interfacial deformation. M.G.Velarde, J.L.Castillo (Fisica Fundamental, UNED, Madrid, Spain).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.235-7
Linear (normal mode) and energy stability analyses have been developed to delineate regions of transition from a motionless state to steady patterned convection, oscillatory convection and finite amplitude convection in a binary liquid layer subjected to thermal constraints in double-diffusion when one of the boundaries is open to the ambient air. Specifically, the authors have concentrated on the role of the deformation of the open interface (liquid-air) and explicit results have been obtained in terms of the crispation (capillary) number. Results for the zero gravity problem (Rayleigh numbers set to zero) have also been obtained. (8 refs.)

107161 Investigation of convective flows in model systems of directional solidification configurations. G.Muller, G.Neumann (Inst. fur Werkstoffwissenschaften, Kristallabor Univ. Erlangen, Nurnberg, Germany).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.285-94
Presents results for the investigation of convective flows in water in a vertical cylindrical test cell (height/diameter=5) heated from below. A sequence of different stable flow configuration is found. The time-dependent convection is characterised by well-defined frequencies. A comparison of these results with water is made with results of the directional solidification of InSb by the vertical Bridgman technique. A clear correlation of material inhomogeneities and unsteady thermal convection is possible by using theoretical results of the critical dimensionless Rayleigh number. (19 refs.)

Measurement of heat transfer in closed hot water systems [errors evaluation] .... See Entry 105320

Heat transfer in the supercritical region at low pressure and mass velocity .... See Entry 106081

Melting and cladding motion in a cylindrical vertical channel with a gaseous counterflow .... See Entry 106116

Boiling of a superheated liquid on the presence of a metallic surface under isothermal conditions .... See Entry 106979

Transient thermal stresses in a rectangular plate due to variation of heat-transfer coefficients on upper and lower surfaces .... See Entry 107005

An experimental study of gas exchange in laminar oscillatory flow .... See Entry 107098

Stationary and oscillatory instabilities for mixture subjected to Soret effect in vertical cylinder with axial temperature gradient .... See Entry 107121

Double diffusive convection in a rotating fluid .... See Entry 107166

Parametric excitation of internal waves and convective instability in the fluid layer heated from above .... See Entry 107173

The spreading of a non-Newtonian liquid over a horizontal plane with intensive heat-transfer and mass-transfer processes on the surface of the layer .... See Entry 107193

Strong spherical two-phase blowoff of liquid metals into vacuum .... See Entry 107224

Experimental study of filmwise condensation considering wave initiation .... See Entry 107227

Fluid physics under reduced gravity—an overview .... See Entry 107229

Thermocapillary migration of bubbles in liquids showing relaxation of surface tension .... See Entry 107230

Bubble motion under reduced gravity .... See Entry 107231

On thermally-driven movement of drops in microgravity conditions .... See Entry 107232

Procedure for calculating a conductive heat exchanger .... See Entry 107243

Investigation of the hydrodynamic regimes of a liquid in a smooth-walled rotating heat pipe. II .... See Entry 107252

Heat transfer to turbulent stream in pipes under supercritical pressures .... See Entry 107253

Measurement of flow rate through a pipe by external heating .... See Entry 107258

A numerical analysis of flow and heat transfer of air in an in-line tube bank .... See Entry 107260

Effect of vapor efflux from a spherical particle on heat transfer from a hot gas .... See Entry 107269

Use of classical Stefan problem for initializing solution in the numerical prediction of freezing .... See Entry 107879

Particle transport induced by directional solidification .... See Entry 107884

Convection-Marangoni effects in solidification-microgravity .... See Entry 107887

Convection effects at solid-liquid interfaces—influence of gravity .... See Entry 107888

The effect of the natural convection on the solidification of metallic alloys .... See Entry 107889

Study of the surface tension minimum of aqueous alcohol solutions and movements at the interface air/solution .... See Entry 108123

Free-surface vibration of a floating zone induced by surface-tension-driven oscillating flow .... See Entry 109140

Measurement of the critical Marangoni number in a floating zone under reduced gravity .... See Entry 109141

Numerical solutions of floating-zone thermocapillary flows .... See Entry 109142

The behaviour of a metallic dispersion under microgravity conditions .... See Entry 109245

Experimental study of stationary flame propagation in a tube under conditions of weightlessness .... See Entry 109744

Method of making heat-engineering calculations for a passive solar heating system (nonsteady conditions) .... See Entry 109910

Reduction of surface mixing in solar ponds by floating rings .... See Entry 109915

A self-similar flow behind an exponential shock with radiative heat flux. II .... See Entry 110886

47.25R Wakes

Flow around turbulence promoters in parallel channels. II. Shedding vortex around cylinder .... See Entry 107165

Motion of fluid particles in perturbed shear flows .... See Entry 107214

47.30 ROTATIONAL FLOW AND VORTICITY

107162 A note on the bathtub vortex and the Earth's rotation. M.Sibulkin (Div. of Engng., Brown Univ., Providence, RI, USA).
Am. Sci. (USA), vol.71, no.4, p.352-3 (July-Aug. 1983).
The author studies whether the same forces govern the direction of rotation of a hurricane and that of water draining out of a bathtub?. (10 refs.)

107163 Steady flow of a polarizable viscous compressible fluid past a charged rotating sphere. A.E.M.A.Mohamed (Dept. of Maths., Ain Shams Univ., Cairo, Egypt).
Arabian J. Sci. & Eng. (GB), vol.8, no.2, p.99-102 (April 1983).
The flow of a polarizable viscous compressible fluid past a uniformly charged sphere rotating with constant angular velocity is studied. The equations of motion have been linearized by using a small parameter β. It was found that if the axis of rotation has the same direction as the flow, the rotation will not affect the drag force, while the couple on the sphere will receive correction of order β.

107164 Response of variations of free stream velocity on inviscid and incompressible flow past a wavy plate. V.K.Sud (Dept. of Biophys., All India Inst. of Medical Sci., New Delhi, India), M.P.Singh.
Int. J. Eng. Sci. (GB), vol.21, no.10, p.1253-65 (1983).
Studies the several types of free stream flow past the wavy plate. The solution is obtained in terms of free stream function by regular perturbation. It may be noted that the introduction of small vorticity does not affect the primary flow due to uniform free stream; however it tends to increase the maximum pressure at the wall. As in the case of uniform free stream, the extrema of the pressure coefficient along the X-direction coincide with those of the wall. The perturbed flow fields due to the presence of the wavy shaped boundary die out transversally at the same rate as in case of uniform stream. (5 refs.)

107165 Flow around turbulence promoters in parallel channels. II. Shedding vortex around cylinder. Y.Shiina (JAERI, Ibaraki, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.5, p.389-99 (May 1983).
For pt.I see ibid., vol.19, p.720 (1982). Effects of walls on vortex shedding in developed channel flow were investigated putting a cylinder at the centre of channels or on a wall for the value of w/d from 2 to 4. Results were compared with the uniform flow result. When a cylinder was put at the centre of the channels, non-dimensional frequency plotted against Reynolds number agreed with the uniform flow result at low Reynolds number. However, it increased rapidly with Reynolds number, then it lay considerably above the uniform flow results at high Reynolds number. When a cylinder was put on a wall, non-dimensional frequency was considerably lower than the uniform flow result in the cases of $w/d=3$ and 4. In the case of $w/d=2$, however, frequency was higher than the uniform flow result at high Reynolds number. In all cases in the present study, the transition Reynolds number increased with decrease in the value of w/d. These results indicate that the increase in shedding frequency was due to the shift in velocity distribution from Poiseuille parabora in the wake region, which obviously increased with Reynolds number and with decrease in channel width. (19 refs.)

107166 Double diffusive convection in a rotating fluid. N.Riahi (Dept. of Theoretical & Appl. Mech., Univ. of Illinois, Urbana, IL, USA).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2620-1 (Aug. 1983).
Double diffusive convection is investigated in a rotating fluid layer with nearly impermeable boundaries. The new results on the instability of the steady motion and the dependence of the various physical quantities (such as the horizontal cells' size and the heat and solute fluxes) on the Rayleigh number R and the rotation parameter τ are discussed. (5 refs.)

107167 The lift on an aerofoil in starting flow. J.M.R.Graham (Dept. of Aeronautics, Imperial Coll., London, England).
J. Fluid Mech. (GB), vol.133, p.413-25 (Aug. 1983).
An analysis is given of the initial development of the lift on an aerofoil in inviscid starting flow. It is shown that because of the spiral shape of the vortex sheet shed initially from the trailing edge the lift and drag are both singular at the start of impulsive motion. This result is in contrast with the prediction of finite forces by methods that assume the vortex sheet to be initially planar. The effect of a steady rate of change of incidence following the sudden onset of transverse (heaving) motion of an aerofoil in a steady stream is also discussed. (9 refs.)

107168 On angles of separation in Stokes flows. M.E.O'Neill (Dept. of Math., Univ. Coll. London, London, England).
J. Fluid Mech. (GB), vol.133, p.427-42 (Aug. 1983).
A two-dimensional Stokes flow close to the line of contact of two touching cylinders or three-dimensional axisymmetric Stokes flow close to the point of contact of two touching bodies is shown in general to separate into infinite sets of eddies with angles of separation from the bodies which tend to 58.61° as the line or point of contact is approached. The flow near the vertex of a conical cusp is shown to be a system of nested toroidal vortices and the separation angles tend to 45.25° as the vertex is appraoched. Stokes flow between parallel planes or within a circular cylinder is shown in general to separate far from the generating disturbances with cellular eddy structure and separation angles which tend to 58.61° and 45.25° respectively. The mathematical equivalence of the various problems is established. (15 refs.)

107169 Method of designing a vortical diffuser. V.T.Bolov (S.P. Korolev Kuibyshev Aviation Inst., Kuibyshev, USSR).
J. Eng. Phys. (USA), vol.44, no.1, p.27-32 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.35-41 (Jan. 1983). [received: Sept. 1983]
A method is proposed for theoretically determining the characteristics of a vortical diffuser. Comparison of the theoretical and experimental results shows that they agree well. (7 refs.)

Statistical mechanics of two-dimensional vortex fluids or guiding center plasmas .... See Entry 105291

Experiments with some low-order finite elements schemes for the Navier-Stokes equations .... See Entry 107093

Dynamics of the phase variable in the Taylor vortex system .... See Entry 107101

Kinematics of velocity and vorticity correlations in turbulent flow .... See Entry 107113

On the structure of wall-bounded turbulent flows .... See Entry 107117

Heat transfer in a MHD flow between eccentric disks rotating at different speeds .... See Entry 107155

Unsteady compressible Stokes layers on a disk .... See Entry 107172

Fluid-property effects on flow-generated waves on a compliant surface .... See Entry 107176

Speckle velocimetry study of vortex pairing in a low-Re unexcited jet .... See Entry 107210

Bubble motion under reduced gravity .... See Entry 107231

Investigation of the hydrodynamic regimes of a liquid in a smooth-walled rotating heat pipe. II .... See Entry 107252

Mixing of chemically reactive fluids by swirling in a tubular reactor .... See Entry 107268

Laser-2-focus velocimeter and wall scattering .... See Entry 107287

A vortex ring shedding flowmeter .... See Entry 107291

Turbulence in superfluid ^{4}He .... See Entry 108097

Boundary conditions for a rapidly rotating hydromagnetic system in a cylindrical container .... See Entry 110288

Effects of rotation and shear on doubly diffusive instability .. See Entry 110446

On equilibrium figures for ideal fluids in the form of confocal spheroids rotating with common and different angular velocities .... See Entry 110903

Turbulence in a self-gravitating gaseous disk. II. Turbulence spectra .... See Entry 110904

47.35 WAVES

107170 On the effect of viscosity on some nonwave-motions of liquids with the free surface. V.D.Djordjevic (Univ. of Belgrade, Belgrade, Yugoslavia).
Acta Mech. (Austria), vol.48, no.3-4, p.219-26 (1983).
The author examines the case where phase velocity is purely imaginary, i.e. a wave-motion is not possible, and derives the equations describing the free surface when the initial perturbation is small compared with the undisturbed depth of liquid (linear case), as well as when these two quantities are of the same order of magnitude (purely nonlinear case). (5 refs.)

107171 Fast deflagration waves. D.S.Stewart, G.S.S.Ludford (Dept. of Theoretical & Appl. Mech., Cornell Univ., Ithaca, NY, USA).
J. Mec. Theor. & Appl. (France), vol.2, no.3, p.463-87 (1983).
The analysis of steady state deflagration waves invariably starts from the combustion approximation, i.e. equations for the leading non-constant terms in Mach-number expansions. Even then explicit formulas can only be obtained in the limit of large activation energy. There are circumstances, however, notably the transition from deflagration to detonation, when the Mach number $\mathcal{M}$ is not vanishingly small; the authors give a description, again using activation-energy asymptotics of such fast deflagrations. The principal result is not limited to Arrhenius kinetics, being a formula for $\mathcal{M}$ as a function of T_*, an ignition temperature near which the reaction is supposed to go very rapidly to completion. Such behavior can be exhibited by Arrhenius kinetics for large activation energy, the model for which the structure of the thin reaction zone and its associated perturbations outside are calculated. The calculations reveal a leakage of reactant through the zone, with its ultimate consumption over exponentially large distances downstream (exponential tail), and a 'Mach layer' behind the reaction zone for $\mathcal{M}$ small, in which a velocity adjustment takes place; both of these are missed by the combustion approximation. (11 refs.)

107172 Unsteady compressible Stokes layers on a disk. K.N.Venkatasiva Murthy (Dept. of Maths., S.K. Univ., Anantapur, India).
Def. Sci. J. (India), vol.33, no.2, p.127-35 (April 1983). [received: Aug. 1983]
The unsteady motion of a viscous compressible rotating gas bounded by a single infinite disk is studied when small amplitude torsional oscillations are superimposed on the disk. The generation and propagation of waves due to the interactions of compressibility, viscosity and rotation during the transient evolution is discussed. In comparison with the non-oscillatory case, the forcing frequency of the disk is capable of inducing several additional interesting features. (6 refs.)

107173 Parametric excitation of internal waves and convective instability in the fluid layer heated from above. S.G.Chefranov, A.G.Chefranov.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.7, p.741-9 (July 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
The criterion of a parametric instability stimulated by a weak time modulation (with amplitude η and period τ) of the gravity acceleration at $1\gg\eta>\tau/T_g$ (where T_g is a characteristic time scale of the dissipation processes for the space scales determined by the excited internal wave length) is obtained for the fluid layer heated from above. The method permits one to generate internal waves with mutually parallel fronts, since the wave amplitude amplification mechanism is not connected with the inclusion of additional anisotropy into the system. The possibility of parametric generation of internal waves with a doubled tidal period in ocean and in upper atmosphere is considered. (20 refs.)

107174 Propagation of obliquely incident water waves over a trench. J.T.Kirby, R.A.Dalrymple (Dept. of Civil Engng., Univ. of Delaware, Newark, DE, USA).
J. Fluid Mech. (GB), vol.133, p.47-63 (Aug. 1983).
The diffraction of obliquely incident surface waves by an asymmetric trench is investigated using linearized potential theory. A numerical solution is constructed by matching particular solutions for each subregion of constant depth along vertical boundaries; the resulting matrix equation is solved numerically. Several cases where the trench-parallel wavenumber component in the incident-wave region exceeds the wavenumber for freely propagating waves in the trench are investigated and are found to result in large reductions in wave transmission; however, reflection is not total owing to the finiteness of the obstacle. Results for one case are compared with data obtained from a small-scale wave-tank experiment. An approximate solution based on plane-wave modes is derived and compared with the numerical solution and, in the long-wave limit, with a previous analytic solution. (16 refs.)

107175 Long-time behaviour of a random inhomogeneous field of weakly nonlinear surface gravity waves. P.A.E.M.Janssen (Dept. of Mech. Engng., Univ. of Rochester, Rochester, NY, USA).
J. Fluid Mech. (GB), vol.133, p.113-32 (Aug. 1983).
The author investigates nonlinear interactions of narrowband, Gaussian-random, inhomogeneous wavetrains. Alber (1978) studied the stability of a homogeneous wave spectrum as a function of the width σ of the spectrum. For vanishing bandwidth the deterministic results of Benjamin & Feir (1967) on the instability of a uniform wavetrain were rediscovered whereas a homogeneous wave spectrum was found to be stable if the bandwidth is sufficiently large. Clearly a threshold for instability is present, and the author studies the long-time behaviour of a slightly unstable modulation by means of a multiple-timescale technique. Two interesting cases are found. For small but finite bandwidth σ the amplitude of the unstable modulation shows initially an overshoot, followed by an oscillation around the time-asymptotic value of the amplitude. This oscillation damps owing to phase mixing except for vanishing bandwidth because then the well-known Fermi-Pasta-Ulam recurrence is found. For large bandwidth, however, no overshoot is found since the damping is overwhelming. In both cases the instability is quenched because of a broadening of the spectrum. (30 refs.)

107176 Fluid-property effects on flow-generated waves on a compliant surface. R.J.Hansen (Fluid Dynamics Branch, Naval Res. Lab., Washington, DC, USA), D.L.Hunston.
J. Fluid Mech. (GB), vol.133, p.161-77 (Aug. 1983).
An experimental study of the influence of liquid viscosity and viscoelasticity on flow-generated waves on a compliant surface has been conducted in a rotating-disk geometry. Over the entire range of liquid properties studied,

each test gave a well-defined critical onset flow velocity above which waves were present and below which no waves were observed. This onset velocity increased with increasing fluid viscosity, and for sufficiently high viscosities the onset occurred when the flow on the disk was laminar rather than turbulent. The effects of liquid viscoelasticity were examined in the turbulent flow using dilute solutions of high-molecular-weight polymers. This type of viscoelasticity had little influence on the onset flow velocity in these circumstances, but did make the wave structure on the surface more regular in appearance than when the liquid was Newtonian. In all cases the wave structure produced a dramatic increase in drag similar to that expected for a rough surface. For the viscoelastic fluid, however, the increase in drag was much less than for a viscous fluid of the same viscosity. (11 refs.)

107177 Initial-value problems for Rossby waves in a shear flow with critical level. K.K.Tung (Dept. of Math., MIT, Cambridge, MA, USA).
J. Fluid Mech. (GB), vol.133, p.443-69 (Aug. 1983).
The time-dependent evolution of sheared Rossby waves starting from an initial disturbance is studied for the simple case in which the shear is uniform. The uniform-shear assumption allows explicit solutions to be obtained which are useful in addressing the issue of the long-time asymptotic approach to normal modes and in assessing the relative importance of viscosity, nonlinearity and time-dependence in the evolution of Rossby waves in the presence of critical layers. (34 refs.)

107178 Anisotropic surface waves on a viscous liquid under uniform magnetic and current fields. L.Debnath, M.Chakraborty (Dept. of Maths. & Phys., East Carolina Univ., Greenville, NC, USA).
J. Math. & Phys. Sci. (India), vol.17, no.3, p.265-78 (June 1983).
The initial value problem is solved for the generation and propagation of two-dimensional anisotropic dispersive surface waves due to a moving oscillatory surface pressure acting at the free surface of a conducting viscous liquid in the presence of horizontal magnetic and current fields. The problem is treated with the aid of generalized functions. It is shown that the wave motions are both dispersive and anisotropic due to the external fields. It is shown that there exists a critical value of the moving speed U of the surface pressure above and below which the ultimate steady-state wave systems have a different character. When U assumes its critical value, the solution for this viscous fluid model is non-singular while the corresponding solution in the inviscid liquid is singular in the sense that the wave-amplitude becomes infinite. The inclusion of a small viscosity introduces an exponential damping factor into the amplitude of each wave of the ultimate wave systems, and hence the waves die out at large distances. The most significant effect of the imposed magnetic and current fields is that the propagation of surface waves becomes strongly anisotropic. Several distinctive features of the wave systems in the viscous liquid are explored. (5 refs.)

Structure of detonation pulsating front in porous and suspension explosives saturated by liquid ....See Entry 107179

Experimental study of filmwise condensation considering wave initiation ....See Entry 107227

Stability of the flow during sedimentation in inclined channels ....See Entry 107255

Wave formation and growth during sedimentation in narrow tilted channels ....See Entry 107256

Parametric excitation of electrohydrodynamic surface waves ....See Entry 107261

Convection effects at solid-liquid interfaces—influence of gravity ....See Entry 107888

Free-surface vibration of a floating zone induced by surface-tension-driven oscillating flow ....See Entry 109140

Wave evolution over a gradual slope with turbulent friction .. See Entry 110445

On the instability of internal Alfven-gravity waves in stratified shear flows ....See Entry 110612

Turbulence in a self-gravitating gaseous disk. II. Turbulence spectra ....See Entry 110904

47.40 COMPRESSIBLE FLOWS; SHOCK AND DETONATION PHENOMENA

(see also 28.70 Nuclear explosions, 52.35T Plasma shock waves)

107179 Structure of detonation pulsating front in porous and suspension explosives saturated by liquid. V.A.Danilenko, V.M.Kudinov (Acad. of Sci., Ukrainian SSR).
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.8, p.48-51 (1983). In Ukrainian.
The front structure of pulsating detonation waves in porous and suspension explosives saturated with liquid has been experimentally and numerically studied. It is shown that two types of structures are realized: one with a transverse wave and the other without a transverse wave with a longitudinal pulsating front. (12 refs.)

107180 A flux splitting method for the numerical simulation of one-dimensional compressible flow. S.R.Mulpuru (Whiteshell Nuclear Res. Establ., AECL, Pinawa, Manitoba, Canada).
Math. & Comput. Simulation (Netherlands), vol.25, no.4, p.309-20 (Aug. 1983).
Using the technique of flux vector splitting, it is shown that one-dimensional, inviscid, compressible-flow equations possess a split conservation form. Some attractive features of this form for the design of finite-difference solution schemes are discussed. Based on the split form, two solution schemes are designed. One is a first-order accurate 'upwind' scheme and the other is similar to the Lax-Wendroff scheme. A hybrid scheme, based on a nonlinear weighting of these two schemes, is demonstrated to yield results superior to either of the two in the solution of an ideal shock-tube problem. (21 refs.)

Steady flow of a polarizable viscous compressible fluid past a charged rotating sphere ....See Entry 107163

Fast deflagration waves ....See Entry 107171

Unsteady compressible Stokes layers on a disk ....See Entry 107172

Erosion combustion of a solid fuel for various gas flow temperatures ....See Entry 109741

Dynamics of gas combustion in closed vessels with various laws of flame-surface variation ....See Entry 109742

Flame zone in gas combustion in an inert porous medium .....See Entry 109743

47.40D General subsonic flows

Application of unsteady laminar triple-deck theory to viscous-inviscid interactions from an oscillating flap in supersonic and subsonic flow ....See Entry 107182

47.40H Transonic flows

107181 Numerical design of a shockless transonic quasi-aircraft. M.Nakamura (Nat. Aerospace Lab., Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2706-10 (Aug. 1983).
In order to design a shock free aircraft in a transonic flow, a numerical simulation is carried out on a three-dimensional flow past a quasi-aircraft composed of a body, a sweepback wing and a tail unit in a physical space when the aircraft has no lift. The design condition of the shockless transonic flow is that the Mach number of the uniform flow is 0.87 and the aircraft angle of attack is zero. The applying method is the extended artificial flow method for a three-dimensional potential flow and the flow model has effects of walls of a wind tunnel.

Luminescence of I_2/Ar mixture flowing out of a quenching setup at atmospheric pressure ....See Entry 109749

47.40K Supersonic and hypersonic flows

107182 Application of unsteady laminar triple-deck theory to viscous-inviscid interactions from an oscillating flap in supersonic and subsonic flow. M.-K.Huang, G.R.Inger (Dept. of Aerospace Engng. Sci., Univ. of Colorado, Boulder, CO, USA).
J. Mec. Theor. & Appl. (France), vol.2, no.3, p.325-49 (1983).
Unsteady triple-deck theory is applied to an analysis of the local viscous-inviscid interaction of an idealized oscillating flap with a laminar boundary layer in either supersonic or subsonic external flow. For small flap amplitudes and small-to-moderate nondimensional frequencies, linearized analytical solutions by means of Fourier transformation are given for the pressure and shear distributions ahead of and behind the flap hinge. In the supersonic case, the predicted unsteady viscous effects reduce the pressure amplitude and spread it out upstream while causing it to lag the quasi-steady inviscid prediction (flap motion); this also results in an unsteady delay of incipient separation at the hinge to a higher flap amplitude. In contrast, the lowered unsteady viscous pressure distribution in purely subsonic flow slightly leads the flap motion, resulting in incipient separation at a smaller flap amplitude than the quasi-steady value. These trends are shown to be in qualitative agreement with available experimental data. (17 refs.)

107183 Simultaneous measurement of the stagnation temperature and specific mass flow rate in a hypersonic gas flow. G.E.Pervushin.
J. Eng. Phys. (USA), vol.43, no.5, p.1229-34 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.759-66 (Nov. 1982). [received: Sept. 1983]
The procedure and results of simultaneous measurement of the stagnation temperature and specific mass flow of gas in a hypersonic flow by means of heated-chamber impact tubes is discussed. The construction of the tubes is described. (9 refs.)

107184 Unified unsteady supersonic/hypersonic theory of flow past double wedge airfoils. W.H.Hui (Dept. of Appl. Maths., Univ. of Waterloo, Waterloo, Ontario, Canada).
Z. Angew. Math. & Phys. (Switzerland), vol.34, no.4, p.458-88 (July 1983).
A unified supersonic/hypersonic theory is given of flow past a pitching oscillating double wedge airfoil at arbitrary mean angle of attack. The amplitude and the (reduced) frequency parameter of the oscillation are assumed small and a perturbation method is employed. Closed form formulae are obtained for the stiffness and damping-in-pitch derivatives. They are exact with respect to the free stream Mach number, angle of attack and body thickness etc., provided only that the bow shock is attached to the leading edge. The theory predicts negative damping (instability) if the angle of attack, or the airfoil thickness is sufficiently large, or if the free stream Mach number is sufficiently low. It is shown to be in good agreement with experiments of Scruton et al. (1962). Comparisons with Van Dyke second order potential theory (1954) and with Lighthill piston theory (1953) are also given. Finally the theory may easily be extended to arbitrary smooth airfoils. (14 refs.)

Electronic absorption spectrum of Hg-Ar complex in a supersonic jet ....See Entry 106495

Mode-selective cooling of vibrational energy during supersonic expansion of pyrimidine: evidence for noncommunicating sets of vibrational manifold ....See Entry 106546

Hydraulic analogy for isentropic flow through a nozzle .... See Entry 107211

Two-dimensional polydisperse flows with interphase mass exchange ....See Entry 107213

47.40N Shock-wave interactions

107185 Three-dimensional effects on the focusing of weak shock waves. M.S.Cramer (Dept. of Engng. Sci. & Mech., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
J. Sound & Vib. (GB), vol.90, no.1, p.25-8 (8 Sept. 1983).
The focusing of weak three-dimensional shock waves at an arete is examined. By aligning the coordinate system with the principal directions on the initial shock surface it is shown that the focusing of an arbitrary three-dimensional shock may be regarded as locally two-dimensional. In addition, the scaling relating the two problems is given explicitly. (6 refs.)

Characterization of the pressure wave originating in the explosion of an extended heavy gas cloud: Critical analysis of the treatment of its propagation in air and interaction with obstacles ....See Entry 106146

Strong spherical two-phase blowoff of liquid metals into vacuum ....See Entry 107224

A lithium sulfate pulse-pressure transducer in a gasdynamic experiment ....See Entry 107276

Experimental research on optical properties of high temperature air in shock tube ....See Entry 107328

An approximate analytical solution for self-similar flow behind a radiation driven shockwave ....See Entry 110885

A self-similar flow behind an exponential shock with radiative heat flux. II ....See Entry 110886

47.45 RAREFIED GAS DYNAMICS

(see also 07.30 Vacuum production and techniques)

107186 Controlling deposition of a substance onto the inner surface of a cylindrical channel. V.V.Levdanskii (A.V. Lykov Inst. of Heat & Mass Transfer, Acad. of Sci., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1090-3 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.573-7 (Oct. 1982). [received: Sept. 1983]
The problem of material deposition on the inner surface of a channel with free-molecular gas is considered. (5 refs.)

47.50 NON-NEWTONIAN DYNAMICS

107187 Small-disturbance stability of a non-isothermal tube flow of power law fluids. I. Derivation of the Orr-Sommerfeld equation extended. Z.Nowak, P.Cryglaszewski, J.Stacharska-Targosz (Tech. Univ., Cracow, Poland).
Acta Mech. (Austria), vol.48, no.3-4, p.157-63 (1983).
An attempt is made to study the flow stability just at the end of thermal entrance region where the temperature and velocity profiles are already fully developed and do not change in flow direction. Only the most simple thermal wall condition of constant temperature is assumed. A basic equation is derived that makes it possible to predict those critical Reynolds numbers over which the laminar tube flow becomes unstable. The equation derived is an extension of the well known Orr-Sommerfeld equation on purely viscous power law fluids with temperature dependent fluid consistency. Also the effects of viscous dissipation are included. (14 refs.)

107188 Small-disturbance stability of a non-isothermal tube flow of power law fluids. II. Numerical solution of the problem. Z.Nowak, P.Cryglaszewski, J.Stacharska-Targosz (Tech. Univ., Cracow, Poland).
Acta Mech. (Austria), vol.48, no.3-4, p.165-72 (1983).
For pt.I see ibid., vol.48, p.157-63 (1983). Selected numerical solutions are obtained to the eigenvalue problem formulated in pt.I, followed by a discussion of the results computed. The effects of both viscous dissipation and dependence of fluid consistency on temperature are also included. The method of searching for eigenvalues generated by respective eigensolutions consists—in the case of the Orr-Sommerfeld equation extended—in replacing the boundary-value problem by an equivalent initial-value problem. The last one has been attacked by means of the Adams-Moulton method. In order to make both problems equivalent, some additional boundary conditions have been postulated. (7 refs.)

107189 On Stokes' problem for a non-Newtonian fluid. K.R.Rajagopal (Univ. of Pittsburgh, Pittsburgh, PA, USA), T.Y.Na.Dearborn.
Acta Mech. (Austria), vol.48, no.3-4, p.233-9 (1983).
The fluids of the differential type are amongst the many models which have been employed to describe the non-Newtonian behavior exhibited by certain fluids. The authors extend the work of Stokes on the flow due to an oscillating plate for a special subclass of the fluids of the differential type, namely the incompressible fluids of grade three. (4 refs.)

107190 Flow of polymer solutions in porous media: inadequacy of the capillary model. J.L.Duda, S.-A.Hong, E.E.Klaus (Dept. of Chem. Engng., Pennsylvania State Univ., University Park, PA, USA).
Ind. & Eng. Chem., Fundam. (USA), vol.22, no.3, p.299-305 (Aug. 1983).
Experimental measurements show that conventional capillary models are inadequate for the description of the flow of nonlinear purely viscous solutions in porous media. A theoretical analysis indicates that any model for the flow of purely viscous polymer solutions in porous media must meet two criteria. First, the model must include expansion and contraction regions where excess pressure drops occur. Secondly, the rheological model for the fluid must include the characteristic transition from Newtonian behavior at low shear rates to shear-thinning behavior at high shear rates. (17 refs.)

107191 A non linear integral constitutive equation for viscoelastic fluids. J.M.Piau (Inst. de Mecanique de Grenoble, Saint Martin D'Heres, France).
Int. J. Eng. Sci. (GB), vol.21, no.10, p.1185-91 (1983).
An integral constitutive equation is written using a particular reference frame, built with unit vectors along the principal axes of the rate-of-deformation tensor, and using the associated intrinsic rate-of-rotation. This equation is easier to handle in calculations than corotational or codeformational models. The material functions for a rheological model including the first six terms of the constitutive equation have been studied in steady and unsteady shear flows, as well as in elongational flows. Material functions are readily written from six memory functions and no inconsistency comes out. (11 refs.)

107192 An analogy between rectilinear flow of plastic solids and Saint-Venant torsion. D.Durban, M.Sitzer (Dept. of Aeronautical Engng., Technion-Israel Inst. of Technol., Haifa, Israel).
Int. J. Eng. Sci. (GB), vol.21, no.10, p.1231-45 (1983).
Presents a new analogy between steady rectilinear flow of plastic materials and Saint-Venant torsion of elastic bars. Material behaviour is modelled as rigid/linear-hardening in conjunction with the von Mises flow rule. Focusing attention on steady flow through pipes with simply connected cross sections and perfectly rough walls the authors arrive at a Dirichlet-type problem. The mathematical formulation of this problem is analogous to that of Saint-Venant torsion of elastic bars. This analogy provides a number of exact solutions for steady rectilinear flow of plastic materials, through pipes with various cross sections. A few simple examples are discussed with emphasis on the growth of plastic boundary layer induced by wall friction. The influence of stress singularities near corners, at the boundary, is also investigated. (10 refs.)

107193 The spreading of a non-Newtonian liquid over a horizontal plane with intensive heat-transfer and mass-transfer processes on the surface of the layer. B.M.Khusid (Belorussian Polytech. Inst., Belorussian SSR).
J. Eng. Phys. (USA), vol.44, no.1, p.41-9 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.51-60 (Jan. 1983). [received: Sept. 1983]
Investigates the flow of a layer of highly viscous non-Newtonian liquid over a horizontal plane, accompanied by intensive heat-transfer and mass-transfer processes. (14 refs.)

107194 Some finite element studies of extrusion. B.P.Huynh (Dept. of Mech. Engng., Univ. of Sydney, Sydney, NSW, Australia).
J. Non-Newtonian Fluid Mech. (Netherlands), vol.13, no.1, p.1-20 (July 1983).
Some finite element results of the non-isothermal extrusion process are presented. For Newtonian fluids, increasing the Nahme-Griffith number Na is found to increase the swelling ratio ε. The temperature distribution near the exit plane is a critical factor determining whether the extrudate would swell or contract relative to the isothermal, Newtonian case. In this way a recent theory by Tanner has been partly verified. For non-Newtonian fluids of the power-law type, where the viscosity is an exponential function of the temperature, increasing the exponential coefficient α (or decreasing the Peclet number Pe) causes an increase in ε when the power-law index n and the (modified) Brinkman number Br are kept fixed. However, the effects are small for shear-thinning fluids ($n<1$), but become stronger as n increases. On the other hand, at fixed Br and Pe (thus fixing α), increasing n causes rapid increases in ε. (17 refs.)

107195 The dependence of viscoelastic flow properties on the structure for styrene-butadiene copolymers. S.Ramachandran, E.B.Christiansen (Dept. of Chem. Engng., Univ. of Utah, Salt Lake City, UT, USA).
J. Non-Newtonian Fluid Mech. (Netherlands), vol.13, no.1, p.21-32 (July 1983).
The flow properties for 300 kg/m^3 solutions of four-arm, star-branched random and block styrene-butadiene-styrene copolymers in n-butylbenzene are presented. The viscosity, η, first and second normal stress differences, N_1 and N_2, and the steady shear compliance J, were determined as a function of the shear rate from cone-plate shearing data. The normal stress differences were determined from total normal force and plate pressure distribution data. Four sensitive, miniature, variable-capacitance pressure transducers mounted in the 7.4-cm plate with their approximately 2.4 mm in diameter pressure-sensing diaphragms flush with the plate surface provided data for the pressure distribution on the plate. In general, the data extend from the zero shear-rate viscosity region somewhat into the shear thinning region. (21 refs.)

107196 Rectilinear oscillatory viscoelastic flow in rectangular ducts. V.O'Brien, L.W.Ehrlich (Appl. Phys. Lab., Johns Hopkins Univ., Laurel, MD, USA).
J. Non-Newtonian Fluid Mech. (Netherlands), vol.13, no.1, p.33-45 (July 1983).
Rectilinear oscillatory pressure-driven motion of Oldroyd fluids with complex dynamic viscosity within straight rectangular ducts is described. The linear viscoelastic flow solutions are given as functions of a Stokes number, the ratio of cross-section side lengths and two Oldroyd time constants. Exact analysis and numerical approximate solutions via finite difference methods are shown, as well as suggestions for applying the theory to measure viscoelastic material properties. (13 refs.)

107197 On the motion of flexible threads in a Stokes shear field. J.D.Goddard, Y.-H.Huang (Dept. of Chem. Engng., Univ. of Southern California, Los Angeles, CA, USA).
J. Non-Newtonian Fluid Mech. (Netherlands), vol.13, no.1, p.47-62 (July 1983).
The authors consider the motion of a flexible threadlike filament suspended in an unbounded Stokes shear flow. As the extension of a well-established slender-body theory, they treat the case of a highly anisotropic drag relation, as reflected by a small ratio ϵ of transverse to longitudinal filament mobility. This provides one potentially useful model of hindered filament motion in highly concentrated filamentary suspensions. They investigate the permanence and stability of threads having uniform axial mobility, showing that only piecewise straight threads have permanent shape. Also they investigate the stability of fully-extended threads by means of both finite and infinitesimal stability analyses, and they provide equations for the growth rate of arbitrary initial disturbances. These are applied to simple shear and simple-extensional flows. Finally, they discuss the failure of the model for small but non-zero ϵ, near points of extreme curvature or 'entanglement', and the possible relevance to the rheology of fibrous composites and suspensions. (10 refs.)

107198 Experimental study of viscoelastic effects in a cylinder-plane lubricated contact. P.Doremus, J.-M.Piau (Inst. de Mecanique de Grenoble, Saint Martin d'Heres, France).
J. Non-Newtonian Fluid Mech. (Netherlands), vol.13, no.1, p.79-91 (July 1983).
The experimental study is related to the flow between a stationary small diameter needle and a moving drum of much larger diameter, seen as a moving plane. The authors' visualisation experimental setup adds new results regarding the flow behaviour of a polymer solution. This flow is compared to that of a Newtonian fluid used under the same kinematic conditions. Important differences between Newtonian and polymeric flows concern mainly streamlines, stagnation point positions, and reverse flow. A second experimental setup enabled them to obtain normal stress profiles along the needle wall and the flow rate through the gap. Results related to Newtonian flows are compared to the well-known analytical solutions for a bidimensional laminar flow. (5 refs.)

107199 Load enhancement effects by polymer-thickened oils in strip squeeze film flow. D.R.Oliver, M.Shahidullah (Dept. of Chem. Engng., Univ. of Birmingham, Birmingham, England).
J. Non-Newtonian Fluid Mech. (Netherlands), vol.13, no.1, p.93-102 (July 1983).
A modification to existing equipment is described which permits continuous squeeze-film flow to be obtained between parallel-sided strips of material, rather than between disc-shaped surfaces. Squeeze film flow is simulated by having liquid move through one of the surfaces via an array of equispaced holes. The squeeze-film behaviour of a Newtonian base oil is first tested at temperatures of 24°C and 55°C. Loads are in reasonable agreement with theoretical predictions and end effects (corrected by means of a guard ring) and fluid maldistribution effects are of small proportions. At the very highest liquid flowrates, the rapid liquid flow through the holes may influence the measured load. The polymer-thickened oils, representing 10 W/30 and 10 W/50 motor oils, are tested at temperatures of 24°C and 55°C. Both oils give marked load enhancement, compared with Newtonian oil under similar flow conditions, at the higher flowrates used. The 10 W/50 oil gives load enhancement of 76 per cent at 55°C, increasing rapidly with the simulated approach velocity. Fluid inertia effects in the squeeze film flow also increase the load significantly. (9 refs.)

107200 Transition of linear flexible-chain polymers from the fluid to the high-elastic state, spurt effect, and superspurting modes of their motion. G.V.Vonogradov, V.P.Protasov, V.E.Dreval (Inst. of Petrochem. Synthesis, Acad. of Sci., Moscow, USSR).
Polym. Bull. (Germany), vol.10, no.5-6, p.274-81 (Aug. 1983).
It is typical of high-molecular linear flexible-chain polymers with a narrow molecular-weight distribution to flow in a broad range of shear stresses similarly to Newtonian liquids. There exists a critical stress at which a spurt effect in the capillary or a jumpwise increase in volume output occurs. It corresponds to the transition of the polymers from the fluid into the rubbery (high-elastic) state. Under supercritical conditions the polymers break at the entrance to the capillary with the result that flowing through the latter is a stream formed by the polymers torn into pieces. For the first time, the regularities of supercritical motion of flexible chain linear polymers have been established. (5 refs.)

Heat transfer for elastico-viscous flow between two rotating porous discs ....See Entry 107126

Conjugate problem of free convection of a non-Newtonian fluid in a vertical channel ....See Entry 107140

Fluid-property effects on flow-generated waves on a compliant surface ....See Entry 107176

The residence time distribution for laminar flow in an annulus with negligible diffusion ....See Entry 107245

47.55 NONHOMOGENEOUS FLOWS

107201 Liquid dispersion in static in-line mixers. A.M.Al Taweel, L.D.Walker (Dept. of Chem. Engng., Tech. Univ. of Nova Scotia, Halifax, Canada).
Can. J. Chem. Eng. (Canada), vol.61, no.4, p.527-33 (Aug. 1983).
Liquid/liquid dispersion in static mixers has been investigated using Lightnin 'In-liner' mixing elements. The average drop size was found to decrease with increasing residence time, gradually approaching an equilibrium size whose magnitude agrees reasonably well with Kolmogoroff's theory for drop rupture in turbulent flows. The efficiency at which mechanical energy is utilized in the generation of new interfacial area was evaluated as a function of design and operating conditions and was found to be highest when the final drop size is much larger than the achievable equilibrium value. (19 refs.)

107202 A time-dependent approach for calculating steady inverse boundary-layer flows with separation. T.Cebeci (Mech. Engng. Dept., California State Univ., Long Beach, CA, USA).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1796, p.171-8 (8 Sept. 1983).
The author describes an unsteady universe boundary-layer method that can be used to compute steady flows with separation. The method uses Keller's box method with Cebeci's Mechul function formulation. Depending on the complexity of the flow, two versions of the box method are used. In regions of positive streamwise velocity component u, the regular box is used; in regions where u becomes negative ($t>0$), the zigzag box is used. When $t=0$, and u becomes negative in some region across the layer, the regular box with the FLARE approximation is used. Calculations performed with this approach indicate that the use of a time dependent inverse boundary-layer method in which time is used as an iteration parameter provides a good approach in improving the accuracy of the solutions obtained from the FLARE approximation. (11 refs.)

107203 On the crenation of a compound liquid droplet. K.A.Landman (Dept. of Math., Southern Methodist Univ., Dallas, TX, USA).
Stud. Appl. Math. (USA), vol.69, no.1, p.51-73 (Aug. 1983).
The dynamic response of a small, very viscous liquid droplet composed of a core fluid surrounded by a thin fluid shell is examined as additional fluid is deposited into this incompressible shell. At early times, the shell incorporates the extra mass by ruffling its external surface, and a number of crenations form. These protuberances decrease in size and number over a longer time period, and eventually the droplet again becomes spherical, with an increased radius. This sequence of events and its dependence on the rheological properties of the fluids are studied. These effects compare well qualitatively with those obtained using a surface fluid rather than a finite thickness shell of fluid. The possible implications of this fluid model for the surface ruffling effects observed in cell biology are discussed. (20 refs.)

47.55B Cavitation

107204 The influence of surface tension on cavitating flow past a curved obstacle. J.-M.Vanden-Broeck (Dept. of Math., Univ. of Wisconsin-Madison, Madison, WI, USA).
J. Fluid Mech. (GB), vol.133, p.255-64 (Aug. 1983).
The problem of cavitating flow past a two-dimensional curved obstacle is considered. Surface tension is included in the dynamic boundary condition. A perturbation solution for small values of the surface tension is presented. It is found that the position of the separation points is uniquely determined by specifying the value of the Weber number and the contact angle at the separation points. In addition, for a given value of the Weber number there exists a particular position of the separation points for which the slope is continuous. This solution tends to the classical solution satisfying the Brillouin-Villat condition as the surface tension tends to zero. Graphs of the results for the cavitating flow past a circular cylinder are presented. (12 refs.)

107205 Experimental investigation of mass transfer from the surface of a sphere under conditions of large Reynolds numbers and cavitation on the surface. G.A.Aksel'rud, S.M.Orel (Lenin Komsomol Lvov Polytech. Inst., Lvov, Ukrainian SSR).
J. Eng. Phys. (USA), vol.44, no.1, p.67-9 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.81-3 (Jan. 1983). [received: Sept. 1983]
Studies mass transfer from the surface of a sphere when a liquid flows around it under conditions of Reynolds numbers 10^3-5.10^5, and also when a cavitation cavern forms behind the sphere. (5 refs.)

47.55C Jets

107206 An experimental investigation of laminar axisymmetric submerged jets. G.W.Rankin, K.Sridhar, M.Arulraja, K.R.Kumar (Dept. of Mech. Engng., Univ. of Windsor, Windsor, Ontario, Canada).
J. Fluid Mech. (GB), vol.133, p.217-31 (Aug. 1983).
Detailed measurements of the velocity profiles in a laminar axisymmetric submerged jet of water were taken using a laser-Doppler anemometer. A non-intrusive measurement technique is particularly advantageous in this application owing to the unstable nature of the laminar jet and the destabilizing effect which objects submerged in the jet have. Flow visualization was employed to ensure that all of the measuring points were located within the laminar region of the jet. The variation of centreline velocity, jet half-radius and velocity-profile shape are investigated for various Reynolds numbers and axial distances. Emphasis is placed on the jet-development region; however, data from the fully developed region are also presented. Particular attention is given to determine the proper non-dimensional groups which are required to collapse the data. The predictions of a simple boundary-layer analysis are used as a guide in this regard and found to give an accurate representation of the flow field. (20 refs.)

107207 Universal equation of transient plane jet in concurrent stream. O.N.Bushmarin, E.Yu.Egorova, N.F.Trubitsyn (M.I. Kalinin Leningrad Polytech. Inst., Leningrad, USSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1224-8 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.753-9 (Nov. 1982). [received: Sept. 1983]
An equation is derived and subsequently integrated which is 'universal' not only with respect to velocity of the concurrent stream and initial conditions of jet discharge but also with respect to choice of characteristic scale for the transverse coordinate. (3 refs.)

107208 Entrance section of a planar turbulent jet in transverse flow. T.A.Girshovich (Sergo Ordzhonikidze Moscow Aviation Inst., Moscow, USSR).
J. Eng. Phys. (USA), vol.44, no.1, p.15-20 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.22-8 (Jan. 1983). [received: Sept. 1983]
The author presents a solution for the entrance section of a planar turbulent jet in a carrier stream, accounting for additional ejection of liquid in the upstream mixing zone. (6 refs.)

107209 An experiment on the noise source strengths in coaxial double jets. Y.Nakazono (Faculty of Engng., Kyushu Tokai Univ., Kumamoto, Japan).
J. Acoust. Soc. Jpn. (Japan), vol.39, no.6, p.367-73 (June 1983). In Japanese.
The distribution of noise source strengths in a coaxial double jet with main nozzle diameter 12 mm and nozzle exit area ratio 2.83 of bypass flow to main flow is measured by the use of a reflector-type directional microphone system. Sound pressure spectrum in the far-field which is predicted with the sound source distribution is in good agreement with the measurement by an omnidirectional microphone at each velocity ratio of the bypass jet to the core jet. Therefore, a reflector type directional microphone system is considered to be suited for the measurement of the sound source distribution in the coaxial double jet. Next, the author measures the pressure fluctuation in an incompressible jet flow with the use of a probe microphone with four static pressure holes and obtains the influence of correlation upon the far-field noise at each Strouhal number on the basis of the distribution of noise source strength and local pressure fluctuation. Moreover, the reasons for the noise increase or decrease of the double jet as opposed to the single jet is considered. (15 refs.)

107210 Speckle velocimetry study of vortex pairing in a low-Re unexcited jet. R.Meynart (Univ. Libre de Bruxelles, Service des Milieux Continus, Brussels, Belgium).
Phys. Fluids (USA), vol.26, no.8, p.2074-9 (Aug. 1983).
Application of speckle velocimetry in a round jet (Re=2300) provides instantaneous 2-D velocity fields and vorticity maps of the interaction between unstable vortices. Detailed descriptions of the pairing process and of the large-scale structures observed near the end of the potential core are obtained without excitation of the jet and without the smearing effects of the conditional sampling method. (12 refs.)

Electronic absorption spectrum of Hg-Ar complex in a supersonic jet ....See Entry 106495

Effect of phase velocity difference on the turbulent structure of a jet carrying heavy impurities ....See Entry 107112

Spectral analysis of turbulent intermittency functions ....See Entry 107119

Electrohydrodynamic droplet generators ....See Entry 107264

Laser-induced fluorescence technique for velocity field measurements in subsonic gas flows ....See Entry 107286

47.55E Nozzles

107211 Hydraulic analogy for isentropic flow through a nozzle. J.S.Rao, V.V.R.Rao, V.Seshadri (Dept. of Mech. Engng., Indian Inst. of Technol., New Delhi, India).
Def. Sci. J. (India), vol.33, no.2, p.97-111 (April 1983). [received: Aug. 1983]
Modelling aspects of isentropic compressible gas flow using hydraulic analogy are discussed. Subsonic and supersonic flows through a typical nozzle are simulated as free surface incompressible water flow in an equivalent 2-*D* model on a water table. The results are first compared for the well known classical analogy in order to estimate experimental errors. Correction factors for pressure and temperature, to account for non-ideal compressible gas flow are presented and the results obtained on the water table are modified and compared with gas dynamic solution. Within the experimental errors, it is shown that the hydraulic analogy can be used as an effective tool for the study of two dimensional isentropic flows of gases. (11 refs.)

A computer controlled laser-Doppler anemometer for flow rate measurement ....See Entry 107303

47.55H Stratified flows

107212 Effect of large-scale turbulence on the structure of the boundary layer in a density flow. B.I.Samolyubov, A.Yu.Pyrkin (Dept. of Phys. & Land Waters, Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.36-42 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.32-8 (1982).
The results of complex natural measurements in the upper contact zone of near-floor density flow are used to analyze the repeating cyclic transformations of the structure of the boundary layer of the flow which were observed by registrations lasting several hours. The authors establish the interdependence of the appearance of fine structure elements of the mixed layer in the stratified flow, such as the lens of translucent liquid, temperature inversions, minima in the velocity profiles and of the root-mean-square values of its fluctuations. An analysis of the results makes it possible to interpret the observed phenomena as the effects of generation and dissipation of outer-scale turbulent formation on the vertical structure of the boundary layer. (13 refs.)

Time evolution of density perturbations in accelerating stratified fluids ....See Entry 107102

The growth of a grid-generated turbulent mixed layer in a two-fluid system ....See Entry 107111

Effects of rotation and shear on doubly diffusive instability ..See Entry 110446

On the instability of internal Alfven-gravity waves in stratified shear flows ....See Entry 110612

47.55K Multiphase flows

107213 Two-dimensional polydisperse flows with interphase mass exchange. V.I.Blagosklonov, A.L.Stasenko.
Power Eng. (J. Acad. Sci. USSR) (USA), vol.20, no.2, p.141-7 (1982). Translation of: *Izv. Akad. Nauk SSSR Energ. & Transp.*, vol.20, no.2, p.153-60 (1982).
A model of a system of equations for the gas-thermodynamics of a two-phase flow is considered; it takes into account present-day information about the interaction of an individual particle with the carrier gas (in particular, the influence of a substantial difference in their temperatures on the interphase exchange of momentum, energy, and mass) and is suitable for the description of polydisperse collision-free flows in cryogenic wind tunnels, nozzles, and jets. Results are reported for a numerical investigation of supersonic vapor-drop flow with specific initial spectrum over a wide range of particle masses (differing by more than factor of 10^3). A qualitative difference has been detected in the nature of the variation in dimensions of particles of different fractions (evaporation of large particles and ring condensation growth of small particles). (15 refs.)

107214 Motion of fluid particles in perturbed shear flows. K.Inoue (Nat. Aerospace Lab., Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2711-19 (Aug. 1983).
The motion of fluid particles in shear flows perturbed by unamplifying traveling sinusoidal waves is considered. The analogy between the formulation of the problem in terms of the stream function and the Hamiltonian dynamics is pointed out. For a perturbed wake type flow, an approximate analytical solution is obtained by employing the method of canonical transformation due to Hori (1966, 1967). (5 refs.)

107215 Flow past a liquid drop with a large non-uniform radial velocity. S.S.Sadhal (Dept. of Mech. Engng., Univ. of Southern California, Los Angeles, CA, USA), P.S.Ayyaswamy.
J. Fluid Mech. (GB), vol.133, p.65-81 (Aug. 1983).
The translation of a liquid drop experiencing a strong non-uniform radial velocity has been investigated. The situation arises when a moving liquid drop experiences condensation, evaporation or material decomposition at the surface. By simultaneously treating the flow fields inside and outside the drop, the authors have obtained physical results relevant to the problem. The magnitude of the radial velocity is allowed to be very large, but the drop motion is restricted to slow translation. The solution to the problem has been developed by considering a uniform radial flow with the translatory motion introduced as a perturbation. The role played by the inertial terms due to the strong radial field has been clearly delineated. The study has revealed several interesting features. An inward normal velocity on a slowly moving drop increases the drag. An increasing outward normal velocity decreases the drag up to a minimum beyond which it increases. The total drag force not only consists of contributions from the viscous and the form drags but also from the momentum transport at the interface. Since the liquid drop admits a non-zero tangential velocity, the tangential momentum convected by the radial velocity forms a part of this drag force. The circulation inside the drop decreases (increases) with an outward (inward) normal velocity. A sufficiently large non-uniform outward velocity causes the circulation to reverse. (15 refs.)

107216 On the calculation of separation bubbles. T.Cebeci (Mech. Engng. Dept., California State Univ., Long Beach, CA, USA), K.Stewartson.
J. Fluid Mech. (GB), vol.133, p.287-96 (Aug. 1983).
The interactive boundary-layer equations for a flat plate are solved numerically when the external velocity field is piecewise linear and would provoke separation if the response of the boundary layer were neglected. A comparable problem had already been solved by Briley using the full Navier-Stokes equations. The equations are solved for various values of the Reynolds number and x_0, a parameter defining the corner point of the external velocity. It is found that flows with a limited region of separation can be computed, but that, if x_0 is too large, the numerical procedure breaks down. Furthermore, this maximum value is a decreasing function of R and seems to approach the value 0.12 predicted by classical theory as $R \rightarrow \infty$. Comparison with Briley's results indicate a reasonable agreement except that different values of x_0 are appropriate. It is conjectured that, once x_0 increases above the acceptable maximum, rapid changes occur in the flow properties when R is large. (16 refs.)

107217 Mean flow in round bubble plumes. J.H.Milgram (Dept. of Ocean Engng., MIT, Cambridge, MA, USA).
J. Fluid Mech. (GB), vol.133, p.345-76 (Aug. 1983).
Previous experimental studies are reviewed and those whose data are deemed reliable are identified. New experiments at larger scale are described and the results are reported. These are combined with the reliable previous studies to form a data set covering heights from 3.66 to 50 m and gasflow rates from 0.0002 to 0.59 normal m^3/s. These wide-ranging data are combined with an integral theory for bubble plumes to determine functional relationships between local plume properties and the entrainment coefficient and the fraction of the momentum flux that is carried in the turbulent velocity fluctuations. These relationships together with the integral theory provide a set of equations that are suitable for numerical solution for the mean flow properties of any round bubble plume. Examples of the numerical solutions are presented and a comparison of one of these with existing experimental data is given. The relationships between the local plume properties and the entrainment coefficient and the momentum flux carried by the turbulence are interpreted to provide a qualitative understanding of the parameters involved and their influences on the plume. (17 refs.)

107218 Experimental study of the motion of solid particles in a turbulent gas flow. The transfer mechanism. L.I.Krupnik, V.N.Oleinik, V.G.Ainshtein.
J. Eng. Phys. (USA), vol.43, no.4, p.1055-61 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.533-41 (Oct. 1982). [received: Sept. 1983]
A model accounting for particle interaction with channel walls and collisions between particles is proposed on the basis of analysis of experimental particle-velocity distribution functions. (15 refs.)

107219 Flow of dilute suspensions of deformable ellipsoidal particles in a plane channel. Kwak Van Dong, Z.V.Pasechnik, Yu.I.Shmakov (T.G. Shevchenko State Univ., Kiev, Ukrainian SSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1079-83 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.560-5 (Oct. 1982). [received: Sept. 1983]
The influence of the internal properties of deformable suspended particles on the laminar flow of suspensions in plane channels is investigated. (10 refs.)

107220 Critical two-phase flow in long channels. Z.P.Bil'der, V.V.Fisenko (Odessa Polytech. Inst., Odessa, USSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1192-5 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.715-18 (Nov. 1982). [received: Sept. 1983]
Results are presented from experimental studies of the critical efflux of a two-phase flow through long channels. (6 refs.)

107221 Diffusion and mass transfer in moderately concentrated disperse system with small Peclet numbers. Yu.A.Buevich, S.P.Fedotov (A.M. Gor'skii Ural State Univ., Sverdlovsk, USSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1213-19 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.740-8 (Nov. 1982). [received: Sept. 1983]
Nonsteady diffusion in a system with identical nonconducting spherical particles is considered, taking account of mass transfer with these particles. (18 refs.)

107222 Applicability of approximate models in calculating the boundary region in dust-laden flows. O.V.Molin, F.E.Spokoinyi (Odessa Engng. Inst. of Refrigeration Industry, Odessa, USSR).
J. Eng. Phys. (USA), vol.44, no.1, p.21-6 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.28-35 (Jan. 1983). [received: Sept. 1983]
The limits of application of 'single-particle' and 'quasihomogeneous liquid' models are established on the basis of analysis of Couette flow for a dust-laden gas. (12 refs.)

107223 Suspension of solid particles in a Newtonian fluid. T.Levy (Dept. de Math., Univ. de Rouen, Rouen, France), E.Sanchez-Palencia.
J. Non-Newtonian Fluid Mech. (Netherlands), vol.13, no.1, p.63-78 (July 1983).
The authors consider the motion of a Newtonian fluid containing solid particles in the case of high concentration (the partial volume of solid is comparable to that of fluid) by using a homogenization technique associated with the small parameter ϵ (the ratio of the particle length to the characteristic macroscopical length). The limit behavior as $\epsilon \rightarrow 0$ is that of fluid with anisotropy properties associated with a microstructure. The evolution equations for the limit flow and for the microstructure are given. (7 refs.)

107224 Strong spherical two-phase blowoff of liquid metals into vacuum. K.Hornung (Hochschule der Bundeswehr Munchen, Neubiberg, Germany).
Phys. Fluids (USA), vol.26, no.8, p.2120-7 (Aug. 1983).
The process of the spherical nonequilibrium expansion of a homogeneous metal liquid-vapor cloud into a vacuum is considered for high initial entropies (up to 0.9 S_{crit}) and high expansion velocities (several km/sec). Starting from phase equilibrium, the system successively passes through stages of increasing nonequilibrium, determined by the characteristic times of the expansion as well as heat and mass transfer and ends up in a state of maximum nonequilibrium, where there is no more contact between the phases. Results are discussed for different metallic fluids. (22 refs.)

107225 Prediction of the film vaporization of hydrocarbons in a stream of hot air. H.Eickhoff (Inst. fur Antriebstech., DFVLR, Koln, Germany).
Waerme- & Stoffuebertrag. (Germany), vol.17, no.4, p.233-6 (1983). In German.
The results of an analytical approximation method to predict the film vaporization are compared with the predictions of a finite difference method of Hermitian type. The analytically estimated rate of vaporization of different hydrocarbons, which is the most important value for practical applications, deviates only a few percent from the numerically estimated value. (8 refs.)

107226 Analysis of homogeneous unary and binary condensation processes. W.Studzinksi (Inst. Maszyn Przeplywowych, PAN, Gdansk, Poland), R.A.Zahoransky, S.L.K.Wittig.
Waerme- & Stoffuebertrag. (Germany), vol.17, no.4, p.241-50 (1983). In German.
The modified theoretical analysis of the binary nucleation and the subsequent heterogeneous droplet growth presented includes the limiting unary condensation. By introducing a new parameter ζ, the ratio of the reduced partial molecular volumes, it is possible to illustrate the changing binary droplet composition during their growth from the metastable equilibrium. A complete calculation of the droplet growth confirms the assumptions. As a typical result it is found, that the binary droplets will obtain their equilibrium composition within 10^{-5} s—starting with their metastable value. The comparison of the droplet growth model and parallel measurements with water-ethanol mixtures in the expansion fan of a shock tube confirms the results. (26 refs.)

107227 Experimental study of filmwise condensation considering wave initiation. H.Sofrata (Mech. Engng. Dept., King Saud Univ., Riyadh, Saudi Arabia).
Waerme- & Stoffuebertrag. (Germany), vol.17, no.4, p.251-60 (1983).
The problem of wavy filmwise condensation was recently investigated using both analytical and numerical concepts. The analytical solution assumed the film profile as a simple sine wave moving with a constant phase velocity and the problem was reduced to a closed integral form, while the numerical solution considers variations in the wave length and amplitude of the proposed sine wavy free surface. In order to find out the validity of the suggested theoretical models, an experimental test rig was installed, where the experimental parameters were controlled to generate data in the range of $40 < Re < 200$. The results of this work demonstrate the possibility of accurate simulation of long vertical condensers using a laboratory set of reasonable dimensions. This simulation yields better results when the thermal and hydrodynamical average quantities at the entrance are properly corrected. Good agreement was found by comparing the generated experimental data, together with other data, with the analytical and numerical models. Empirical formulas for heat transfer were considered and differences between the correlation coefficients were found to be mainly due to improper definition of the validity ranges of the used dimensionless groups. More realistic definition for the range of validity was introduced with these empirical formulas. (20 refs.)

107228 The effect of boundary absorption on longitudinal dispersion in steady laminar flows. C.Van den Broeck, E.Dekempeneer (Dept. Natuurkunde, Vrije Univ. Brussel, Brussels, Belgium).
Z. Angew. Math. & Phys. (Switzerland), vol.34, no.4, p.489-501 (July 1983).
The effect of absorbing or semi-absorbing boundary conditions on the dispersion of suspended particles in a flowing fluid are investigated. In the case of absorbing boundary conditions, the dispersion of absorption times gives rise to an increase in the longitudinal dispersion of the absorbed particles. The effect of sedimentation is discussed. For semi-absorbing boundary conditions, the longitudinal dispersion is increased by an amount proportional to the dispersion of the time spent by the particles in the semi-absorbing state. The relative importance of this dispersion versus Taylor diffusion is discussed. (16 refs.)

107229 Fluid physics under reduced gravity—an overview. I.Da-Riva (Aerodynamics Lab., Polytech. Univ. of Madrid, Madrid, Spain), L.G.Napolitano.
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.5-12
Problems related to several fluid physics experiments to be performed under reduced gravity, onboard Spacelab (1st Mission), are discussed. Special attention is placed on parallel and preparatory work on Earth, which could throw some light on the opportunity, present interest and limitations of those experiments. The need for strong supporting fundamental research and, in particular, a more precise determination of the parameters involved, is stressed. (63 refs.)

107230 Thermocapillary migration of bubbles in liquids showing relaxation of surface tension. A.Bewersdorff (DFVLR, Inst. for Space Simulation, Koln-Porz, Germany).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.41-4
The migration of macroscopic, gaseous or liquid particles, that is caused by temperature gradients could become important in many experiments when buoyancy is eliminated. The basic formula for bubble motion, that was first derived by Young, is valid only for rather idealized situations. The author extends the analysis of thermocapillary migration of bubbles to the case where surface tension is also time-dependent. As a new surface is created continuously on the leading hemisphere of a moving bubble a counterforce appears that slows the forward motion. A modified formula for particle velocity is presented and implications for μg-experiments are discussed. (9 refs.)

107231 Bubble motion under reduced gravity. A.Crespo, F.Manuel (ETSI Industriales, Univ. Politecnica, Madrid, Spain).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.45-9
Three mechanisms to make bubbles move are considered: thermocapillary forces, radiation pressure gradient, and centrifugal force. A method to estimate thermocapillary velocities, based on energy conservation is presented; the discrepancies with experimental results are analyzed. The bubble movement due to radiation pressure gradient is estimated for the single bubble, and distributed bubbles cases: the effect of sound velocity variation with void fraction and frequency is considered. The problem of the escape of the single bubble that is formed inside a liquid mass, by the migration, due to centrifugal forces, of distributed bubbles, is studied. The case of the liquid mass moving as a vortex is considered as a limiting situation of non-uniform angular velocity. (23 refs.)

107232 On thermally-driven movement of drops in microgravity conditions. A.El Kouraychi, F.Feuillebois, A.Lasek (Lab. d'Aerothermique, CNRS, Meudon, France).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.51-4
A liquid drop is embedded in a non-miscible liquid under microgravity conditions. A temperature gradient imposed to the outer liquid induces a gradient of surface tension on the surface of the drop. The resulting stresses set the drop into motion. The flow and temperature fields are calculated as expansions for small Marangoni number (analogous to a Reynolds number). The 0^{th} order solution yields the velocity of the drop. The deformation is of order 2. It is obtained by solving first the velocity field to order 1. (3 refs.)

Analysing thermal hydraulics with the Bethsy loop .... See Entry 106126

Kinematic, integral, and thermal characteristics of turbulent stream of gaseous suspension under nonsteady thermal conditions .... See Entry 107105

Effect of phase velocity difference on the turbulent structure of a jet carrying heavy impurities .... See Entry 107112

Regenerative heat exchangers with periodic time variation of coolant temperature .... See Entry 107137

Heat and mass exchange of a droplet in a polyatomic gas .... See Entry 107146

Boiling heat transfer in a vertical tube with Freon 114 .... See Entry 107153

On the motion of flexible threads in a Stokes shear field ...... See Entry 107197

Hydrodynamics and mass transfer characteristics of co-current downflow packed tube columns .... See Entry 107238

Behavior of air-liquid surface moving downward in a straight pipe .... See Entry 107244

Stability of the flow during sedimentation in inclined channels .... See Entry 107255

Wave formation and growth during sedimentation in narrow tilted channels .... See Entry 107256

Effect of vapor efflux from a spherical particle on heat transfer from a hot gas .... See Entry 107269

Physical modelling of multi-phase flow .... See Entry 107273

On automatic measurements of very low sedimentation velocity .... See Entry 107288

Transit time measurement of density fluctuations for the determination of the mean flow velocity in dense-phase fluidized conveying channels .... See Entry 107296

Capacitive sensors for solids flow measurement by correlation methods .... See Entry 107297

Measuring the velocity distribution of particles dispersed in a flow by an ultrasonic Doppler anemometer .... See Entry 107302

Particle transport induced by directional solidification .... See Entry 107884

Method of calculating limits of stabilization of a flame of inhomogeneous mixtures traveling over a poorly streamlined body .... See Entry 109746

The effect of Brownian diffusion on shear-induced coagulation of colloidal dispersions .... See Entry 109817

Kinetics of the aggregation of a dilute, finely disperse system at low shear velocities .... See Entry 109818

Mixing in mechanically agitated gas-liquid contactors, bubble columns and modified bubble columns .... See Entry 109840

47.55M Flow through porous media

107233 Slow viscous incompressible fluid flow through a wall perforated by periodically distributed holes. E.Sanchez-Palencia (Univ. Paris VI, Paris, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.21, p.1629-32 (13 June 1983). In French.
The steady flow of an incompressible viscous fluid is considered in the Stokes approximation. The fluid domain contains a wall hollowed by holes forming a periodic lattice. The asymptotic behavior when the size of the holes, as well as their mutual distances, tend to zero, is given. In particular, it is shown that the filtration velocity tends to a value which is independent of the point on the wall. (3 refs.)

107234 Analysis of transport processes with granular media using the constricted tube model. H.Pendse, Hsu-Wen Chiang, Chi Tien (Dept. of Chem. Engng., Syracuse Univ., Syracuse, NY, USA).
Chem. Eng. Sci. (GB), vol.38, no.8, p.1137-50 (1983).
Four kinds of transport processes occurring in granular media were studied, using the recently formulated constricted tube model for media characterization. The problems considered were: (a) momentum transfer associated with the flow through the media; (b) convective mass transfer; (c) axial dispersion; and (d) collection of aerosol particles in granular beds. Special emphasis was placed on the effect of the wall geometry of the constricted tube on the relevant relationships obtained from model predictions. (36 refs.)

107235 Hydrodynamics of constrained inverse fludization and semifluidization in a gas-liquid-solid system. Song-Hsing Chern, Katsuhiko Muroyama, Liang-Shih Fan (Dept. of Chem. Engng., Ohio State Univ., Columbus, OH, USA).
Chem. Eng. Sci. (GB), vol.38, no.8, p.1167-74 (1983).
Experiments were conducted to study the hydrodynamic behavior of the constrained inverse gas-liquid-solid fluidized bed and the semifluidized bed where the liquid is the continuous phase. Also included in the experiments was a study of the hydrodynamic behavior of countercurrent flow of gas and liquid in a packed bed. This part of the study simulates the packed section of a constrained inverse semifluidized bed. A mathematical model is developed to account for the friction factor between the liquid and solid in the packed bed. The gas hold-up and friction factor of the packed bed are analyzed and empirically correlated. Wallis' drift flux model is modified to describe the gas hold-up in a constrained inverse fluidized bed. For the constrained inverse semifluidized bed, the gas hold-up in the fluidized section, and height of the packed section were investigated. (8 refs.)

107236 A unified model for particulate expansion of fluidised beds and flow in fixed porous media. P.U.Foscolo, L.G.Gibilaro, S.P.Waldram (Dept. of Chem. & Biochem. Engng., Univ. Coll. London, London, England).
Chem. Eng. Sci. (GB), vol.38, no.8, p.1251-60 (1983).
A model is derived for a fluidised bed that enables its steady state particulate expansion to be predicted as a funtion of superficial velocity from the initial (packed bed) condition to the final fully expanded (single suspended particle) state. These predictions are in good agreement with the literature empirical correlations and functional dependencies over the full range of flow conditions. The derivations incorporate revisions in the form of the pressure drop correlations for flow in porous media that are justified on theoretical and empirical grounds. (16 refs.)

107237 Estimation of liquid film mass transfer coefficients for randomly packed absorption columns. P.H.Au-Yeung, A.B.Ponter (Dept. of Chem. & Chem. Engng., Michigan Technol. Univ., Houghton, MI, USA).
Can. J. Chem. Eng. (Canada), vol.61, no.4, p.481-93 (Aug. 1983).
Empirical and theoretical correlations, published since 1940 are reported which predict liquid film mass transfer coefficients in packed columns. Brief comments on the usefulness of the equations are given together with the range of operating variables, where available. Dimensional constants in the empirical correlations have been recalculated for the cases where the original values were not in SI units. (54 refs.)

107238 Hydrodynamics and mass transfer characteristics of co-current downflow packed tube columns. V.K.Patil, M.M.Sharma (Dept. of Chem. Technol., Univ. of Bombay, Bombay, India).
Can. J. Chem. Eng. (Canada), vol.61, no.4, p.509-16 (Aug. 1983).
Hydrodynamics and effective interfacial area in a 25 mm ID packed tube column were studied over a wide range of operating conditions for demister pad packings (DPP). Flow maps have been prepared. Values of effective interfacial area as high as 1880 m^{-1} in the spray flow regime were obtained. Data on pressure drop and effective interfacial area have been correlated for different flow regimes. Values of liquid side volumetric mass transfer coefficient, $k_L\mathbf{a}$, were measured by absorption and desorption of oxygen in different packed tube columns containing Pall rings (standard and low height to dia. ratio), multifilament wire gauge packings (MFWGP) and DPP. $k_L\mathbf{a}$ was found to vary from 0.017 to 0.34 s^{-1} for DPP. (12 refs.)

107239 Mass transfer characteristics of low H/D bubble columns. J.S.Gopal, M.M.Sharma (Dept. of Chem. Technol., Univ. of Bombay, Bombay, India).
Can. J. Chem. Eng. (Canada), vol.61, no.4, p.517-26 (Aug. 1983).
The mass transfer characteristics of 0.2, 0.6 and 1.0 m diameter bubble columns having a low height to diameter ratio ($0.6<H/D<4$) and operated at low superficial gas velocities ($0.01<V_G<0.08$ m/s) were investigated. Different types of spargers were used to study their effect on the column performance. The values of effective interfacial area, **a**, and volumetric mass transfer coefficient, $k_L\mathbf{a}$, were measured by using chemical methods. The values of **a** and $k_L\mathbf{a}$ were found to vary from 40 to 420 m^2/m^3 of clear liquid volume and from 0.01 to 0.16 s^{-1}, respectively, in the range of V_G and V_L covered in this investigation. The value of the liquid-side mass transfer coefficient, k_L, was found to vary from 3×10^{-4} to 7×10^{-4} m/s. The effect of the physical properties of the system on the values of **a** was also investigated. (35 refs.)

107240 Behaviour of vapour bubbles growing at a wall with forced flow. M.G.Cooper, K.Mori, C.R.Stone (Dept. of Engng. Sci., Oxford Univ., Oxford, England).
Int. J. Heat & Mass Transfer (GB), vol.26, no.10, p.1489-507 (Oct. 1983).
Experiments are reported in which individual bubbles are grown at a wall into initially isothermal supersaturated liquid moving relative to the wall, with independent control of the velocity and gravity fields. Cine observations of the bubble motion could be simply explained by non-dimensional groups involving bubble growth, fluid velocity and gravity. There was no indication of surface tension affecting overall bubble motion by causing bubbles to 'stick' at the wall. Thermometers on the wall surface indicated the extent of the region of dry wall below the bubble, and that was found to be smaller than suggested by other workers. The observations of previous workers may have been affected by a 'mirage', caused by variation of refractive index in the thermal boundary layer at the wall. (17 refs.)

107241 The diffusion of a fluid through a highly elastic spherical membrane. K.R.Rajagopal (Dept. of Mech. Engng., Univ. of Pittsburgh, Pittsburgh, PA, USA), A.S.Wineman, J.J.-J.Shi.
Int. J. Eng. Sci. (GB), vol.21, no.10, p.1171-83 (1983).
There are several problems of practical interest of which the problem of filtration is one where a membrane theory for diffusion would be appropriate. It is the authors' aim to develop such a membrane theory which would be applicable in the case of interacting continua. The membrane theory as developed by Green and Adkins (1960) for elastic solids forms the basis for the work. It is, however, found that modifications have to be made to the theory if it is to be compatible with the theory of interacting continua. (8 refs.)

107242 The permeability of a random array of identical rigid-spheres. S.Itoh (Dept. of Phys., Tokyo Metropolitan Univ., Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2379-88 (July 1983).
The permeability of a random array of identical rigid-spheres is determined as a function of the radius, *a*, and the volume concentration, *c*, of the spheres. A statistical formulation due to Lundgren is used here. A particular state formed around a test sphere, which is called the intermediate layer, is taken into consideration by adding the radial dependence of a coefficient of a Darcy resistance. A resultant equation is solved approximately by Galerkin's method, then the permeability is derived from the solution by using the self-consistency condition. It agrees with the experimental data near $c=2/3$. Thus, the formula for the permeability of the densely packed bed of spheres is improved.

107243 Procedure for calculating a conductive heat exchanger. V.F.Stepanchuk, A.F.Shilo, V.V.Kozhushko, E.G.Zavadovskii (Belorussian Polytech. Inst., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1154-8 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.648-53 (Oct. 1982). [received: Sept. 1983]
In a number of devices a fluid is heated as it flows through a porous wall or a metal wall with a high thermal conductivity which has channels containing the flowing fluid. There naturally arise problems of finding the temperature distribution in the material of such a wall heat exchanger, the temperature change of the flowing fluid, and the amount of heat transferred for given geometric parameters of the wall heat exchanger and given values of the initial temperature and the flow rate of the fluid. To simplify the problems the authors make the following assumptions: (1) the thermal and physical properties and the heat-transfer characteristics are constants; (2) end effects related to the finite dimensions of the wall heat exchanger can be neglected, i.e. they assume an infinite porous wall; (3) heat transfer through the skeleton of the wall is by conduction only in the direction normal to the boundary surfaces, i.e. the temperature gradient in the transverse direction can be neglected. (2 refs.)

Exact enumeration approach to fractal properties of the percolation backbone and $1/\sigma$ expansion ....See Entry 105257

Heat transfer for elastico-viscous flow between two rotating porous discs ....See Entry 107126

Free convective viscous flow past a hot vertical porous plate with periodic temperature ....See Entry 107132

Heat exchange and hydrodynamics during boiling on a horizontal tube bundle in a fluidized bed of solid particles ....See Entry 107138

Measurement of pulsations in heat flow on thermally loaded surfaces ....See Entry 107141

Convective heat transfer in a parallel plate channel with porous lining ....See Entry 107152

Structure of detonation pulsating front in porous and suspension explosives saturated by liquid ....See Entry 107179

Flow of polymer solutions in porous media: inadequacy of the capillary model ....See Entry 107190

Regularities of the propagation of the standing countercurrent wave of an exothermal reaction in forced filtration of an oxidizing gas through porous material ....See Entry 107270

Particle growth mechanisms in fluidised bed granulation. I. The effect of process variables ....See Entry 109180

Particle growth mechanisms in fluidised bed granulation. II. Comparison of experimental data with growth models ....See Entry 109181

The influence of catalyst dilution by inert particles on the effectivity of a catalytical process in a fluidized bed ....See Entry 109702

Flame zone in gas combustion in an inert porous medium .....See Entry 109743

The measurement of light transmission through an irradiated fluidised bed ....See Entry 109905

47.60 FLOWS IN DUCTS, CHANNELS, AND CONDUITS

(for biological fluid dynamics, see 87.45)

107244 Behavior of air-liquid surface moving downward in a straight pipe. K.Murakami (Faculty of Engng., Ehime Univ., Matsuyama, Japan), N.Isshiki, H.Yamauchi.
Bull. JSME (Japan), vol.26, no.215, p.770-7 (May 1983).
An experimental study on the behavior of the air-liquid surface in various vertical and circular pipes is described. The case when a liquid piston is suddenly started from a vertical pipe which is previously filled up with a liquid and pressurized air on the top, is examined. It is known that the measured velocity of the tip of the surface agrees approximately with the simplest one-dimensional model, and the shape of the surface is divided into two areas; one is flat shape for the case of nearly constant velocity, and the other is spherical shape accompanied with an accelerating velocity. And further, the effects of an obstacle on the wall on the air-liquid surface behavior are observed, and it is found that sometimes a turbulence appears on the surface and grows up sharply, and the condition for the growth of the disturbance depends on Reynolds number and stability number. (9 refs.)

107245 The residence time distribution for laminar flow in an annulus with negligible diffusion. V.Pechoe (Res. Inst. of Man-Made Fibers, Svit, Czechoslovakia).
Chem. Eng. Sci. (GB), vol.38, no.8, p.1341-2 (1983).
The author develops an expression for the density of residence time distribution (RTD) for annular flow (Newtonian and power-law) using the theoretical A.G. Frederickson and R.B. Bird (1958) velocity profile, and compares this RTD with the approximate one of S.H. Lin (1980). (6 refs.)

107246 Condensation of vapor in stream with surface-active substances. V.A.Ageev, L.I.Seleznev.
Power Eng. (J. Acad. Sci. USSR) (USA), vol.20, no.6, p.109-12 (1982). Translation of: *Izv. Akad. Nauk SSSR Energ. & Transp.*, vol.20, no.6, p.136-9 (1982).
A theoretical description is given of spontaneous condensation during adiabatic expansion in the presence of surface-active substances; calculated results are compared with experiment. (6 refs.)

107247 Unsteady viscous flow down an inclined open channel with naturally permeable bed. J.S.Chaudhary, P.C.Gupta (Dept. of Maths., Agra Coll., Agra, India).
Def. Sci. J. (India), vol.33, no.2, p.159-63 (April 1983). [received: Aug. 1983]
The exact velocity distribution for the flow of viscous incompressible fluid in an inclined channel with naturally permeable bed has been obtained by using the Laplace transform and the finite Fourier sine transform technique. It has been assumed that (i) the fluid flows in the steady state for $t\leq 0$, (ii) unsteady state occurs at $t>0$, and (iii) unsteady state motion is influenced by time dependent pressure gradient. (6 refs.)

107248 On the stability of plane Poiseuille flow to finite-amplitude disturbances, considering the higher-order Landau coefficients. P.K.Sen (Dept. of Appl. Mech., Indian Inst. of Technol., New Delhi, India), D.Venkateswarlu.
J. Fluid Mech. (GB), vol.133, p.179-206 (Aug. 1983).
A study has been made of the Stuart (1960)-Watson (1960) formalism as applied to plane Poiseuille flow. In particular, the higher-order Landau coefficients have been calculated for the Reynolds & Potter (1967) method and for the Watson (1960) method. The results have been used to study the convergence of the Stuart-Landau series. A convergence curve in the (α,R)-plane has been obtained by using suitable Domb-Sykes plots. In the region of poor convergence of the series, and also in a part of the divergent region of the series, it has been found that the Shanks (1955) method, using the $e_1{}^m$ transformation, serves as a very effective way of finding the proper sum of the series, or of finding the proper antilimit of the series. The results for the velocity calculations at $R=5000$ are in very good agreement with Herbert's (1977) Fourier-truncation method using $N=4$. The Watson method and the Reynolds & Potter method have also been compared in the subcritical and supercritical regions. It is found in the supercritical region that there is not much difference in the results by the 'true problem' of Watson and the 'false problem' of Reynolds & Potter when the respective series in both methods are summed by the Shanks method. This fact could possibly be capitalized upon in the subcritical region, where the Watson method is difficult to apply. (19 refs.)

107249 Diffusion in oscillatory pipe flow. E.J.Watson (Dept. of Math., Univ. of Manchester, Manchester, England).
J. Fluid Mech. (GB), vol.133, p.233-44 (Aug. 1983).
The rate of mass transfer of a diffusing substance along a pipe is augmented by an oscillatory motion of the ambient fluid in the pipe. The increase of the flux is evaluated for the cases of a circular pipe and of a two-dimensional channel. Results are given for a general cross-section in the limiting cases of slow and fast oscillations of the flow. (8 refs.)

107250 Unidimensional model for pipe flow of a gas mixture allowing for condensation. N.I.Zverev, Yu.P.Korotaev, V.I.Maron (I.M. Gubkin Moscow Inst. of Petrochem. & Gas Industry, Moscow, USSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1202-7 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.727-33 (Nov. 1982). [received: Sept. 1983]
Condensation kinetics is described with allowance for the dependence of the temperature of the phase transformation on the pressure and concentration of the condensing gas at the phase boundary. (2 refs.)

107251 Hydrodynamic regimes of a liquid in a smooth-walled rotating heat pipe. I. M.G.Semena, Yu.A.Khmelev (Kiev Polytech. Inst., Kiev, Ukrainian SSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1235-42 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.766-74 (Nov. 1982). [received: Sept. 1983]
The article presents the results of the analytical and experimental investigation of the hydrodynamics of a liquid in a horizontal rotating heat pipe. A formula is derived for determining the thickness of the layer of liquid entrained from the groove of the inner cylindrical surface. (9 refs.)

107252 Investigation of the hydrodynamic regimes of a liquid in a smooth-walled rotating heat pipe. II. M.G.Semena, Yu.A.Khmelev (Kiev Polytech. Inst., Kiev, Ukrainian SSR).
J. Eng. Phys. (USA), vol.44, no.1, p.4-9 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.8-14 (Jan. 1983). [received: Sept. 1983]
Deals with the analytical and experimental investigation of the influence of the slope of a rotating heat pipe and of the taper of its inner surface on the hydrodynamics of a liquid. (2 refs.)

107253 Heat transfer to turbulent stream in pipes under supercritical pressures. N.L.Kafengauz (G.M. Krzhizhanovskii Sci.-Res. Inst. of Power Engng., Moscow, USSR).
J. Eng. Phys. (USA), vol.44, no.1, p.9-12 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.14-19 (Jan. 1983). [received: Sept. 1983]
Experimental results are presented on heat transfer to several liquid hydrocarbons under supercritical pressures and pseudoboiling conditions. An empirical relation is proposed which generalizes these results. (12 refs.)

107254 Streaming current in stainless steel and nickel pipes for heptane and hexane flows. G.Touchard, P.Dumargue (Lab. de Phys. et Mecanique des Fluides, Univ. de Poitiers, Poitiers, France).
J. Electrostat. (Netherlands), vol.14, no.2, p.209-23 (Aug. 1983).
Important studies have already been made on charge generation; however, because of the difficulties in obtaining reproducible experimental results, and also because of the very complicated theoretical analysis due to the great number of parameters involved, the phenomenon is not yet very well understood. The work described is a new contribution towards a better understanding of these phenomena. The experimental results obtained demonstrate the influence of several non-dimensional parameters. The agreement between experiment and theory is generally good. It seems that one of the most important parameters is the space charge density at the inner wall of the tube, which is due to local electrochemical reaction. In future studies, it seems important to analyse the mechanism of adsorption between the metal and the dielectric liquid in order to help the control of charge generation. (15 refs.)

107255 Stability of the flow during sedimentation in inclined channels. E.Herbolzheimer (Dept. of Chem. Engng., California Inst. of Technol., Pasadena, CA, USA).
Phys. Fluids (USA), vol.26, no.8, p.2043-54 (Aug. 1983).
The conditions for wave formation and growth during sedimentation in inclined channels is investigated using a linear stability analysis in the limit of large sedimentation Grashof number with the Reynolds number remaining *O*.

An asymptotic solution for long waves reveals that the critical Reynolds number is proportional to the tangent of the angle of inclination of the channel times the ratio of the thickness of the thin pure-fluid layer, which forms beneath the downward-facing surface of the channel, to the width of the channel. Hence, the critical Reynolds number is very small unless the channel is extremely long and narrow. Numerical calculations indicate, however, that the maximum amplification rates are often so small that the disturbances may be convected out of the channel before they reach an observable size. This conclusion is consistent with experiments performed in the laboratory, and the observed wave inception point and the calculated maximum amplification rates exhibit remarkably similar dependence on the angle of inclination and the suspension concentration. (20 refs.)

107256 Wave formation and growth during sedimentation in narrow tilted channels. R.H.Davis, E.Herbolzheimer, A.Acrivos (Dept. of Chem. Engng., Stanford Univ., Stanford, CA, USA).
Phys. Fluids (USA), vol.26, no.8, p.2055-64 (Aug. 1983).
A linear-stability analysis is performed to investigate in detail the conditions for wave formation and growth during sedimentation in long, narrow channels that are inclined from the vertical. The maximum amplification rates of such waves are predicted by solving the equations governing the instabilities both asymptotically for long-wavelength disturbances and also numerically for disturbances with moderate wavelengths. The general trends set forth by the linear theory are found to be consistent with experimental observations. In particular, it is shown that very tall and narrow vessels not only give the largest enhancement in the settling rate but also significantly increase the stability of inclined settling systems. (15 refs.)

107257 Experimental study of the near wall region of unsteady turbulent flow in two-dimensional duct. J.Tartarin (Lab. d'Etudes Aerodynamiques, Poitiers, France).
Rev. Phys. Appl. (France), vol.18, no.8, p.495-505 (Aug. 1983). In French.
Experimental study in the near wall region of a two-dimensional turbulent flow, with oscillating perturbation, was performed with particular attention focused on the influence of the imposed frequency, when close to the burst frequency. Noticeable changes in the turbulence and velocity periodic fields profiles in the viscous and buffer layers ($y^+ < 25$) led the author to propose an assumption concerning the behaviour of the turbulence in that region. (35 refs.)

107258 Measurement of flow rate through a pipe by external heating. H.Tanaka, T.Fujii.
Rep. Res. Inst. Ind. Sci. Kyushu Univ. (Japan), no.74, p.115-22 (1983). In Japanese.
A conjugate heat transfer problem is numerically solved when a fully developed laminar flow in a pipe is locally heated from the outside of the pipe wall. A transient temperature distribution is presented and a relation of the temperature increase at the heated site with the dimensionless velocity parameter C_u^- and the dimensionless wall thickness ΔR is derived. A flow rate of water through a stainless steel pipe of 1.25 mm i.d. and 1.61 mm o.d. is measured in the range of 0.01 to 10 ml/min., where the size and heat flux of the heater is optimally designed based on the numerical results. The agreement between the theory and experiment is found to be good. (no refs.)

107259 Reference velocity in the definition of friction factor for tube banks with suction. T.Fujii.
Rep. Res. Inst. Ind. Sci. Kyushu Univ. (Japan), no.74, p.123-7 (1983). In Japanese.
Theoretical consideration is given for a reference velocity in the estimation of friction factor from experimental data on pressure losses through tube banks with suction. The reference velocity can be determined for a given distribution of suction rate in the bank and a given functional form of Reynolds number in the friction factor, when total fluid is sucked in the bank. It is recommended from numerical results that an arithmetic mean value of the inlet and exit velocities should be employed as the reference velocity in both Reynolds number and definition equation. This recommendation is valid when the number of tube rows is less than 40% of that necessary for total suction. (3 refs.)

107260 A numerical analysis of flow and heat transfer of air in an in-line tube bank. M.Fujii, T.Fujii, T.Nagata.
Rep. Res. Inst. Ind. Sci. Kyushu Univ. (Japan), no.74, p.135-48 (1983). In Japanese.
Describes a numerical method to predict laminar flow and heat transfer characteristics over the whole region from the inlet to exit of a tube bank. Calculations are performed for an in-line tube bank which is up to five rows deep, having the longitudinal and transverse pitch-diameter ratios of 1.5×1.5, under the conditions of uniform tube wall temperature, $Re = 60$, 120, and 300, and $Pr = 0.7$. The local and average Nusselt numbers, pressure distributions along tube wall and in the flow direction, and friction factor are presented. These features show clearly a developing region at the inlet, a fully developed one in the core part and a wake one at the exit. The average Nusselt number and friction factor agree well with the experimental results. It is found that there exists an analogy between an in-line tube bank and a plane duct in the heat transfer characteristics, when effective flow length and duct height are adequately chosen. (no refs.)

Melting and cladding motion in a cylindrical vertical channel with a gaseous counterflow .... See Entry 106116

Prediction of critical heat flux in flow boiling at low qualities .... See Entry 106117

An experimental study of gas exchange in laminar oscillatory flow .... See Entry 107098

On the structure of wall-bounded turbulent flows .... See Entry 107117

An experimental investigation of convection patterns in flow past an obstacle .... See Entry 107123

Heat exchange and hydrodynamics during boiling on a horizontal tube bundle in a fluidized bed of solid particles .... See Entry 107138

Experimental investigation of heat transfer in a centrifugal heat pipe with an optimized layer on heat-transfer agent .... See Entry 107139

Conjugate problem of free convection of a non-Newtonian fluid in a vertical channel .... See Entry 107140

Solution of a two-dimensional conjugate problem of stabilized heat transfer in the laminar flow of a liquid in a channel .... See Entry 107143

Transient thermal entrance heat transfer in laminar pipe flows with step change in pumping pressure .... See Entry 107151

Convective heat transfer in a parallel plate channel with porous lining .... See Entry 107152

Boiling heat transfer in a vertical tube with Freon 114 .... See Entry 107153

Flow around turbulence promoters in parallel channels. II. Shedding vortex around cylinder .... See Entry 107165

Controlling deposition of a substance onto the inner surface of a cylindrical channel .... See Entry 107186

Small-disturbance stability of a non-isothermal tube flow of power law fluids. I. Derivation of the Orr-Sommerfeld equation extended .... See Entry 107187

Small-disturbance stability of a non-isothermal tube flow of power law fluids. II. Numerical solution of the problem .... See Entry 107188

An analogy between rectilinear flow of plastic solids and Saint-Venant torsion .... See Entry 107192

Rectilinear oscillatory viscoelastic flow in rectangular ducts .... See Entry 107196

Experimental study of the motion of solid particles in a turbulent gas flow. The transfer mechanism .... See Entry 107218

Flow of dilute suspensions of deformable ellipsoidal particles in a plane channel .... See Entry 107219

Critical two-phase flow in long channels .... See Entry 107220

MHD flow past a circular cylinder in a channel .... See Entry 107262

The dispersion of a reactive species (atomic hydrogen) in a flowing gas .... See Entry 107271

New developments in magnetic flow measurement in partly filled open channels .... See Entry 107289

A vortex ring shedding flowmeter .... See Entry 107291

Transit time measurement of density fluctuations for the determination of the mean flow velocity in dense-phase fluidized conveying channels .... See Entry 107296

Measurement of instantaneous flow rate through estimation of velocity profiles .... See Entry 107305

A note on the signal intensity of the second spin echo in Carr-Purcell-Meiboom-Gill sequence of turbulent flows .... See Entry 108831

Experimental study of stationary flame propagation in a tube under conditions of weightlessness .... See Entry 109744

47.65 MAGNETOHYDRODYNAMICS AND ELECTROHYDRODYNAMICS

(for MHD in plasma, see 52.30)

107261 Parametric excitation of electrohydrodynamic surface waves. A.E.M.A.Mohamed (Dept. of Maths., Ain Shams Univ., Cairo, Egypt), N.K.Nayyar.
Arabian J. Sci. & Eng. (GB), vol.8, no.2, p.103-11 (April 1983).
The electrohydrodynamic surface wave propagating through a horizontal interface between two-dielectrics can be amplified by introducing a horizontal periodic electric field. For certain values of the frequency of the field, the system is set into a state of resonance. An expression for the dependence of such subharmonics on the various parameters of the system is obtained. Detailed studies for limiting cases of small and large modulation are introduced. (18 refs.)

107262 MHD flow past a circular cylinder in a channel. J.Zachariah, K.R.Singh (Dept. of Math., Gauhati Univ., Gauhati, India).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2742-50 (Aug. 1983).
Plane slow motion of an incompressible, electrically conducting and viscous fluid past a circular cylinder placed midway between the two parallel walls in a channel in the presence of a uniform magnetic field parallel to the walls is considered; the consideration is restricted to the case when the magnetic diffusivity is large (i.e. when electrical conductivity is small) and investigation is carried out by considering outer and inner solutions on the basis of Stokes approximation. The drag force on the cylinder is also derived. It is found that the walls have significant effect on the drag force.

107263 A two-dimensional MHD flow of an inviscid fluid past an elliptic cylinder. J.Zachariah, K.R.Singh (Dept. of Math., Gauhati Univ., Gauhati, India).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2751-60 (Aug. 1983).
A steady two-dimensional MHD flow of an incompressible, inviscid, electrically conducting fluid past an elliptic cylinder (of small eccentricity) is considered for the aligned field case when the magnetic diffusivity (η_m) is large. Attempt is made to find the interaction of the field and the motion, and also the drag force experienced by the cylinder by retaining the non-linear terms. It is found, to a first approximation, that the drag force is independent of the fluid density; the drag force for a circular cylinder is also deduced.

107264 Electrohydrodynamic droplet generators. J.M.Crowley (Dept. of Electrical Engng., Univ. of Illinois, Urbana, IL, USA).
J. Electrostat. (Netherlands), vol.14, no.2, p.121-34 (Aug. 1983).
In an electrohydrodynamic (EHD) droplet generator, an electric field acts directly on the surface of an electrically conducting jet after it has been formed and ejected from the nozzle. If the electric field has the proper frequency, it will induce compression and expansion of the jet, which will eventually break up into droplets some distance downstream. In contrast to acoustic droplet generators, the initial disturbance is physically separated from the nozzle, so that the exciter and nozzle can be individually designed to perform their separate tasks efficiently. This paper presents a theory of EHD exciters which predicts the breakup length of the jet in terms of the geometry and physical properties of the printer. Experiments confirm this theory, and show that practical exciters can be designed from first principles with the expectation that the breakup length will be close to that predicted, and insensitive to changes in operating frequency. (11 refs.)

107265 Unsteady hydromagnetic boundary layers on an infinite flat plate in the presence of a transverse magnetic field. R.P.Pathak (St. Xavier's Coll., Ranchi, India), R.C.Choudhary.
Rev. Roum. Phys. (Rumania), vol.28, no.5, p.405-12 (1983).
The momentum integral and the kinetic energy integral equations and the wall compatibility conditions have been derived in dimensionless forms and they are used to study the boundary layer formation on an impulsively started and on a uniformly accelerated infinite flat plate in the presence of a transverse magnetic field. It is observed that the time to reach the steady state pattern decreases with the increase in the strength of the magnetic field. (6 refs.)

107266 Calorimetric investigation of electrohydrodynamic instabilities in liquid crystals. I.A.Kleinman, S.A.Kozlovskii, G.R.Allakhverdov (All-Union Sci. Res. Inst. of Chem. Reagents & Very Pure Chem. Substances, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.105-6 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.183-4 (Jan.-Feb. 1983). [received: Sept. 1983]
As the object of their investigation the authors chose the well-researched liquid-crystal compound p-methoxybenzylidene-p′-butylaniline (MBBA) doped with tetrabutylammonium bromide. They prepared two identical cells with

planar-oriented layers of MBBA 20 μ thick. On both specimens they made preliminary microscopic observations and measured the volt-ampere and volt-contrast characteristics. Both specimens were placed in the calorimeter cell which was at room temperature and connected in a differential circuit. To one of the specimens the authors supplied a voltage from a stabilized source, while the other acted as a control. For various voltages U they obtained the dependences of the emitted heat power P vs. the time τ. (7 refs.)

107267 On stability of longitudinal electric current in a viscous liquid cylinder within the longitudinal magnetic field. A.G.Dmitrenko, A.I.Fesenko.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1185-91 (Aug. 1983). In Russian.
Stability of small kink magnetohydrodynamic oscillations of a cylinder of incompressible conducting viscous liquid is considered in the paper for crossed magnetic fields. The type of bifurcation was established in transition from stable to labile state. (9 refs.)

Heat transfer in a MHD flow between eccentric disks rotating at different speeds .... See Entry 107155

Streaming current in stainless steel and nickel pipes for heptane and hexane flows .... See Entry 107254

Commensurate and incommensurate structures in a nonequilibrium system .... See Entry 107536

A new kind of instability in the smectic-*C* phase of a liquid crystal .... See Entry 107541

Boundary conditions for a rapidly rotating hydromagnetic system in a cylindrical container .... See Entry 110288

On the instability of internal Alfven-gravity waves in stratified shear flows .... See Entry 110612

47.70 REACTIVE, RADIATIVE, OR NONEQUILIBRIUM FLOWS

107268 Mixing of chemically reactive fluids by swirling in a tubular reactor. J.-J.Ou, Chu-Shu Lee, Shaw-Horng Chen (Dept. of Chem. Engng., Univ. of Rochester, Rochester, NY, USA).
Chem. Eng. Sci. (GB), vol.38, no.8, p.1323-9 (1983).
To achieve a varying degree of radial mixing in a single phase fluid, a stable laminar swirl is created by two fluid streams tangentially entering a tubular reactor. The details of the resultant fluid motion is described using the material stretching coordinate technique. The combination of fluid motion, molecular diffusion, and intrinsic chemical kinetics provides the basis for investigating mixing with chemical reactions for nonpremixed feeds. Computations on an infinitely fast second-order reaction for the radial Peclet number ranging from 10^2 to 10^6 reveal features for the flow-induced swirling in a tubular reactor. (13 refs.)

107269 Effect of vapor efflux from a spherical particle on heat transfer from a hot gas. P.A.Kalson (Dept. of Chem. Engng., Univ. of Michigan, Ann Arbor, MI, USA).
Ind. & Eng. Chem., Fundam. (USA), vol.22, no.3, p.355-7 (Aug. 1983).
The efflux of vapor from a particle reduces the heat transfer to the particle. This effect was evaluated for spherical and elongated (cylindrical) particles. One example of this phenomenon is the devolatilization of small coal particles, for which previous investigators have used the Ackermann correction which was derived for flat-plate geometry. Computation shows that for the case of 74-μm coal particles in an entrained-flow gasifier, the flat-plate solution yields significantly greater values for this effect, and hence significantly lower rates of heat transfer, than the spherical-geometry solution. (5 refs.)

107270 Regularities of the propagation of the standing countercurrent wave of an exothermal reaction in forced filtration of an oxidizing gas through porous material. O.S.Rabinovich, I.G.Gurevich (Lykov Inst. of Heat & Mass Transfer, Acad. of Sci., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.44, no.1, p.62-7 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.75-80 (Jan. 1983). [received: Sept. 1983]
Presents a numerical simulation of the countercurrent wave of an exothermal reaction and the dependences of its characteristics on the 'input' parameters of the system. (4 refs.)

107271 The dispersion of a reactive species (atomic hydrogen) in a flowing gas. T.Boddington, A.A.Clifford (Dept. of Phys. Chem., Univ. of Leeds, Leeds, England).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1796, p.179-96 (8 Sept. 1983).
Recent studies of the dispersion of hydrogen atoms in a flowing gas have necessitated the solution of the differential equation governing the dispersion of a very reactive species in a medium flowing along a uniform circular tube with appropriate boundary conditions. The treatment takes into account irreversible loss of the reactive species by reaction on the tube wall and also their reversible adsorption and desorption at the wall. It is also shown how first-order reaction in the moving medium, 'slip' of the boundary layer, and a pressure drop along the tube can be taken into account. (13 refs.)

Effect of phase velocity difference on the turbulent structure of a jet carrying heavy impurities .... See Entry 107112

Fast deflagration waves .... See Entry 107171

Dynamics of gas combustion in closed vessels with various laws of flame-surface variation .... See Entry 109742

Flame zone in gas combustion in an inert porous medium .... See Entry 109743

Experimental study of stationary flame propagation in a tube under conditions of weightlessness .... See Entry 109744

Method of calculating limits of stabilization of a flame of inhomogeneous mixtures traveling over a poorly streamlined body .... See Entry 109746

Luminescence of I_2/Ar mixture flowing out of a quenching setup at atmospheric pressure .... See Entry 109749

47.80 INSTRUMENTATION FOR FLUID DYNAMICS

107272 Proposal for the measuring molecular velocity vector with single-pulse coherent Raman spectroscopy. C.Y.She (Phys. Dept., Colorado State Univ., Fort Collins, CO, USA).
Appl. Phys. B (Germany), vol.B32, no.1, p.49-52 (Sept. 1983).
Methods for simultaneous measurements of more than one flow velocity component using coherent Raman spectroscopy are proposed. It is demonstrated that using a kilowatt broad-band probe pulse (3-30 GHz) along with a megawatt narrow-band pump pulse (~100 MHz), coherent Raman signal resulting from a single laser pulse is sufficient to produce a high-resolution Raman spectrum for a velocity measurement. (17 refs.)

107273 Physical modelling of multi-phase flow.
Control & Instrum. (GB), vol.15, no.7, p.37, 39, 41, 43, 45 (July 1983).
Forms a progress report on measurements using turbine, vortex and electromagnetic flowmeters in a vertical upward water flow with small amounts (up to 14% by volume) of air entrained. The results are given as errors in volumetric flow rate. The aim is to establish an envelope bounding the likely errors due to two-phase flow and for this reason, rather than a long upstream settling length, two perforated plates have been used to vary the flow pattern and air distribution. The rig is described and the behaviour of each flowmeter is dealt with in turn. (9 refs.)

107274 Cross-correlation helps to solve the hard ones.
Control & Instrum. (GB), vol.15, no.7, p.47, 49 (July 1983).
The multichannel correlation flowmeter described can prove beneficial when it is hard or impossible to meter accurately. (no refs.)

107275 The many benefits of ultrasonic flowmeters. D.Gerrard.
Control & Instrum. (GB), vol.15, no.7, p.51, 53 (July 1983).
Characteristics, advantages and disadvantages of 'Doppler shift' and 'time of flight' types of ultrasonic flowmeters are introduced. (no refs.)

107276 A lithium sulfate pulse-pressure transducer in a gasdynamic experiment. M.K.Berezkina, I.V.Plotnikov.
Combust. Explos. & Shock Waves (USA), vol.18, no.6, p.666-70 (Nov.-Dec. 1982). Translation of: *Fiz. Goreniya & Vzryva (USSR)*, vol.18, no.6, p.63-8 (Nov.-Dec. 1982).
Results with three gasdynamic processes show that a built-in transducer (for measuring pulse pressures in shock tubes), made of lithium sulfate has adequate sensitivity, low dynamic error, high time resolution, high natural frequency, and stable characteristics, while it introduces no perturbations in the flow. (8 refs.)

107277 Calibration of rolling ball viscometer in the intermediate Reynolds number region. M.A.Hasan (Karachi Labs., Pakistan Council of Sci. & Industrial Res., Karachi, Pakistan).
Can. J. Chem. Eng. (Canada), vol.61, no.4, p.607-11 (Aug. 1983).
The applicability of proposed correlations for the calibration of a rolling ball viscometer in the intermediate Reynolds number region ($0.3<Re\leq 1000$) has been studied. The constants for the equation correlating ball roll time with viscosity have been derived and compared with their experimental values. The dependency of these constants on temperature and on the dimensions of the viscometer has also been described which may help in the optimal design of a rolling ball viscometer. (15 refs.)

107278 Analysis of ultrasonic correlation flowmeters for pulp suspension. J.S.Tornberg, M.Karras, E.M.Harkonen, O.Hirsimaki (Dept. of Electrical Engng., Univ. of Oulu, Oulu, Finland).
IEEE Trans. Sonics & Ultrason. (USA), vol.SU-30, no.4, p.264-9 (July 1983).
A transit time flow measurement system using ultrasonics and cross correlation is studied and constructed for use in the pulp and paper industry. The primary signals are produced by the modulation action of suspension particles on the intensity of two ultrasonic beams. Both continuous and pulsed intensities are used. The signals may be received either as attenuated beams penetrating the tube or as echoes scattered from the backwall. The intensity of the Doppler-shifted frequency of the scattered ultrasound is also used as a primary signal in order to avoid the ringing of the transmitted frequency within the crystal and pipe wall. The radial flow profile, the nature of the correlation method and the frequency filtering of the primary signals make the correlation function asymmetric and cause measurement errors. The system has been used for the measurement of pulp suspension in various cases, and some results are presented. (14 refs.)

107279 Instrument for automatic determination of the direction of the velocity vector of a moving medium. P.I.Savostenko, V.I.Tumanov (Donets State Univ., Donets, Ukrainian SSR).
Instrum. & Exp. Tech. (USA), vol.25, no.6, pt.2, p.1527-30 (Nov.-Dec. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.6, p.190-3 (Nov.-Dec. 1982).
This instrument for automatic determination of the azimuthal velocity vector of a moving gaseous or liquid medium has been built on the basis of an F-210 digital voltmeter and a B3-19M calculator. The sensor is a split film sensor with hot wire anemometers. The maximum absolute directional error is $\leq 5°$ for angles in the range 0-360° and velocities in the range 1-20 m/sec with the velocity vector deviating no more than 10° from the horizontal. The rate at which the direction is indicated is no less than 1 count in 4-5 sec and may vary. (6 refs.)

107280 A Couette cell with fixed stator alignment for the measurement of flow modified permittivity and electroviscosity. H.Block, E.M.Gregson, A.Qin, G.Tsangaris, S.M.Walker (Inorganic, Phys. & Industrial Chem. Dept., Univ. of Liverpool, Liverpool, England).
J. Phys. E (GB), vol.16, no.9, p.896-902 (Sept. 1983).
The design features required for the construction of a Couette shear cell with fixed stator-rotor alignment to measure the permittivity of liquids in flow is discussed. Details of the construction of such a cell having the capability of measuring permittivities of liquids from rest to flow rate $\lesssim 10^5$ s^{-1}, and also of measuring viscosity are presented. The provision of both macro- and micro-measuring electrodes enables the equipment to be used for low- and high-permittivity liquids including aqueous systems, at selected and well controlled temperatures. (8 refs.)

107281 On the force fluctuations acting on a circular cylinder in crossflow from subcritical up to transcritical Reynolds numbers. G.Schewe (DFVLR-Inst. fur Aeroelastik, Gottingen, Germany).
J. Fluid Mech. (GB), vol.133, p.265-85 (Aug. 1983).
Force measurements were conducted in a pressurized wind tunnel from subcritical up to transcritical Reynolds numbers $2.3\times 10^4 \leq Re \leq 7.1\times 10^6$ without changing the experimental arrangement. The steady and unsteady forces were measured by means of a piezobalance, which features a high natural frequency, low interferences and a large dynamic range. In the critical Reynolds-number range, two discontinuous transitions were observed, which can be interpreted as bifurcations at two critical Reynolds numbers. In both cases, these transitions are accompanied by critical fluctuations, symmetry breaking (the occurrence of a steady lift) and hysteresis. In addition, both transitions were coupled with a drop of the C_D value and a jump of the Strouhal number. Similar phenomena were observed in the upper transitional region between the super- and the transcritical Reynolds-number ranges. The transcritical range begins at about $Re \approx 5\times 10^6$, where a narrow-band spectrum is formed with $Sr(Re=7.1\times 10^6)=0.29$. (17 refs.)

107282 Particle-sampling statistics in laser anemometers: sample-and-hold systems and saturable systems. R.V.Edwards (Chem. Engng. Dept., Case Western Reserve Univ., Cleveland, OH, USA), A.S.Jensen.
J. Fluid Mech. (GB), vol.133, p.397-411 (Aug. 1983).
The output statistics of a laser anemometer operating in a low particle density are discussed. A rigorous derivation is given for the influence of two popular

data-handling algorithms on these statistics. In particular it is shown that the measured statistics can differ from those of the flow statistics and from the particle-arrival statistics. The variables that control the statistical regime are derived and quantitative estimates are given for their ranges of influence. The first system discussed is a sample-and-hold system where the output is a piecewise-continuous signal obtained by holding the last processor measurement until a new one is obtained. The second system is one where an attempt is made to store all the measurements for processing, but which contains a rate-limiting device. Because of this device, some measurements may be lost when the particle rate is high. This system is referred to as a saturable system. (13 refs.)

107283 Measurement of unsteady gas flow under anisothermic conditions. L.V.Gulin, V.F.Shipitsin, P.V.Volobuev (Sverdlovsk Engng. Pedagogical Inst., Sverdlovsk, USSR).
J. Eng. Phys. (USA), vol.44, no.1, p.59-61 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.71-4 (Jan. 1983). [received: Sept. 1983]
The authors describe a dynamic method for measuring unsteady gas flow under anisothermic conditions. They show that the value of the flow sensitivity determined under isothermal conditions can be used for molecular flow. (3 refs.)

107284 Calibration of hot-wire probes and determination of their directional sensitivity by numerical methods. L.Paulsen (Daimler-Benz AG, Stuttgart, Germany).
Mess. & Pruef. (Germany), vol.19, no.6, p.342-5 (June 1983). In German.
A method is described whereby the calibration curve of a hot-wire sensor is approximated numerically by polynomial functions. It is shown that five parameters are needed to describe the directional sensitivity of the probe, and a method is suggested to determine these parameters from measurements in a flow of known velocity at five different positions of the probe. The method is particularly suitable and convenient to use in conjunction with online computer processing. (7 refs.) *S.R.*

107285 Effect of wall scattering on SNR in off-axis differential-type laser Doppler velocimetry. H.Mishina (Dept. of Imaging Sci. & Technol., Chiba Univ., Chiba-shi, Japan), K.Takahashi, T.Asakura.
Opt. & Quantum Electron. (GB), vol.15, no.5, p.419-31 (Sept. 1983).
Though various properties and applications of laser Doppler velocimetry have been extensively studied in the past decade, there is little discussion on the effect of light scattering from the surface of a cell on Doppler beat signals or on methods of reducing it. In this paper, the effect of light scattering from the surface of the cell is treated as a background noise and is studied theoretically and experimentally on the detecting process of Doppler beat signals in off-axis differential-type laser Doppler velocimetry. Laser Doppler velocimetry of an off-axis type is verified to be effective for measurement of the flow velocity in the vicinity of a scattering wall. The effect of the light scattered from the wall surface on the signal-to-noise ratio (SNR) of Doppler beat signals is discussed in detail. The minimum distance, which is close to the wall and at which good Doppler beat signals can be obtained, is defined and determined quantitatively. This minimum distance is found to be strongly affected by the off-axis angle of the detecting optical system. (5 refs.)

107286 Laser-induced fluorescence technique for velocity field measurements in subsonic gas flows. B.Hiller, J.C.McDaniel, E.C.Rea,Jr., R.K.Hanson (Dept. of Mech. Engng., Stanford Univ., Stanford, CA, USA).
Opt. Lett. (USA), vol.8, no.9, p.474-6 (Sept. 1983).
A nonintrusive optical technique is reported for multiple-point velocity measurements in subsonic flows. The technique is based on the detection of fluorescence from a Doppler-shifted absorption line of seeded iodine molecules excited at a laser frequency fixed in the wing of the line. Counterpropagating laser sheets are used to illuminate the flow, in the present case a nitrogen round jet, thereby eliminating the need for an unshifted reference signal. The fluorescence is detected simultaneously at 10000 points in a plane of the flow using a 100×100 element photodiode-array camera. The velocity at each point is computed from four successive camera frames, each recorded with a different beam direction. The measured mean velocities between 5 and 50 m/sec agree well with data from the literature. (8 refs.)

107287 Laser-2-focus velocimeter and wall scattering. H.Hayami, H.Ueki, H.Higashimori, Y.Senoo.
Rep. Res. Inst. Ind. Sci. Kyushu Univ. (Japan), no.74, p.159-66 (1983). In Japanese.
It is demonstrated by Schodl (1977) that a laser-2-focus velocimeter (L2FV) with high S/N ratio is of great advantage to make measurements of the magnitude and direction of flow in a rotating impeller. In the case of a narrow passage of the centrifugal impeller however, the S/N ratio deteriorates for measurement near walls owing to light scattering. A L2FV is developed and the measurement of velocity distribution is pursued in a narrow passage, similar to that of centrifugal impeller, and some attempts are made to reduce the unmeasurable zone near the walls due to strong scattering. (7 refs.)

107288 On automatic measurements of very low sedimentation velocity. H.Ueki, H.Hayami.
Rep. Res. Inst. Ind. Sci. Kyushu Univ. (Japan), no.74, p.249-54 (1983). In Japanese.
An automatic measuring system using a laser Doppler velocimeter is developed, in order to make measurements of very low sedimentation velocity of seeding particles for laser velocimetry. The details of the system are presented. Furthermore, the sedimentation velocities of seeding particles of SiO_2 with individual particle diameter of $0.04\ \mu m$, which are agglomerated to form flocks of about $2\ \mu m$ in mean diameter, are measured, and fidelity of the motion of particles to flow is discussed. (5 refs.)

107289 New developments in magnetic flow measurement in partly filled open channels. K.W.Bonfig (Inst. fur Messtech., Univ. GH Siegen, Siegen, Germany).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.61-70 vol.2
To measure flow in open channels it is necessary to know both the velocity of flow and the cross-section of the fluid. The volumetric flowrate is gained by multiplying an electrical signal proportional to the filled cross-section with an electrical signal proportional to the mean velocity of the fluid. In the concept described the signal proportional to the mean velocity of the fluid is obtained by magnetic flow measurement by means of a keyed DC-field. The signal proportional to the cross-section which is filled by the fluid is gained by using a circuit consisting of conducting wires, electrodes and the surface of the conducting fluid. Because of the rate of change of the magnetic field, which penetrates this circuit, a voltage is induced in this circuit which is proportional to the area and to the strength of this field. (12 refs.)

107290 Possibilities of improving the accuracy of electromagnetic flowmeters through the influence of geometrical parameters and field configuration. I.D.Velt, Yu.V.Mikhailova (Sci. Res. Inst. of Thermal Power Instrument Construction, Moscow, USSR).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.71-8 vol.2
The influence of insulated layer on the electromagnetic flowmeter output signal has been studied. This influence is simply described by means of a flowmeter weight function. The calculation is easily accomplished in two cases, when the insulated layer length is small compared to the flowmeter diameter. In a general case the problem is reduced to integral equation solution. It has been obtained by means of the perturbation theory. (1 ref.)

107291 A vortex ring shedding flowmeter. M.Takamoto, K.Komiya (Nat. Res. Lab. of Metrology, Ibaraki, Japan).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.87-96 vol.2
The vortex shedding from a ring was studied. A remarkably regular sinusoidal velocity fluctuation was detected at the center of the wake behind the ring, and a stable vortex ring shedding from the ring was recognized through flow visualization. A flowmeter and a velocimeter applying the vortex ring shedding phenomenon were developed which can be used for measuring a turbulent pipe flow and a low velocity flow, respectively. (90 refs.)

107292 Momentum type flowmeter. Improvement in dynamic characteristics. K.Yamamoto, A.Nomoto (Faculty of Engng., Tokyo Agricultural & Technol. Univ., Tokyo, Japan).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.97-106 vol.2
The momentum type flowmeter consisting of two flexibly supported U-tubes features simple construction without any elements within a conduit. The system is nonlinear and of the second-order type. For improving the dynamic characteristics, the static pressure is detected directly by means of a semiconductor transducer instead of a pressure sensing U-tube system. Deviation in transient response can this be reduced and settling time decreased to less than 0.1 sec. (2 refs.)

107293 The influence of flow distortion on the accuracy of non-intrusive flowmeters. A.Lauber (Dept. of Phys. & Measurement Technol., Linkoping Inst. of Technol., Linkoping, Sweden).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.107-11 vol.2
Analyses the influence of flow distortion on the measuring accuracy of non-intrusive flowmeters of the inductive, acoustic (time-of-flight and Doppler) and correlation types. In a fully developed flow, inductive flowmeters will always measure correct total flow, while acoustic time-of-flight flowmeters may be designed to exhibit an error $<1\%$ under similar conditions. When exposed to distorted flow, all now available types of non-intrusive flowmeters may exhibit sizeable errors. (17 refs.)

107294 A novel fluid flow measuring device employing pn-heat pulses. W.Witte, P.W.Baier (Fachbereich Elektrontech., Univ. Kaiserslautern, Kaiserslautern, Germany).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.159-67 vol.2
Deals with the volume flow measurement of laminar fluid flows based on a transit time measurement of tagged fluid particles by correlation. The tagging is done by means of low-intensity heat pulses constituting a binary pseudo-noise sequence (pn-seuenc) independent of the temperature of the flow medium. (5 refs.)

107295 Velocity measurements of non-steady one-phase flows by correlation techniques. C.Koppermann (Inst. fur Mess- und Regelungstech., Univ. Karlsruhe, Karlsruhe, Germany).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.169-76 vol.2
Application of cross-correlation methods to one-phase flows is possible only if suitable statistical signals can be detected. An optical sensor is described which uses the variations of the refractive index occurring especially in mixtures of hydrocarbons. Because of the high bandwidth of the sensor signals and the small transit-times a very fast measurement results. Using a closed-loop tracking correlator the sensor system is qualified to measure non-steady flows in a high measurement range. (5 refs.)

107296 Transit time measurement of density fluctuations for the determination of the mean flow velocity in dense-phase fluidized conveying channels. H.P.Greiner (Inst. fur Prozessmesstech., Univ. Karlsruhe, Karlsruhe, Germany).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.177-86 vol.2
Describes a new injection method for the determination of the mean velocity of flow of bulk materials in dense-phase fluidized conveying channels. The transit time of specially generated air pulses is analyzed. The density fluctuations are measured with new capacitive sensors. A mathematical model is developed, which describes the behavior of the density fluctuations in the fluidized mass flow. The injection method is used for the continuous mass flow measurement in dense-phase fluidized conveying channels. (5 refs.)

107297 Capacitive sensors for solids flow measurement by correlation methods. G.Schneider, W.Bernard, F.Mesch (Inst. fur Mess- und Regelungstech., Univ. Karlsruhe, Karlruhe, Germany).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.187-93 vol.2
Describes robust transducers which are well suited for solids flow measurement by correlation techniques. They consist of a capacitive sensor having a high degree of interference immunity and a low frequency measurement bridge. The development started with a transformer-ratio-arm bridge from which a transformer-free bridge was derived. Capacity changes of 10^{-15}F were resolved with good reproducibility. By applying these transducers to the

velocity measurement of solids in a pneumatic conveyor, very good cross-correlation was obtained. (5 refs.)

107298 Sources of error and their minimisation in ultrasonic cross correlation flowmeters. J.Coulthard, R.P.Keech, S.T.Olszowski (Dept. of Mech. Engng., Teesside Polytech., Middlesbrough, England).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.195-204 vol.2
Ultrasonic cross correlation flowmeters offer an attractive alternative to magnetic flowmeters in two-phase flow applications and in pipe diameters above 300 mm. Experience in applying prototype flowmeters to industrial flow situations revealed three main sources of error arising from ultrasonic design, correlator design and fluid flow properties. The nature of these errors and their minimisation are described. (7 refs.)

107299 Systematic errors in cross-correlation velocity measurements. R.Rell (School of Control Engng., Univ. of Bradford, Bradford, England).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.205-14 vol.2
Space-time intensity correlations are derived for a frozen tracer pattern and a simple, nonfrozen pattern formed by tracer particles with independent, random velocities. The transit time correlation function used in velocity measurement is shown to be the convolution of this pattern intensity correlation with a velocimeter response function describing the spatial and temporal filtering performed by the velocimeter sensors. Effects of pattern and velocimeter parameters on the apparent pattern velocity are investigated. Systematic errors exceeding 20% are possible in uncalibrated measurements while errors of 10% can occur, even after calibration, because of changes in the trace pattern. (3 refs.)

107300 Vortex signal analysis. H.Ihalainen, J.Halttunen (Measurement Engng., Tampere Univ. of Technol., Tampere, Finland).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.215-20 vol.2
Describes the features of the vortex indication signal of the vortex flowmeter. As a result of the analysis settling time of the meter is estimated. The unequally spaced sampling of the frequency signal is applied to the analysis. (no refs.)

107301 Measurement of non-stationary fluid parameters by Kalman-filters. T.Weber (Inst. fur Mess- und Regelungstech., Univ. Karlsruhe, Karlsruhe, Germany).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.221-9 vol.2
Measurement of non-stationary fluids is considered. Well known sensor-configurations are used for dynamic measurements with the aid of modern signal processing methods which were developed to estimate dynamic parameters. The methods described are compared with those used previously. (7 refs.)

107302 Measuring the velocity distribution of particles dispersed in a flow by an ultrasonic Doppler anemometer. H.Braun (Inst. fur Mess- und Regelungstech., Univ. Karlsruhe, Karlsruhe, Germany).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.231-40 vol.2
Presents theoretical and experimental investigations of ultrasonic Doppler anemometry. The spatial character of the considered phenomenon is discussed. It is shown that the power spectrum of Doppler signals and the velocity distribution of the particles are closely related. On account of good experimental results, the usefulness of this method, especially for measurements in chemical reactors, can be expected. (9 refs.)

107303 A computer controlled laser-Doppler anemometer for flow rate measurement. G.Taux (Phys.-Tech. Bundesanstalt, Braunschweig, Germany).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.241-9 vol.2
Describes a new flow test rig at the PTB for precise flow rate measurements. The fundamental principles of the laser Doppler anemometry (LDA) are given and a specially designed two-colour LDA is described which allows one to measure two orthogonal velocity components in a nozzle flow. The LDA system is mounted on a three dimensional NC-controlled (XYZ) traverse. The electronic data processing systems consist of two transient recorders, computer controlled variable bandpass filters and a digital computer for the final digital data evaluation of the flow velocity. (4 refs.)

107304 The LADO-II laser Doppler anemometer. Design and application. N.Feistauer (Jenoptik Jena GmbH, Jena, Germany), H.E.Albrecht.
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.251-6 vol.2
The state of laser Doppler anemometry (LDA) in the CMEA, represented by the LADO-II system, a joint development with the Siberian Branch of the Soviet Academy of Sciences, is described. The authors briefly outline the field of LDA applications, describe the concept and design of the LADO-II system, and report on three different applications illustrating the system's flexibility of use. (12 refs.)

107305 Measurement of instantaneous flow rate through estimation of velocity profiles. M.Uchiyama, K.Hakomori (Dept. of Precision Engng., Tohoku Univ., Sendai, Japan).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.261-70 vol.2
Describes a new method to measure the instantaneous flow rate of unsteady flows in a circular pipe by estimating the velocity profiles of the flows. The estimation problem is formulated as a discrete Kalman filter problem after the dynamics of the velocity profile variation is approximated by a finite-dimensional model. An instantaneous flowmeter consisting of a laser Doppler velocimeter and an eight-bit microcomputer which implements the solution has been successfully developed. (6 refs.)

107306 A non-invasive flowmeter based on electrical conductivity measurements. A.Longoni, C.Bussolati, G.Franceschini (Lab. di Elettronica, Politecnico di Milano Sezione di Brescia, Brescia, Italy).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.271-7 vol.2
A non-invasive flowmeter based on measurements of the random fluctuations of the conductivity of the moving fluid is described. A new circuit capable of detecting fluctuation of the order of 10^{-4} of the mean value has been developed. The circuit can be described as a 'lock-in' amplifier with a feedback loop in which the output signal, suitably averaged, is synchronously modulated and subtracted from the input signal. The fluid velocity is evaluated by using cross-correlation techniques. (5 refs.)

107307 Ultrasonic measurement of volume flow independent of velocity distribution. H.Lechner (Landis & Gyr AG, Zug, Switzerland).
Technological and Methodological Advances in Measurement. Acta IMEKO 1982. Proceedings of the 9th IMEKO Congress of the International Measurement Confederation, Berlin, Germany, 24-28 May 1982 (Amsterdam, Netherlands: North-Holland 1983), p.279-88 vol.2
In ultrasonic flow metering based on transit time differentials, pairs of acoustic signals are simultaneously exchanged between two locations in a measuring tube, arranged so that one signal travels upstream and the other downstream. The propagation times of the two signals are different and the difference can be used as a measure of the flow. It is shown that a very accurate measurement of the total flow rate, independent of the flow's profile, can be achieved when the tube is utilized as an acoustic waveguide, provided plane waves are excited. (2 refs.)

Real-time measurements of spatial velocity distribution with a laser Doppler imaging system .... See Entry 105311

A digital technique for the simultaneous measurement of streamwise and lateral velocities in turbulent flows .... See Entry 107110

Evaporative convection in minute drops on a plate with temperature gradient .... See Entry 107128

Mechanism for transition to turbulence in buoyant plume flow .... See Entry 107129

Experimental study of viscoelastic effects in a cylinder-plane lubricated contact .... See Entry 107198

An experimental investigation of laminar axisymmetric submerged jets .... See Entry 107206

Speckle velocimetry study of vortex pairing in a low-Re unexcited jet .... See Entry 107210

Motion of fluid particles in perturbed shear flows .... See Entry 107214

Behaviour of vapour bubbles growing at a wall with forced flow .... See Entry 107240

Measurement of flow rate through a pipe by external heating .... See Entry 107258

Determination of the first and second normal stress differences in the truncated-cone-and-plate apparatus. I. Measurements on a polyisobutylene/decalin solution .... See Entry 107798

47.90 OTHER TOPICS IN FLUID DYNAMICS

107308 Slow viscous flow around an inclined fence on a plane. Jae-Tack Jeong (Dept. of Mech. Engng., Korea Advanced Inst. of Sci. & Technol., Seoul, Korea), Moon-Uhn Kim.
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2356-63 (July 1983).
Two-dimensional slow viscous flow around an inclined fence on an infinite plane is investigated on the basis of the Stokes approximation. A formal expression for the flow is obtained by solving a pair of simultaneous Wiener-Hopf equations. The force and moment exerted on the fence are calculated and features of the flow are discussed. (7 refs.)

50.00 FLUIDS, PLASMAS AND ELECTRIC DISCHARGES

(for fluid dynamics, see 47.; for the physics of condensed matter, see 60. and 70.)

51.00 KINETIC AND TRANSPORT THEORY OF FLUIDS; PHYSICAL PROPERTIES OF GASES

51.10 KINETIC AND TRANSPORT THEORY

107309 Dynamic equation of state of a gas containing vaporizing droplets. G.P.Yasnikov, V.S.Belousov (S.M. Kirov Ural Polytech. Inst., Sverdlovsk, USSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1207-12 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.733-40 (Nov. 1982). [received: Sept. 1983]
On the basis of the relaxational formalism of nonequilibrium thermodynamics, a differential equation is obtained relating the pressure and volume of a gas containing vaporizing droplets. The relaxation time is calculated. (13 refs.)

107310 Constructing a single equation of state for gas and liquid by the method of minimizing the sum of squares of the relative deviations. B.A.Grigor'ev, S.A.Plotnikov, D.S.Kurumov (M.D. Millionshchikov Grozny Petroleum Inst., USSR).
J. Eng. Phys. (USA), vol.44, no.1, p.96-9 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.114-18 (Jan. 1983). [received: Sept. 1983]
The use of the sum of squares of the relative deviations as the minimization criterion in the scheme of the least-squares method is proposed for the construction of a single thermal equation of state. (6 refs.)

107311 Self-diffusion of spheres in a concentrated suspension. C.W.J.Beenakker, P.Mazur (Inst.-Lorentz, Rijkskuniv. te Leiden, Leiden, Netherlands).
Physica A (Netherlands), vol.120A, no.1-2, p.388-410 (1983).
The authors calculate the concentration-dependence of the short-time self-diffusion coefficient $\mathbf{D}_s$ for spherical particles in suspension. The analysis is valid up to high densities and fully takes into account the many-body hydrodynamic interactions between an arbitrary number of spheres. The importance of these many-body interactions can be inferred from the calculation of the second virial coefficient of $\mathbf{D}_s$. (26 refs.)

107312 Milne problem for a hard sphere Rayleigh gas: a study based on the Fokker-Planck equation. S.Waldenstrom, K.J.Mork, K.Razi Naqvi (Dept. of Phys., Univ. of Trondheim, Trondheim, Norway).
Phys. Rev. A (USA), vol.28, no.3, p.1659-61 (Sept. 1983).
The Milne problem for a hard-sphere Rayleigh gas is studied by solving the stationary Fokker-Planck equation according to the method of moments; the results, obtained with only a modicum of effort, are in excellent agreement with a recent treatment, based on the Boltzmann equation. The belief that the one-dimensional Fokker-Planck equation is appropriate for solving this problem is not supported by the analysis. (19 refs.)

107313 Self-consistent kinetic theory for the Lorentz gas. E.Leutheusser (Dept. of Nuclear Engng., MIT, Cambridge, MA, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1762-73 (Sept. 1983).
A new kinetic theory for a particle moving in a random array of static spherical scatterers is derived. By decoupling a higher-order dynamical correlation function, a kinetic equation is obtained comprising known approximations like ring, repeated-ring theory, and their self-consistent versions and, in particular, the equivalence of a recent mode-coupling theory and self-consistent ring theory is established. Vertex corrections, as represented by a new class of collision sequences, are shown to be essential for the Lorentz gas. New results for the Burnett coefficient are also presented. (29 refs.)

107314 Topoenergetic aspects of quenching processes of atomic and molecular excited species in rarefied gases. G.Dragan (Inst. of Chem. Res., Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.5, p.389-403 (1983).
The universal representation (UR) of kinetic data associated to non-equilibrium systems, and established in the framework of the topoenergetic theory of composite systems, is applied to deactivation processes of atomic and molecular excited species in rarefied gas phases. Three distinct cases are considered in which the driven potential is the temperature, concentration and energy level of excited species, respectively, and experimental conditions for which UR can be applied are discussed in detail. For the last case this manner of data representation is strongly argued by the recent exponential scaling law empirically established. The affine parameters resulted according to UR define both the individual behaviour of an excited species-quencher system and a group of excited species and/or quenchers in the framework of a measuring system and this means that UR can define the ontogeny and respectively the phylogeny of the measuring system. (23 refs.)

Vapor-liquid equilibria calculations by means of an equation of state .... See Entry 107856

Modified Redlich-Kwong equation of state for saturated vapour-liquid equilibrium .... See Entry 107857

Revised parameters for modeling the transport of PCB components across an air water interface .... See Entry 110484

51.20 VISCOSITY AND DIFFUSION: EXPERIMENTAL

107315 Ab initio calculation of transport—orientation-phenomena (Senftleben-Beenakker effects) for HD infinitely dilute in helium. W.E.Kohler (Inst. fur Theoretische Phys., Univ. Erlangen-Nurnberg, Erlangen, Germany), J.Schaefer.
Physica A (Netherlands), vol.120A, no.1-2, p.185-212 (1983).
The effective kinetic cross sections, governing the magnetic field influences (Senftleben-Beenakker effects) on viscosity, heat conductivity, diffusion and thermal diffusion as well as flow birefringence and the collisional broadening of the depolarized Rayleigh line have been evaluated for HD infinitely dilute in He in the temperature range between 20K and 450K. Starting point was a new He-HD anisotropic interaction obtained from the ab initio He-H_2 potential surface of Meyer, Hariharan and Kutzelnigg (1980). The elements of the scattering amplitude matrix needed for the calculation of all effective cross sections have been obtained in close coupled procedures. Rotational levels of HD up to $j=5$ have been taken into account. As far as comparison with experiment is possible, full quantitative agreement is obtained. The inelastic contributions to the cross sections are shown to be mainly due to the strong $P_1(\cos\theta)$-anisotropy in the potential. (31 refs.)

107316 Diffusive separation of binary mixtures of CO_2-H_2 in a sonic-orifice expansion. T.Dwayne McCay (NASA, Marshall Space Flight Center, AL, USA), L.L.Price.
Phys. Fluids (USA), vol.26, no.8, p.2115-19 (Aug. 1983).
The separation of binary gas mixtures of carbon dioxide and hydrogen in sonic-orifice-generated free jets is investigated over a source Reynolds number range of 100 to 3000 using the well-known electron beam fluorescence technique. The lighter species, hydrogen, is chosen as the minor species in order to examine the extent of the validity of Sherman's first-order diffusive separation theory for large separation. The diffusive separation of mixtures containing approximately 2%, 5%, and 20% hydrogen in carbon dioxide is investigated by experimentally determining the relative number densities of the two species as a function of centerline axial distance within the free jets. Sherman's diffusive separation theory is applied to the jets using axial Mach number profiles which were a combination of experimental and analytical results for $\gamma=1.40$ expansions. The $\gamma=1.40$ expansion is shown to approximate the CO_2-H_2 expansion quite well, and the calculated separation agrees remarkably well with the experimentally determined values. (33 refs.)

51.30 THERMAL PROPERTIES OF GASES

107317 A switch function applied to the thermodynamic properties of steam near and not near the critical point. H.W.Woolley (Thermophysics Div., NBS, Washington, DC, USA).
Int. J. Thermophys. (USA), vol.4, no.1, p.51-95 (March 1983).
A study is presented of the still-unsolved problem of estimating thermodynamic property values in a region intermediate between the critical region in which the scaling laws apply, and regions further from critical, where classical behaviour prevails. A procedure has been developed in which a varying weighting function is used in obtaining a weighted 'average' of the scaled and the classical Helmholtz free energy. Other properties are then obtained by differentiation. It is first demonstrated that it is fundamentally impossible for the 'averaged' Helmholtz free energy and its first two derivatives to all be intermediate between the corresponding values from the scaled and the classical formulations. The procedure has been developed and tested for steam. The scaled function is the simple linear model of Murphy et al. (1975), the classical equation that of Pollak (1974, 1976). The properties of power-weighted switch functions, particularly with respect to the behaviour of higher-order derivatives, and the choice of the boundaries of the switching region, were examined in detail and optimized by proper choice of parameters. It is shown that a resonably smooth transfer from the scaled to the classical region can be achieved as far as free energy, energy, and specific heat C_v are concerned. For satisfactory behaviour of all second derivative properties, the two formulations need to be more compatible in the switching region than they are in the present case. (11 refs.)

107318 Thermal conductivity of inert gases over a wide temperature range. A.G.Shashkov, N.A.Nesterov, O.A.Kolenchits (Inst. of Appl. Phys., Acad. of Sci., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1253-60 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.788-95 (Nov. 1982). [received: Sept. 1983]
Presents the results of correcting and correlating experimental data on the thermal conductivity of inert gases in the temperature range 90-6000K. (84 refs.)

107319 Thermodynamic analysis of the reasons for the difference between the values of the thermal conductivities of gases as measured by steady-state and transient methods. T.N.Abramenko (Appl. Phys. Inst., Acad. of Sci., Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1268-71 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.804-7 (Nov. 1982). [received: Sept. 1983]
It is shown that the effective thermal conductivities of a gas measured by steady-state and transient methods are not equal. (15 refs.)

107320 An application of a representation theorem for entropy functionals. B.Forte (Dept. of Appl. Math., Univ. of Waterloo, Waterloo, Ontario, Canada), C.C.A.Sastri.
Mol. Phys. (GB), vol.49, no.6, p.1337-40 (20 Aug. 1983).
An attempt is made to answer two apparently unrelated questions. The first question is, under what conditions are the kinetic and thermodynamic derivations of the equation of state of a perfect gas consistent? The second question concerns an expression for entropy derived earlier by the authors (1975, 1977). The expression contains a new term—the continuous analogue of the Hartley entropy—whose coefficient (c) is non-negative. The question is, are there physical systems for which $c>0$? The answer to the first question is affirmative only if $c=0$ and $u\to\infty$, where u is the maximum speed of a molecule in any direction. It is also pointed out that in the case of a non-ideal gas, the presence of a positive c would be necessary for consistency between the kinetic and thermodynamic derivations. (6 refs.)

Computer assessment of thermodynamic data .... See Entry 105315

Evaluation of spectrally-integrated radiative fluxes of molecular gases in multi-dimensional media .... See Entry 106975

Ab initio calculation of transport—orientation-phenomena (Senftleben-Beenakker effects) for HD infinitely dilute in helium .... See Entry 107315

Thermal conductivity measurement of n-butane over wide temperature and pressure ranges .... See Entry 108078

Thermal conductivity of methyl and butyl propionates at various temperatures and pressures .... See Entry 108080

51.40 ACOUSTICAL PROPERTIES OF GASES; ULTRASONIC RELAXATION

(see also 43. Acoustics; for acoustic properties of liquids, see 62.60; for ultrasonic relaxation in liquids, see 62.80)

107321 Velocity of sound in argon and in helium-argon and nitrogen-carbon dioxide gas mixtures at high pressures. Yu.L.Kachanov, B.E.Kanishchev, L.L.Pitaevskaya (M.V. Lomonosov State Univ., Moscow, USSR).
J. Eng. Phys. (USA), vol.44, no.1, p.1-4 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.5-8 (Jan. 1983). [received: Sept. 1983]
The sound velocity is measured in argon and in mixtures of helium with argon and of nitrogen with carbon dioxide at pressures up to 800 MPa and at temperatures in the range 298.16-423.16K. (7 refs.)

107322 Nonlinear tridimensional propagation of acoustic waves in radiative gas dynamics. A.Palumbo (Dipartimento di Matematica, Univ. di Messina, Messina, Italy).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.17, p.588-92 (27 Aug. 1983).
The evolution of nonlinear acoustic waves in radiative gas dynamics is investigated, without assuming any symmetry on the wave surfaces. Such waves, subject to dissipative and nonlinear effects, are asymptotically governed by a Burger-like equation. (9 refs.)

51.50 ELECTRICAL PHENOMENA IN GASES

(see also 52. Plasma and electric discharges)

107323 Electron and ion transport in gaseous methanol and water: density and temperature effects. N.Gee, G.R.Freeman (Dept. of Chem., Univ. of Alberta, Edmonton, Alberta, Canada).
Can. J. Chem. (Canada), vol.61, no.7, p.1664-70 (July 1983).
Electron and cation mobilities in methanol and water vapor measured at $293\leq T$ (K)≤ 617 were used to estimate the corresponding momentum transfer cross sections. The electron cross sections correlate with the square of the dipole moment. The onset of electron quasilocalization in the saturated vapor occurs at $n_{ql}\approx 10^{25}$ molecules/m^3 ($n_{ql}/n_c\approx 0.010$) in methanol and 3×10^{25} ($n_{ql}/n_c\approx 0.003$) in water. The Ioffe-Regel limit for quasifree states gives $n_{ql}\approx 0.36\times(Tn\mu_e)_{ql}$, which holds quite well when the gas molecules are relatively rigid. The density normalized mobility of cations $n\mu_+$ in saturated methanol vapor is constant at 1.02×10^{21} molecules/m V s up to 67×10^{25} molecules/m^3 (25 Amagats). In saturated water vapor $n\mu_+=1.87\times 10^{21}$ molecules/m V s up to 30×10^{25} molecules/m^3 (11 Amagats). (50 refs.)

107324 Molecular shape effect on electron transport in fluids: density and temperature studies in mixtures of *n*-pentane and neopentane. I.Gyorgy, N.Gee, G.R.Freeman (Chem. Dept., Univ. of Alberta, Edmonton, Alberta, Canada).
J. Chem. Phys. (USA), vol.79, no.4, p.2009-17 (15 Aug. 1983).
Electron mobility μ_0 in nonpolar and slightly polar ($D\leq 0.5$ D) hydrocarbon fluids is strongly affected by the external shape of the molecules. The mobility is large in a liquid of spherelike molecules such as neopentane. Addition of rodlike molecules such as *n*-pentane decreases μ_0, but has little effect on the

value of the threshold field for electron heating. A liquid of spherelike molecules forms a conduction band that has relatively small undulations in its lower potential surface. Addition of rodlike molecules provides orientational disorder, anisotropic polarizability, and restricted rotation, which in combination produce potential fluctuations that are durable enough to localized electrons. The maximum in μ_0 that occurs in pure liquid neopentane at 3.5×10^{27} molecule/m^3 progressively decreases in magnitude and shifts to lower densities as *n*-pentane is added; it occurs at the critical density in *n*-pentane. A plot of log μ_0 against mol.% *n*-pentane for liquid mixtures of *n*- and neo-pentane at constant T/T_c is slightly S shaped. A plot of the Arrhenius temperature coefficient E_μ against mole% *n*-pentane is S shaped in the opposite direction. At $T/T_c=0.999$ the log μ_0 plot is not S shape and the slope is much smaller than at $T/T_c\leq0.92$; the molecular shape effect is minimal in the critical fluids and dense gases, $1.0\geq n/n_c\geq0.3$. Quasilocalization occurs to a similar extent in all gases at the same n/n_c and T/T_c. In the low density gases the molecular shape effect is the opposite of that in dense liquids; at electron energies <0.10 eV the spherelike neopentane has a larger scattering cross section than does its nonspherelike isomer *n*-pentane. In an equimolar mixture the stronger scatterer dominates the electron behavior, which means *n*-pentane in the liquid and neopentane in the normal gas. (39 refs.)

107325 Electron mean energy, secondary ionisation coefficients and $(E/p)_{crit}$ in binary mixtures of SF_6-N_2 and CCl_2F_2-N_2. M.C.Siddagangappa, C.S.Lakshminarasimha, M.S.Naidu (Dept. of High Voltage Engng., Indian Inst. of Sci., Bangalore, India).
J. Phys. D (GB), vol.16, no.9, p.1595-601 (14 Sept. 1983).
Measurements of the ratio of diffusion coefficient to mobility (D/μ) of electrons in SF_6-N_2 and CCl_2F_2-N_2 mixtures over the range $80<E/p<200$ (where E is the electric field in V cm^{-1} and p is the pressure in Torr reduced to 20°C) are reported. Values of $(E/p)_{c.mix}$ (the critical E/p of the mixture, where $\alpha=\eta$), and the electron mean energies $\bar{\epsilon}_{c.mix}$ corresponding to $(E/p)_{c.mix}$, are found to vary with the percentage of the electronegative gas in the mixture (F) according to the following relationship: $(E/p)_{c.mix}=(E/p)_{c.N(2)}+[(E/p)_{c.A}-(E/p)_{c.N(2)}]\ [1-\exp(-\beta F/100-F)]$ and $\bar{\epsilon}_{c.mix}=\bar{\epsilon}_{c.N(2)}+(\bar{\epsilon}_{c.A}-\bar{\epsilon}_{c.N(2)})\ [1-\exp(-\beta F/100-F)]$ where A refers to the attaching gas, either SF_6 or CCl_2F_2 and β is a constant, equal to 2.43 for SF_6 mixtures and 5.12 for CCl_2F_2 mixtures. In the present study, it has been possible to show that β is indeed to a factor of synergism. Estimated γ values (secondary ionisation coefficients) did not show any significant variation with F for $F<50$. (25 refs.)

107326 Ion mobilities and clustering in SF_6 at high pressures. J.de Urquijo-Carmona (Inst. de Fisica, Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
J. Phys. D (GB), vol.16, no.9, p.1603-9 (14 Sept. 1983).
Using a time-resolved technique (uniform field), ion transients in SF_6 at low E/p_{20} (2.5-80 V cm^{-1}Torr^{-1}) and a high gas pressures (70.1, 192.8 Torr) have been analysed by curve fitting to an expression derived from a simplified discharge scheme which considers complete stabilisation of unstable $(SF_6^-)^*$, followed by a saturated reaction leading to the formation of predominantly $SF_6^-(SF_6)$ clusters. Reduced mobilities for this ion are reported, together with an 'apparent' stabilisation rate constant. (13 refs.)

107327 Fast gas-ionization wave in a laser beam. V.I.Fisher, V.M.Kharash (Astron. Obs., Odessa State Univ., Odessa, Ukrainian SSR).
Sov. Phys.-JETP (USA), vol.83, no.5, p.1004-9 (Nov. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.5, p.1738-46 (Nov. 1982). [received: Sept. 1983]
The threshold intensity of laser radiation corresponding to the appearance of a fast ionization wave is determined. The velocity of the nonstationary motion of the plasma front is calculated. The nonstationary motion is characterized by an increase of the front velocity with increase of the gas pressure and this distinguishes it from stationary regimes. The dependences of the front velocity and of plasma temperature behind the front on the laser beam radius are found for the stationary motion of the fast ionization wave. The results of the calculations are in good agreement with the experimental data. (19 refs.)

Membrane inlet for ion mobility spectrometry (plasma chromatography) .... See Entry 105413

Electron transport parameters and excitation rates in argon .... See Entry 106602

Study of electron attachment in air during prolonged interaction with an electron beam .... See Entry 106619

Electrodeless breakdown in elliptically polarized fields at 60 Hz .... See Entry 107452

The extremal nature of the dependence of the formation time of breakdown on the magnetic field strength .... See Entry 107471

51.60 MAGNETIC PHENOMENA IN GASES

(for liquids, see 75.)

Ab initio calculation of transport—orientation-phenomena (Senftleben-Beenakker effects) for HD infinitely dilute in helium .... See Entry 107315

51.70 OPTICAL PHENOMENA IN GASES

(for liquids, see 78.)

107328 Experimental research on optical properties of high temperature air in shock tube. Li Hongde, Luo June, Li Siwen (Inst. of Mech., Acad. Sinica, Beijing, China).
Acta Opt. Sin. (China), vol.3, no.4, p.380-4 (1983). In Chinese.
Mainly presents the experimental research on the optical properties of high temperature, low density air using a 800 mm diameter shock tube and a radiometer. The experimental temperature ranges over 4380~7500K; the density ranges over $1.41\times10^{-2}\sim1.00\times10^{-1}\ \rho_0$ (ρ_0 is the standard density at sea level). The spectral wavelengths are 4300, 5400, 6400, 7200 and 10380 Å. The experimental results are compared with the theoretical and experimental results published by other countries and show a good coincidence. The characteristics of the flow field are given and the reliability of experimental results is also analysed. (12 refs.)

The fifth order susceptibility calculus of alkali metal vapours .... See Entry 106807

Picosecond air breakdown studies at 0.53 μm .... See Entry 107408

Role of accelerating processes in the formation of volume nanosecond discharges in dense gases .... See Entry 107470

The coexistence curve of GeH_4 and correction-to-scaling .... See Entry 107891

Luminescence of I_2/Ar mixture flowing out of a quenching setup at atmospheric pressure .... See Entry 109749

52.00 THE PHYSICS OF PLASMAS AND ELECTRIC DISCHARGES

(for solid-state plasma, see 72.30)

52.20 ELEMENTARY PROCESSES IN PLASMA

107329 Strong coupling effects on plasma lineshapes and Thomson scattering signals. D.B.Boercker, R.W.Lee, F.J.Rogers (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
J. Phys. B (GB), vol.16, no.17, p.3279-90 (14 Sept. 1983).
The authors use the static correlations calculated from the hypernetted chain equation for the two-component plasma in a generalised Vlasov equation to estimate the effects of strong plasma coupling on spectral lineshapes and Thomson scattering signals. The authors find Thomson scattering to be much more sensitive to such effects than the lineshapes. (21 refs.)

107330 Scattering properties and electrical conductivity for the Coulomb cut-off potential. W.D.Kraeft, M.Luft (Sektion Phys. & Elektronik, Ernst Moritz Arndt-Univ., Greifswald, Germany), A.A.Mihajlov.
Physica A (Netherlands), vol.120A, no.1-2, p.263-78 (1983).
The scattering phase shifts are determined and consequently collisional and transport cross sections. The electrical conductivity of a totally ionized plasma is determined. The resonances located near the origin of the complex momentum plane give rise to minima in the conductance. A comparison with previous results is given. (22 refs.)

Rate of nuclear fusion reaction in a magnetoplasma .... See Entry 105942

Reply to the comment 'Rate of nuclear fusion reaction in a magnetoplasma' .... See Entry 105943

Neoclassical transport in a multiple-helicity torsatron in the low-collisionality (1/ν) regime .... See Entry 107343

Statistical mechanics of a bounded, ideal magnetofluid .... See Entry 107354

Relaxation of runaway electron energies due to excitation of high frequency waves .... See Entry 107359

Particle exchange in the plug of a thermal barrier tandem mirror .... See Entry 107429

52.20F Electron collisions

107331 Suprathermal electron energy deposition in plasmas with the Fokker-Planck method. B.R.Wienke (Computing Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
J. Comput. Phys. (USA), vol.51, no.2, p.208-26 (Aug. 1983).
A one-dimensional multigroup discrete-ordinates technique for computing electron energy deposition in plasmas is detailed. The Fokker-Planck collision operator is employed in the continuous approximation and electric fields (considered external) are included in the equation. Bremsstrahlung processes are not treated. Comparisons with analytic and Monte Carlo results are given. Fits to deposition profiles and energy scaling are proposed and discussed for monoenergetic and Maxwellian sources in the range 0.150 keV, with and without uniform fields. (31 refs.)

107332 Collision operator for a strongly magnetized pure electron plasma. T.M.O'Neil (Dept. of Phys., Univ. of California, San Diego, CA, USA).
Phys. Fluids (USA), vol.26, no.8, p.2128-35 (Aug. 1983).
Collisions are discussed for a pure electron plasma which is so strongly magnetized that the Larmor radius is small compared to the classical distance of closest approach. In this regime, the most important collisions are characterized by an impact parameter which is the order of the distance of closest approach. Assuming that this distance is small compared to the interparticle spacing, a Boltzmann-like collision operator may be derived. In turn, this operator may be reduced to a Fokker-Planck operator, which is integrable. An interesting property of the collision operator results from an adiabatic invariant which is preserved during scattering. There is no energy exchange between the velocity components which are parallel to the field and the velocity components which are perpendicular to the field. This may have implications for a current effort to cool a pure electron plasma to low temperature by cyclotron radiation. (15 refs.)

Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute .... See Entry 105031

Experimental studies of electron-ion recombination .... See Entry 106586

Novel short-pulse photoionization electron source: Li $(1s2s2p)^4P^\circ$ deexcitation measurements in a plasma .... See Entry 106603

Theory of electron-atom collisions .... See Entry 106608

Electron impact excitation of ions .... See Entry 106609

Electron-impact ionization of ions .... See Entry 106610

The measurement of inelastic ion-ion and electron-ion collisions .... See Entry 106611

Potential energy curves for dissociative recombination .... See Entry 106620

Shifts of hydrogen lines from electron collisions in dense plasmas .... See Entry 107335

Collisional damping of plasma cyclotron oscillations .... See Entry 107388

Development of concentric equipotential surfaces in bumpy torus plasma .... See Entry 107422

Electron-ion and proton-ion collisions in astrophysics .... See Entry 110905

52.20H Atomic, molecular, heavy-particle collisions

107333 Reactions of carbonyl compounds and Group Ib metals in a plasma in the wake of a spark. W.L.Grady, M.M.Bursey (William Rand Kenan Jr.-Labs. of Chem., Univ. of North Carolina, Chapel Hill, NC, USA).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.247-58 (1 Sept. 1983).
The reaction of the model system of C_3H_6 and Cu to produce cationized species $C_nH_mCu^+$ in a spark source mass spectrometer proceeds through neutral organic species and Cu^+. On this basis, reactions of Cu^+, Ag^+ and Au^+ with neutral methyl, ethyl and propyl ethanoate, butanone, butanal, 2,4-pentanedione, ethanoic acid and ethanoic anhydride are compared with reactions of similar compounds with laser-generated Cu^+ in an ion cyclotron resonance spectrometer. In the wake of the spark more fragmentation of the cationized organic species is observed. The simple cationized molecule is not observed if the metal ion has low-lying excited states. (26 refs.)

107334 Reactions of Group Ib metal ions with selected hydrocarbons in the source of a spark source mass spectrometer. W.L.Grady, M.M.Bursey (William Rand Kenan Jr.-Labs. of Chem., Univ. of North Carolina, Chapel Hill, NC, USA).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.259-66 (1 Sept. 1983).
Evidence for the intervention of excited states of Au^+, Ag^+ and Cu^+ in chemical reactions is gathered from differences in the chemistry of the interaction of these ions with hexane, cyclohexene, benzene and propene, and of Au^+ only with butadiene and cyclohexane. Most ions are explained by insertions into C-C bonds; only in the case of Au^+ is there unequivocal evidence for insertion into C-H bonds. The products of decyclotrimerization reactions dominate the Au^+ and Cu^+ spectra of cyclohexene and benzene, and the Au^+ spectrum of cyclohexane. (24 refs.)

107335 Shifts of hydrogen lines from electron collisions in dense plasmas. H.R.Griem (Lab. for Plasma & Fusion Energy Studies, Univ. of Maryland, College Park, MD, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1596-601 (Sept. 1983).
The semiclassical impact-parameter method is used to calculate shifts of Lyman and Balmer lines from levels $n \leq 6$ caused by electrons in a dense plasma. Comparison with measurements and estimates of shifts due to ion quadrupole interactions indicate that shifts from distant electron-atom collisions are the major cause of observed shifts of Balmer lines. Blue shifts from ion-atom quadrupole interactions are relatively small for low series members. (25 refs.)

107336 The role of atomic collisions in fusion. D.E.Post (Plasma Phys. Lab., Princeton Univ., Princeton, NJ, USA).
Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute, Baddeck, NS, Canada, 13-26 Sept. 1981 (New York, USA: Plenum 1983), p.37-99
Atomic physics issues have played a large role in controlled fusion research. A general discussion of the present role of atomic processes in both magnetic and inertial controlled fusion work is presented. (111 refs.)

107337 Studies of ion-ion recombination using flowing afterglow plasmas. D.Smith, N.G.Adams (Dept. of Space Res., Univ. of Birmingham, Birmingham, England).
Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute, Baddeck, NS, Canada, 13-26 Sept. 1981 (New York, USA: Plenum 1983), p.501-31
The authors describe the advances that have been made in the study of thermal energy ionic recombination using the flowing afterglow/Langmuir probe (FALP) technique which has been developed and exploited during the last few years to study ionic recombination and other low-temperature plasma processes. They also briefly refer to the important contributions to ionic recombination studies which were made prior to the FALP work. (70 refs.)

Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute .... See Entry 105031

General classical scaling of electron-loss cross sections in collisions of atoms with highly charged ions .... See Entry 106579

Experimental studies of electron-ion recombination .... See Entry 106586

Novel short-pulse photoionization electron source: Li $(1s2s2p)^4P^\circ$ deexcitation measurements in a plasma .... See Entry 106603

Theory of electron-atom collisions .... See Entry 106608

Electron impact excitation of ions .... See Entry 106609

Electron-impact ionization of ions .... See Entry 106610

The measurement of inelastic ion-ion and electron-ion collisions .... See Entry 106611

Collisional damping of plasma cyclotron oscillations .... See Entry 107388

52.25 PLASMA BASIC PROPERTIES

107338 Thermodynamic parameters and mean radiation path lengths for textolite plasma. G.S.Romanov, L.K.Stanchits, K.L.Stepanov.
J. Appl. Spectrosc. (USA), vol.37, no.5, p.1229-33 (Nov. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.733-7 (Nov. 1982). [received: Sept. 1983]
Textolite is widely used as a thermoprotective structural material in various devices intended for obtaining and investigating erosional plasma with specified parameters (temperature, pressure, charged-particle concentration, spectral brightness of the radiation, etc.); however, the thermodynamic parameters of textolite plasma have only been calculated in a limited temperature range, and there are no data on the optical characteristics. In view of this, the theoretical analysis of the working conditions of these devices and the plasma parameters realized in them, as well as the interpretation of experimental data, is of approximate, mock-up type. The work outlines the results of calculating the thermodynamic and optical characteristics of the multicomponent plasma of textolite ($C_{37}H_{47}O_{16}$), in the approximation of weak nonideality, in the temperature range $\sim$1-100 eV and the density range $\rho \sim 10^{-6}$-10^{-2} g/cm^3, which allows them to be used for quantitative estimates and calculations in the most diverse of experimental conditions. (14 refs.)

107339 Electric microfield distributions in strongly coupled plasmas. C.A.Iglesias (Dept. of Maths., Rutgers Univ., New Brunswick, NJ, USA), J.L.Lebowitz, D.MacGowan.
Phys. Rev. A (USA), vol.28, no.3, p.1667-72 (Sept. 1983).
A new method is developed for calculating electric microfield distributions in a plasma. The method uses a coupling-parameter integration technique to express the Fourier transform of the microfield distribution in terms of a special pair-distribution function. An approximation of this function yielding the exact second moment of the microfield distribution gives results which agree well with computer simulations for strongly coupled one-component plasmas. (23 refs.)

107340 Effect of radiation and non-Maxwellian electron distribution on relaxation processes in an atmospheric cesium seeded argon plasma. C.A.Borghi, A.Veefkind, J.M.Wetzer (Dept. of Electrical Engng., Eindhoven Univ. of Technol., Netherlands).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.269-80 (1983).
A model, describing the time-dependent behaviour of a noble gas MHD generator plasma has been set up. With this model it is possible to calculate the relaxation for ionization or recombination as a response to a stepwise temperature development, once the initial and final conditions are given. In the model radiative transitions and a deviation from Maxwellian electron distribution are included. Radiation causes an enhancement of both the ionization relaxation time and the recombination relaxation time. A non-Maxwellian electron distribution results in an increase of the relaxation time for an ionizing plasma because of a depletion of the high energy electrons. A decrease of the relaxation time for a recombining plasma is caused by an excess of high energy electrons. The relaxation time is strongly dependent on the seed ratio and the temperature step. (11 refs.)

Statistical mechanics of two-dimensional vortex fluids or guiding center plasmas .... See Entry 105291

Zero-dimensional analysis of burn control with compression-decompression .... See Entry 106159

Photoionization by intense line radiation in laser-produced plasmas .... See Entry 106372

Fast gas-ionization wave in a laser beam .... See Entry 107327

Plasma transport in stochastic magnetic fields. III. Kinetics of test particle diffusion .... See Entry 107341

Decay of optical discharge plasma .... See Entry 107347

Statistical mechanics of a bounded, ideal magnetofluid .... See Entry 107354

Relaxation of runaway electron energies due to excitation of high frequency waves .... See Entry 107359

Beta and density limits in Tokamaks .... See Entry 107374

Plasma startup patterns in Tokamak reactors .... See Entry 107404

Dependence of loading resistance and wave structures on plasma density of ICRF wave using cold slab model .... See Entry 107405

Thermal magnetic fluctuations and anomalous electron diffusion in a mirror-confined plasma .... See Entry 107433

Transverse modes of a relativistic quantum plasma .... See Entry 107437

Spectroscopic measurements of plasma ion density by neutral beam probing .... See Entry 107441

An interferometric electron density estimate of a TE-CO_2 laser sustained plasma in front of a metallic target .... See Entry 107444

The finite collector effect in obtaining the distribution function and temperature of Maxwellian plasmas measured with plane-parallel retarding potential analysers .... See Entry 107445

Modelling of a low-pressure plasma column sustained by a surface wave .... See Entry 107462

Theoretical study of electron concentration distribution in positive column glow discharge with longitudinal gas stream .... See Entry 107466

52.25F Transport properties

107341 Plasma transport in stochastic magnetic fields. III. Kinetics of test particle diffusion. J.A.Krommes, C.Oberman, R.G.Kleva (Plasma Phys. Lab., Princeton Univ., Princeton, NJ, USA).
J. Plasma Phys. (GB), vol.30, pt.1, p.11-56 (Aug. 1983).
For pt.II see Prog. Theor. Phys. Suppl., no.64, p.137-49 (1978). A discussion is given of test particle transport in the presence of specified stochastic magnetic fields, with particular emphasis on the collisional limit. Certain paradoxes and inconsistencies in the literature regarding the form of the scaling laws are resolved by carefully distinguishing a number of physically distinct correlation lengths, and thus identifying several collisional subregimes. The common procedure of averaging the conventional fluid equations over the statistics of a random field is shown to fail in some important cases because of breakdown of the Chapman-Enskog ordering in the presence of a stochastic field component with short autocorrelation length. A modified perturbation theory is introduced which leads to a Kubo-like formula valid in all collisional regimes. The direct-interaction approximation is shown to fail in the interesting limit in which the orbit exponentiation length L_K appears explicitly. A higher-order renormalized kinetic theory in which L_K appears naturally is discussed and used to redrive more systematically the results of the heuristic scaling arguments. (47 refs.)

107342 Numerical evaluation of magnetic coordinates for particle transport studies in asymmetric plasmas. G.Kuo-Petravic, A.H.Boozer (Plasma Phys. Lab., Princeton Univ., Princeton, NJ, USA), J.A.Rome, R.H.Fowler.
J. Comput. Phys. (USA), vol.51, no.2, p.261-72 (Aug. 1983).
A numerical procedure is described for the evaluation of magnetic coordinates given a toroidal scalar-pressure plasma with an arbitrary magnetic field. The accurate representation of magnetic field strength in this way is invaluable for the calculation of drift orbits and transport in asymmetric plasmas. (13 refs.)

107343 Neoclassical transport in a multiple-helicity torsatron in the low-collisionality $(1/\nu)$ regime. K.C.Shaing (Nuclear Engng. Dept., Univ. of Wisconsin, Madison, WI, USA), S.A.Hokin.
Phys. Fluids (USA), vol.26, no.8, p.2136-9 (Aug. 1983).
For a sufficiently high number of toroidal field periods $(m/t>l)$, the magnetic field of a multiple-helicity torsatron can be reduced to a simple form such that the second adiabatic invariant J can be calculated. It is found that the particle and the heat fluxes for a multiple-helicity torsatron in the low-collisionality $(1/\nu)$ regime have the same geometric dependences. An optimization of both quantities is carried out for a given equilibrium constraint. It is shown that the transport fluxes can be smaller than those of the conventional stellarator by an order of magnitude. The effect of finite plasma beta on the neoclassical fluxes is also studied. (9 refs.)

107344 Charged particle motion near a linear magnetic null. Jin-Soo Kim, J.R.Cary (Inst. for Fusion Studies, Univ. of Texas, Austin, TX, USA).
Phys. Fluids (USA), vol.26, no.8, p.2167-75 (Aug. 1983).
Charged particle motion near the null of a two-dimensional magnetic field is studied. Specifically, the magnetic field is given by the vector potential $\mathbf{A} = \hat{z}\psi_0[(y/a)^2 + (\epsilon x/a)^2]$, in which ψ_0, a, and ϵ are constants with ϵ parameterizing the ellipticity of the flux surfaces. Conservation of canonical z momentum p_z reduces the number of nontrivial degrees of freedom to two. Scaling reduces the number of parameters in the system to two, ϵ and σ (the sign of p_z). Analytical and numerical methods are used to study the nature of orbits. The results are expressed conveniently in terms of ϵ and $Q \equiv \sqrt{2mE}/p_z$. When ϵ is unity, the additional symmetry implies integrability. When ϵ is less than unity (the case $\epsilon > 1$ is trivially related) three regimes are found: (1) for $|Q| \gg 1$ particle orbits are regular, (2) for $\epsilon^{3/2} \lesssim |Q \lesssim 1$ most particle orbits are stochastic, and (3) for $|Q| \ll \epsilon^{3/2}$ particle orbits are regular, with the third invariant being the magnetic moment. (20 refs.)

107345 A nonlinear kinetic energy principle for two-dimensional collision-free plasmas. K.Schindler (Theoretische Phys. IV, Ruhr-Univ. Bochum, Bochum, Germany), H.Goldstein.
Phys. Fluids (USA), vol.26, no.8, p.2222-6 (Aug. 1983).
A nonlinear kinetic energy principle is derived for two-dimensional collision-free plasmas and its properties are discussed. The present approach provides a simplified derivation of the small-amplitude limit derived earlier by a different technique. (11 refs.)

107346 Analysis of fast-ion velocity distributions in laser plasmas with a truncated Maxwellian velocity distribution of hot electrons. Y.Kishimoto, K.Mima (Inst. of Laser Engng., Osaka Univ., Osaka, Japan), T.Watanabe, K.Nishikawa.
Phys. Fluids (USA), vol.26, no.8, p.2308-15 (Aug. 1983).
Fast-ion production in laser plasmas with a truncated Maxwellian velocity distribution of hot electrons is investigated by using a new numerical method, namely the systematic Newton's iteration method which has been applied to nonlinear equations. The analysis of the temporal evolution of coronal plasma expansion discloses that the ion-front velocity approaches a constant value within thirty ion plasma oscillation periods, when the high-energy tail is truncated. In such a case, the maximum ion velocity is found to be proportional to the maximum energy of hot electrons. Consequently, the ion velocity distributions are steepened and truncated. Furthermore, it is found that the energy partition of the absorbed laser energy to fast energy to fast ions is appreciably reduced when the maximum electron energy is below a few times the hot-electron temperature. (20 refs.)

107347 Decay of optical discharge plasma. M.Dembinski, J.Kurzyna, Z.Szymanski (Inst. of Fundamental Technol. Res., Polish Acad. of Sci., Warsaw, Poland).
Physica B & C (Netherlands), vol.121B+C, no.3, p.441-9 (Aug. 1983).
The decay of the high pressure (7, 19 bar) optical discharge argon plasma is studied experimentally and theoretically. Time resolved spatial distributions of electron temperature and density have been measured spectroscopically giving the maximum values $T_e \approx 15000$ and $N_e \approx 8 \times 10^{17}$ cm^{-3}. The characteristic time of the decay is of the order of 10^{-4} s. The experimental results are compared with the calculations based on the solution of the simplified energy equation in the spherically symmetric case. The kinetic and diffusion terms are neglected in the energy balance. It is found that radiation and thermal conduction are the dominant energy loss mechanisms during the decay process. (28 refs.)

107348 An introduction to the theory of diffusive shock acceleration of energetic particles in tenuous plasmas. L.O'C.Drury (Max-Planck-Inst. fur Kernphys., Heidelberg, Germany).
Rep. Prog. Phys. (GB), vol.46, no.8, p.973-1027 (Aug. 1983).
The central idea of diffusive shock acceleration is presented from microscopic and macroscopic viewpoints; applied to reactionless test particles in a steady plane shock the mechanism is shown to produce a power law spectrum in momentum with a slope which, to lowest order in the ratio of plasma to particle speed, depends only on the compression in the shock. The associated time scale is found (also by a macroscopic and a microscopic method) and the problems of spherical shocks, as exemplified by a point explosion and a stellar-wind terminator, are treated by singular perturbation theory. The effect of including the particle reaction is then studied. It is shown that if the scattering is due to resonant waves these can rapidly grow with unknown consequences. The possible steady modified shock structures are classified and generalised Rankine-Hugoniot conditons found. Modifications of the spectrum are discussed on the basis of an exact, if rather artificial, solution, a high-energy asymptotic expansion and a perturbation expansion due to Blandford. It is pointed out that no steady solution can exist for very strong shocks; the possible time dependence is briefly discussed. (75 refs.)

107349 Field of a test body in a stream of charged particles. B.E.Meierovich (S.I. Vavilov Inst. of Phys. Problems, Acad. of Sci., Moscow, USSR).
Sov. Phys.-JETP (USA), vol.83, no.5, p.1016-23 (Nov. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.5, p.1756-69 (Nov. 1982). [received: Sept. 1983]
It is shown that the potential of a field created by a test body in a relativistic stream of charged particles includes not only a component which decreases rapidly because of the Debye screening, but also an oscillatory component decreasing slowly with distance and associated with the magnetic interaction between currents. An exact analytic solution is obtained of the problem of a field formed by a charged current-carrying filament placed inside a plasma with a Bennet profile. The long-range field of the interaction between charges and such a current-carrying filament, and also of the interaction of filaments with one another helps to understand better the nature of filamentation of a plasma in high-current channels. The long-range magnetic interaction should affect not only the structure properties of a plasma but also its correlation properties, as well as its thermodynamic and kinetic characteristics. (7 refs.)

Tokamak-like equilibria of relativistic electron beams .... See Entry 106690

Scattering properties and electrical conductivity for the Coulomb cut-off potential .... See Entry 107330

Suprathermal electron energy deposition in plasmas with the Fokker-Planck method .... See Entry 107331

Radial flow due to convective cells in drift waves .... See Entry 107355

Transport by weak electrostatic density drift fluctuations .... See Entry 107365

Bifurcation of thermal equilibria in ohmically heated plasmas .... See Entry 107367

Nonlinear coupling of drift waves, convective cells, and magnetic drift modes in finite-β plasmas .... See Entry 107382

Modeling TFTR plasma physics .... See Entry 107425

Enhancement of neoclassical transport coefficients by a poloidal electric field in Tokamaks .... See Entry 107427

Direct losses in the ELMO Bumpy Torus experiment .... See Entry 107428

Particle exchange in the plug of a thermal barrier tandem mirror .... See Entry 107429

Thermal magnetic fluctuations and anomalous electron diffusion in a mirror-confined plasma .... See Entry 107433

Predicted behaviour of the pumped limiter of INTOR .... See Entry 107450

52.25P Emission, absorption, and scattering of radiation

107350 Spatial resolved $K\alpha$ spectra of two-structure plasmas in a vacuum spark. S.Morita, J.Fujita (Inst. of Plasma Phys., Nagoya Univ., Nagoya, Japan).
Appl. Phys. Lett. (USA), vol.43, no.5, p.443-5 (1 Sept. 1983).
Spatially resolved Fe$K\alpha$ spectra in the wavelength range of 1.7-2.0 Å (FeII-XXVI) and 1.91-1.95 Å (FeII-XIX) are first observed in a single shot with low-resolution Johansson and high-resolution Johann type crystal spectrometers, respectively. The spectra show the evident proof that the vacuum spark plasma has two different structures. One is a thermalized point plasma ($\lesssim 10$ μm) with high temperature ($T_e \sim 2$ keV) and high density ($n_e \sim 10^{11}$ cm^{-3}). The spectrum contains X-ray lines from FeXXIII-XXVI. The other is an extended plasma (~ 3 mm) associated with nonthermal electrons, where the region of intense emission of $K\alpha$ lines from FeIII-XX shifts toward the cathode with the increase of the ionic charge. (14 refs.)

107351 Stimulated Brillouin scattering due to laser-plasma interactions. Xu Zhi-zhan, Yin Guang-yu, Zhang Yan-zhen, Lin Kang-chun (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, China).
Acta Phys. Sin. (China), vol.32, no.4, p.481-9 (April 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)* [received: Sept. 1983]
The authors' investigation indicates that if the incident laser contains distinct pre-pulse, the occurrence of stimulated Brillouin scattering under the interaction of high intensity sub-ns pulse laser with plasmas can be self-consistently confirmed. The evidence includes an anomalous increase of the fraction of incident laser energy which is backscattered into the focusing lens the red shift and broadening of spectrum of back-reflected laser, the dramatic reduction of total ion energy and fast ion emission, the enhancement of sidescattered laser light at large scattering angles and so on. (14 refs.)

107352 Experimental observation on 3/2 ω_0 harmonic emission from laser plasma. Chen Shi-sheng, Zhao Qin-chun, Bi Wu-ji, Wang Xiao-qin, He Xing-fa (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, China).
Acta Phys. Sin. (China), vol.32, no.4, p.544-7 (April 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)* [received: Sept. 1983]
The measurement on the 3/2 ω_0, harmonic emission from laser plasma has been carried out. The experimental results show that harmonic spectra has a blue-shift of about 70 Å and is broadened by about 26 Å when power density on the target surface is about 10^{14} W/cm^2. There is a slight broadening of spectra following the increase of power density on the target surface. (5 refs.)

107353 Oscillator radiation in media with periodic inhomogeneity. V.A.Buts, Yu.P.Machekhin.
Ukr. Fiz. Zh. (USSR), vol.28, no.7, p.1101-2 (July 1983). In Russian.
Investigates of weak periodic inhomogeneity of a medium on the radiation spectrum of an oscillator. It is shown that it is possible for an additional maximum to appear in the region of harmonics with high numbers, the value of which may be comparable with the maximum at the main frequency. (4 refs.) *V.G.P.*

Accurate wavelength measurements of He-like resonance lines of titanium through zinc from a high-temperature plasma .... See Entry 106339

Photoionization by intense line radiation in laser-produced plasmas .... See Entry 106372

Strong coupling effects on plasma lineshapes and Thomson scattering signals .... See Entry 107329

The origin of line-free XUV continuum emission from laser-produced plasmas of the elements $62 \leq Z \leq 74$ .... See Entry 107413

Supersonic radiation waves with motion of plasma .... See Entry 107414

Axial magnetic field measurements and the stability of a vacuum spark plasma .... See Entry 107459

Hydrogen line broadening in the presence of a magnetic field with the unified classical path theory .... See Entry 110889

52.30 PLASMA FLOW; MAGNETOHYDRODYNAMICS

(see also 47.65 Fluid dynamics)

107354 Statistical mechanics of a bounded, ideal magnetofluid. L.Turner (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
Ann. Phys. (USA), vol.149, no.1, p.58-161 (Aug. 1983).
A statistical model of a three-dimensional, incompressible, cylindrically bounded, current-bearing magnetofluid is presented for the purpose of gaining insight into the nonlinear relaxation process routinely observed in reversed-field-pinch experiments. An absolute equilibrium ensemble is utilised that incorporates energy, magnetic helicity, and magnetic flux constraints. Results are extracted only after an extensive mathematical treatment of the properties of poloidal and toroidal fields. The model predicts the presence of magnetic fluctuations about a cylindrically symmetric, Bessel-function-model, mean magnetic field, which satisfies $\nabla \times \langle \mathbf{B} \rangle = \mu \langle \mathbf{B} \rangle$. As Taylor's Θ-parameter approaches 1.56, the model predicts that the significant region of the fluctuation spectrum narrows down to a single (coherent) $m=1$ mode. An analogy between the Debye length of an electrostatic plasma and μ^{-1} suggests the physical validity of the model's prediction of the magnetic-field-fluctuation autocorrelation tensor $\langle \delta\mathbf{B}(\mathbf{r}) \delta\mathbf{B}(\mathbf{r}') \rangle$, when $|\mathbf{r}-\mathbf{r}'| \geq \mu^{-1}$. (26 refs.)

107355 Radial flow due to convective cells in drift waves. N.Bekki (Dept. of Phys., Nagoya Univ., Nagoya, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2736-41 (Aug. 1983).
Anomalous transport due to the excitation of convective motion in the drift waves is investigated. A set of model equations describing the interaction among the drift waves and the convective cells is derived, and the general dispersion relation is presented for the decay instability. It is shown that the spectrum of the growth rate is broad and that an excited convective cell by the drift waves can cause a radial flow (the direction along the density-inhomogeneity) in the cold ion plasma. (9 refs.)

107356 A linear model for the tearing mode of a Tokamak plasma with flow and a resistive wall boundary condition. T.H.Jensen, M.S.Chu (GA Technol. Inc., San Diego, CA, USA).
J. Plasma Phys. (GB), vol.30, pt.1, p.57-63 (Aug. 1983).
The tearing mode of a tokamak plasma without flow may be stabilized by the presence of a conducting wall surrounding the plasma. When the wall has a finite resistivity, its presence does not affect stability, only growth rates. If, however the plasma has a flow relative to the resistive wall, both stability and growth rates may be affected. For the cylindrical, circular cross-section tokamak the problem is formulated as a complex eigenvalue problem, with a complex eigenvalue Δ', which in the limit of vanishing flow becomes identical to the usual 'delta prime'. The real part of Δ' describes as usual the power absorbed at the singular surface while the imaginary part describes absorption of momentum. For a plasma with shearless flow, a resistive wall has a stabilizing effect which even for relatively small flow velocities approaches that of a wall of infinite conductivity. Shear flow is found inherently destabilizing, but important only for very large flow velocities. (4 refs.)

107357 Inhomogeneous stationary states of two-dimensional magnetofluids. R.Calinon (Dept. de Phys., Ecole Polytech. Federale de Lausanne, Lausanne, Switzerland), D.Merlini.
J. Plasma Phys. (GB), vol.30, pt.1, p.95-107 (Aug. 1983).
The authors discuss ensemble inhomogeneous states of general two-dimensional magnetofluids. A subclass of approximate statistical inhomogeneous states of the model equation is constructed using the principle of maximum entropy. The fields are shown to satisfy generalized nonlinear Poisson equations and some limiting cases are solved analytically. The method is

then applied to a pseudo-three-dimensional model of an electromagnetic filamentation instability. The results illustrate the general role of the global constants of the motion on the nature of the statistical profiles for the fields describing the most probable states in magnetofluids. (17 refs.)

Effects of toroidicity on resistive tearing modes .... See Entry 107376

Supersonic radiation waves with motion of plasma .... See Entry 107414

The macroscopic magnetohydrodynamics of inhomogeneously turbulent cosmic plasmas .... See Entry 110893

52.35 WAVES, OSCILLATIONS, AND INSTABILITIES IN PLASMA

107358 On the ponderomotive effects at the lower hybrid waves excitation. V.A.Petrzilka, R.Klima, P.Pavlo (Inst. of Plasma Phys., Czechoslovak Acad. of Sci., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.9, p.1002-10 (1983).
Due to ponderomotive density modulations at the plasma edge, the propagation of the lower hybrid primary wave changes. The third spatial harmonic wave is generated. The nonlinearities in question do not modify the directionality of the primary wave. The directionality of the third harmonic wave inside the plasma approximately equals the directionality of the primary wave. The results are important for the high frequency current drive in Tokamaks. (8 refs.)

107359 Relaxation of runaway electron energies due to excitation of high frequency waves. T.Michishita, H.Nishihara (Dept. of Nuclear Engng., Kyoto Univ., Kyoto, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2371-8 (July 1983).
The relaxation process of the runaway electron energy in a plasma is studied numerically by using quasi-linear equations combined with a Fokker-Planck collision term. It is assumed that the relaxation is caused by the interactions of the runaway electrons with the plasma waves of $\omega_k=\omega_{pe}k_z/k$. It is shown that the perpendicular energy of the runaway electrons increases rapidly with time, while that of the parallel one decreases relatively slowly. Time developments of the wave spectrum and the electron distribution function are examined in detail. The relaxation process is closely correlated with the asymptotic value of the energy density of the plasma wave excited.

107360 Scattering of waves by Langmuir solitons. J.T.Mendonca (Centro de Electrodinamica, Inst. Superior Tecnico, Lisbon, Portugal).
J. Plasma Phys. (GB), vol.30, pt.1, p.65-73 (Aug. 1983).
Scattering of electromagnetic and electrostatic waves by one-dimensional Langmuir solitons in a uniform and isotropic plasma is studied analytically using a perturbation method. Mode conversion via scattering by solitons is also considered. The results are also relevant for the case of ion-acoustic solitons. (11 refs.)

107361 Linear density drift instabilities in very low beta plasmas: a different approach. S.P.Gary (Earth & Space Sci. Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
J. Plasma Phys. (GB), vol.30, pt.1, p.75-94 (Aug. 1983).
The author reports a study of the linear Vlasov electromagnetic dispersion equation for density drift instabilities in very low β plasmas. A uniform magnetic field and a weak uniform density gradient are assumed. This differs from most other studies of this topic in three important ways: (i) no low-frequency or long-wavelength approximations are made, (ii) no gauge condition is imposed and (iii) a modification of the local approximation is used which is argued to be less arbitrary than the usual local approximation. Numerical solution of the resulting dispersion equation yields stabilization of the universal density drift instability at values of β somewhat higher than those obtained from the local approximation, and near maximum growth shows no evidence of coupling between the universal and Alfven modes. (23 refs.)

107362 Forced reconnexion by fast magnetosonic waves in a current sheet with stagnation-point flows. J.Sakai (Dept. of Appl. Maths. & Phys., Toyama Univ., Toyama, Japan).
J. Plasma Phys. (GB), vol.30, pt.1, p.109-24 (Aug. 1983).
Forced reconnexion due to tearing modes driven by fast magnetosonic waves in a current sheet with stagnation-point flows is discussed. The current sheet with stagnation-point flows which is weakly unstable against tearing modes can be strongly destabilized by vortex motions due to the ponderomotive force of the fast magnetosonic wave. This forced tearing instability can be driven when the incident fast magnetosonic wave intensity, I, exceeds a critical value given by $I_c=(\bar{v}_A/v_g)(kl)^{-3/2}(v_0/\bar{v}_A)^{-1/2}$, where $\bar{v}_A$ is the Alfven velocity, v_g the group velocity of the fast wave, v_0 the background inflow velocity, l the thickness of the current sheet and k the wavenumber of the forced tearing mode. The growth rate is estimated. Applications to solar flares and magnetopause reconnexion processes are briefly discussed. (61 refs.)

107363 Weakly relativistic dielectric tensor and dispersion functions of a Maxwellian plasma. V.Krivenski, A.Orefice (Istituto de Fisica del Plasma, CNR, Milano, Italy).
J. Plasma Phys. (GB), vol.30, pt.1, p.125-31 (Aug. 1983).
In order to study the absorption and emission properties of a magnetized plasma in the electron cyclotron range of frequencies, the weakly relativistic (Shkarofsky) plasma dispersion functions are simply and exactly expressed in terms of the Z function. This gives a useful working form to the dielectric tensor, for any wave vector and harmonic number, covering also the case of electron Maxwellian distributions drifting along the magnetic field. (10 refs.)

107364 Plasma boundary motion and the ion-acoustic wave. N.St.J.Braithwaite, L.M.Wickens (Dept. of Engng. Sci., Univ. of Oxford, Oxford, England).
J. Plasma Phys. (GB), vol.30, pt.1, p.133-51 (Aug. 1983).
Ion-acoustic waves can be launched into plasmas by applying an oscillating voltage wave form to an electrode. The precise mechanism by which these waves are launched from such an electrode is not fully understood. The work described examines the modelling of sheath edge motion in connexion with acoustic wave launching in both planar and spherical geometries. A novel demonstration of the applicability of the kinetic Bohm criterion is given by using the method of characteristics. A characteristics analysis is also used to show that an expanding, but decelerating, non-planar sheath can give rise to quasi-neutral compression like features in a plasma. In planar geometry neither this kind of expansion, nor an oscillatory sheath motion, generates compression-like features. (14 refs.)

107365 Transport by weak electrostatic density drift fluctuations. J.J.Sanderson, S.P.Gary (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
J. Plasma Phys. (GB), vol.30, pt.1, p.153-68 (Aug. 1983).
Expressions are derived for transport by weak electrostatic microfluctuations driven unstable by a density gradient perpendicular to a uniform magnetic field in a Vlasov plasma. These expressions, which are evaluated for the universal and lower-hybrid density drift instabilities, provide improved physical interpretations for various wave-particle exchange frequencies previously reported. Wave-particle effects generally reduce the free energy driving these instabilities, and that some forms of steady-state distribution functions are inappropriate for nonlinear theory. (11 refs.)

107366 Radiation damping of waves in a cold magnetized plasma. L.S.Kuz'menkov, P.B.Podosenov, P.A.Polyakov (Dept. of Theoretical Phys., Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.71-5 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.62-6 (1982).
The authors study the dispersion and radiation damping of waves in a cold magnetized plasma. The appropriate analytical formulae are given for various frequency cases. It is shown that in a strong magnetic field, the decrement of radiation damping of electromagnetic waves with the right hand circular polarization and the decrement of oscillations near the cyclotron and hybrid frequencies, are proportional to the square of the cyclotron frequency. In a weak magnetic field, the radiation damping decrements of all modes are proportional to the square of the plasma frequency. (7 refs.)

107367 Bifurcation of thermal equilibria in ohmically heated plasmas. V.Zampaglione (EURATOM-ENEA sulla Fusione, Centro Ricerche Energia Frascati, Rome, Italy).
Phys. Lett. A (Netherlands), vol.97A, no.4, p.155-8 (22 Aug. 1983).
Stability of thermal equilibria of cylindrical plasmas are studied in the case where ohmic heating is balanced by thermal diffusion for a wide class of heat conductivities depending both upon the temperature and the azimuthal magnetic field. (12 refs.)

107368 Ion-acoustic solitary waves in a magnetized plasma with arbitrary electron equation of state. E.Witt, W.Lotko (Space Sci. Lab., Univ. of California, Berkeley, CA, USA).
Phys. Fluids (USA), vol.26, no.8, p.2176-85 (Aug. 1983).
The oblique propagation of fully nonlinear, slow ion-acoustic solitary waves in a collisionless, low-beta, magnetized plasma is examined. The analysis includes the effects of a finite ion pressure, electron trapping, and multicomponent particle populations. The existence of both compressive and rarefactive modes propagating obliquely to the magnetic field in a plasma with two distinct Boltzmann electron populations and cold ions is demonstrated. It is shown that paired electrostatic shocks observed over the Earth's auroral zone may be closely related to the rarefactive modes. As a measure of the collisionless dissipation encountered by the solitary waves, the linear response of the plasma to slow ion-acoustic waves is also examined. (25 refs.)

107369 Purely growing thermal instability of an electromagnetic wave in a collisional plasma. A.K.Sharma, V.K.Tripathi (Lab. for Plasma & Fusion Energy Studies, Univ. of Maryland, College Park, MD, USA).
Phys. Fluids (USA), vol.26, no.8, p.2186-8 (Aug. 1983).
A high-amplitude electromagnetic wave propagating through a collisional plasma heats the electrons to a temperature higher than that of the heavy particles. This state is, however, shown to be unstable to a purely growing temperature higher than that of the heavy particles. This state is, however, shown to be unstable to a purely growing temperature perturbation with $\mathbf{k}\perp\mathbf{k}_0$; $\mathbf{k}$ and $\mathbf{k}_0$ being the wave vectors of the perturbation and the pump. The temperature perturbation modulates the local electron resistivity and generates two sidebands. The sidebands couple with the pump to heat the electrons and hence to enhance the temperature perturbation. The growth rate of the instability in a strongly ionized plasma is of the order of $\nu_0\omega_p\alpha^{1/2}m^{1/4}/2\omega_0(1+\alpha)m_i^{1/4}$, where $\alpha\simeq v_0^2/3c_s^2$ is a nonlinearity parameter, v_0 and c_s are the electron oscillatory and ion thermal velocities, ν_0 and ω_p are the electron collision and plasma frequencies, ω_0 is the frequency of the pump, and m and m_i are the electron and ion mass. (13 refs.)

107370 Runaway electron instability in the high-density ($\omega_{pe}/\Omega_e>0.5$), low-electric-field ($E/E_D<0.05$) regime. R.F.Gandy, D.A.Hitchcock, S.M.Mahajan, R.D.Bengtson (Fusion Res. Center, Univ. of Texas, Austin, TX, USA).
Phys. Fluids (USA), vol.26, no.8, p.2189-92 (Aug. 1983).
The characteristics of the runaway instability are studied for the high-density ($\omega_{pe}/\Omega_e>0.5$) and low-electric-field ($E/E_D<0.05$) cases. For this experimentally relevant case, the wave oscillation frequency as well as the growth rate are calculated for a variety of plasma parameters. (7 refs.)

107371 Wave precession as a consequence of the nonlinearly developed birefringence in plasmas. B.Chakraborty, S.N.Paul (Dept. of Math., Jadavpur Univ., Calcutta, India).
Phys. Fluids (USA), vol.26, no.8, p.2193-4 (Aug. 1983).
In plasmas, even in the absence of any static magnetic field, due to nonlinearities of the medium, the left and right circular polarization components of a strong electromagnetic wave are found to have different dispersion rates. Using this property of nonlinearly induced birefringence, the rate of precessional rotation and wavenumber shift of a strong ellipticity polarized electromagnetic wave passing through a cold, homogeneous, collision-free, and unmagnetized plasma are derived analytically. (17 refs.)

107372 Discrete Alfven eigenmode spectrum in magnetohydrodynamics. M.Swadesh, D.W.Ross (Inst. for Fusion Studies, Univ. of Texas, Austin, TX, USA), Gwo-Liang Chen.
Phys. Fluids (USA), vol.26, no.8, p.2195-9 (Aug. 1983).
The conditions for the existence of global Alfven eigenmodes below the continuum are investigated, and an analytical dispersion relation describing the modes is obtained. In cylindrical geometry, the curvature together with gradients of the equilibrium current (magnetic shear), and finite ω/ω_{ci} effects are responsible for these modes which could play an important part in Alfven wave heating of Tokamak plasmas. (9 refs.)

107373 A solution of the linear wave conversion problem in weakly inhomogeneous plasmas. D.J.D.Gambier (EURATOM-CEA, Fontenay-aux-Roses, France), J.P.M.Schmitt.
Phys. Fluids (USA), vol.26, no.8, p.2200-9 (Aug. 1983).
The wave equation for electromagnetic and electrostatic waves propagating in a weakly inhomogeneous plasma is studied near a conversion layer (any layer where the WKB approximation breaks down). The wave equation is approximated by a Laplace equation, $[\mathrm{P}(id/dx)-x\mathrm{Q}(id/dx)]E(x)=0$, where P and Q are polynomials of arbitrary order. The general solution is given in terms of contour integrals. Simple transformations on sets of contours allows connection of the WKBJ asymptotic solutions on both sides of the conversion layer. The mathematical technique is general (matrix operations) and is well suited to numerical computation. The method is illustrated by solving the fourth-order problems met in ion-cyclotron fast-wave and lower-hybrid wave conversion. (17 refs.)

107374 Beta and density limits in Tokamaks. H.R.Strauss (Courant Inst. of Math. Sci., New York Univ., New York, USA).
Phys. Fluids (USA), vol.26, no.8, p.2219-21 (Aug. 1983).
Ballooning modes with toroidal mode number $n=1$, 2 can be stable in Tokamaks for all beta. Below a density limit, modes with all n can be stable

for any beta, because of finite-Larmor-radius effects. The critical density, found for a particular choice of model profiles, is somewhat below the density of actual experiments, such as the ISX-B Tokamak. However, finite-Larmor-radius effects can still raise the critical beta for instability and substantially restrict the number of unstable modes. (10 refs.)

107375 Fast reconnection of magnetic fields in a plasma. Pung Nien Hu (Courant Inst. of Math. Sci., New York Univ., New York, NY, USA).
Phys. Fluids (USA), vol.26, no.8, p.2234-9 (Aug. 1983).
The reconnection process of magnetic fields in a plasma is analytically studied by perturbing the boundary conditions on a slab of incompressible plasma with a resonant surface inside. It is found, for small resistivity, that the reconnection takes place on an Alfven time scale and continues into a slow time scale $t_1=\eta^{1/3}t$. both time scales are faster than the usual tearing time scale. Furthermore, the plasma evolves globally from its initial equilibrium on the slow time scale and settles down to a different final equilibrium. (10 refs.)

107376 Effects of toroidicity on resistive tearing modes. R.Izzo, D.E.Monticello, W.Park, J.Manickam, H.R.Strauss, R.Grimm, K.McGuire (Princeton Plasma Phys. Lab., Princeton, NJ, USA).
Phys. Fluids (USA), vol.26, no.8, p.2240-6 (Aug. 1983).
A reduced set of resistive magnetohydrodynamic (MHD) equations is solved numerically in three dimensions to study the stability of Tokamak plasmas. Toroidal effects are included self-consistently to leading and next order in inverse aspect ratio ϵ. The equations satisfy an energy integral. In addition, the momentum equation yields the Grad-Shafranov equation correct to all orders in ϵ. Low-beta plasmas are studied using several different q profiles. In all cases, the linear growth rates are reduced by finite toroidicity. Excellent agreement with calculations using the resistive PEST code is obtained. In some cases, toroidal effects lead to complete stabilization of the mode. Nonlinear results show smaller saturated island widths for finite aspect ratio compared to the cylindrical limit. If the current channel is wide enough so as to produce steep gradients towards the outside of the plasma, both the finite-aspect-ratio cases and cylindrical cases disrupt. (8 refs.)

107377 'Stabilization' of the lower-hybrid-drift instability in finite-β plasmas. J.F.Drake (Science Applications Inc., McLean, VA, USA), J.D.Huba, N.T.Gladd.
Phys. Fluids (USA), vol.26, no.8, p.2247-9 (Aug. 1983).
The stability properties of the lower-hybrid-drift instability are reexamined for finite-β plasmas. In contrast to previous results, it is found that finite-β does not stabilize the instability in the sense that the growth rate becomes negative. Rather, as β increases, the fastest growing mode shifts to longer wavelengths and makes a transition to an ion-cyclotron mode when the growth rate falls below the ion-cyclotron frequency. (10 refs.)

107378 Modulation of the current-driven ion-cyclotron instability by the potential relaxation instability. R.Schrittwieser (Dept. of Phys., Univ. of California, Irvine, CA, USA).
Phys. Fluids (USA), vol.26, no.8, p.2250-5 (Aug. 1983).
An experimental investigation in a single-ended current-carrying Q machine is presented in which the radius of the current channel is varied. For increasing radius R (where R is normalized to the ion Larmor radius) the electrostatic ion-cyclotron instability is excited mainly at first. For $R \gtrsim 7$, however, the potential relaxation instability mainly appears. In the transition region both instabilities are observed but the amplitude of the cyclotron instability is strongly modulated with the frequency of the relaxation instability. This is because of the periodic current limitation by the latter which nearly inhibits the electron drift necessary for the excitation of the former. (24 refs.)

107379 Instability of the boundary layer between a streaming plasma and a vacuum magnetic field. W.Peter, R.Amiram (Dept. of Phys., Technion-Israel Inst. of Technol., Haifa, Israel), N.Rostoker.
Phys. Fluids (USA), vol.26, no.8, p.2276-80 (Aug. 1983).
Analysis is carried out for the long-wavelength stability of the boundary layer formed when a plasma or neutralized ion beam is incident upon, and reflected by, an applied magnetic field. This equilibrium is similar to the Ferraro-Rosenbluth sheath which forms the basis for many models in magnetic fusion and magnetospheric physics. For wavelengths much greater than the sheath thickness a_h, the equilibrium is unstable with growth rate (in the regime $ka_\mathrm{h} \ll m/M$) proportional to $(kg)^{1/2} \equiv (ka_\mathrm{h}\Omega_\mathrm{i}\Omega_\mathrm{e})^{1/2}$. The nonlinear evolution of the instability describes plasma propagation across the magnetic field. This instability is similar to the classical flute instability except that polarization along the boundary is due to electron, and not ion, motion. (15 refs.)

107380 Bandwidth effects in Brillouin scattering from inhomogeneous plasma. G.R.Mitchel (Inst. de Recherche d'Hydro-Quebec, Varennes, Quebec, Canada), T.W.Johnston, H.Pepin.
Phys. Fluids (USA), vol.26, no.8, p.2292-8 (Aug. 1983).
Convective Brillouin amplification in inhomogeneous, drifting plasmas is discussed. The bandwidth of the amplifier is a function of both wave damping and plasma inhomogeneity. For any given plasma model and source spectrum, the final amplified spectrum can be constructed, including the effects of inhomogeneity, drift, damping, and gain narrowing. Conversely, the shape of observed spectra of Brillouin scattering can be used to obtain information about conditions in the underdense plasma corona if it can be assumed that amplification is high enough that the final spectra bandwidth is amplifier dominated. (22 refs.)

107381 Self-consistent eigenvalue analysis of Rayleigh-Taylor instability in an ablating plasma. H.Takabe, L.Montierth, R.L.Morse (Dept. of Nuclear & Energy Engng., Univ. of Arizona, Tucson, AZ, USA).
Phys. Fluids (USA), vol.26, no.8, p.2299-307 (Aug. 1983).
A mathematical method for a fully self-consistent treatment of the Rayleigh-Taylor instability is developed by solving the linearized fluid equations as an eigenvalue problem. The method is applied to analyze the instability in stationary ablating plasmas with strong inhomogeneity. A reduction of growth rate compared to the classical value is found. The importance of a self-consistent treatment of the Rayleigh-Taylor instability is shown by comparing the result with the growth rate estimated by approximate theoretical arguments. (10 refs.)

107382 Nonlinear coupling of drift waves, convective cells, and magnetic drift modes in finite-β plasmas. H.U.Rahman, J.Weiland (Inst. for Electromagnetic Field Theory, Chalmers Univ. of Technol., Goteborg, Sweden).
Phys. Rev. A (USA), vol.28, no.3, p.1673-8 (Sept. 1983).
A set of three coupled nonlinear equations describing electrostatic drift waves, drift Alfven waves, convective cells, and magnetic drift modes has been derived for finite ion temperature. The reduction to simplified nonlinear model equations in different β regimes and the consequences for transport properties are discussed. (24 refs.)

107383 Stimulated scattering of a large amplitude electromagnetic wave by the eigenmodes of a plasma slab. O.M.Gradov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Phys. Scr. (Sweden), vol.28, no.2, p.214-16 (Aug. 1983).
The stimulated scattering of strong radiation by the low-frequency ion-sound oscillations (Brillouin scattering) as well as by the longitudinal surface modes of a plasma slab is considered. It is shown that the leaking eigenmodes of the slab then can be excited. The scattered wave intensity, taking into account the generation of harmonics, is also calculated. (6 refs.)

107384 Transition to chaos for ballooning modes stabilized by finite Larmor radius effects. J.Weiland, H.Wilhelmsson (Inst. for Electromagnetic Field Theory, Chalmers Univ. of Technol., Goteborg, Sweden).
Phys. Scr. (Sweden), vol.28, no.2, p.217-20 (Aug. 1983).
The nonlinear dynamics of interacting ballooning modes, stabilized by finite Larmor radius effects is analyzed in terms of a set of equations, which exhibit stochastic properties. These are explicitly shown to depend on the balance between shear and driving pressure force. The onset of bifurcations and chaotic behaviour are directly identified with certain values of parameters characterizing the physical system. (17 refs.)

107385 Near-resonant interaction of longitudinal plasma waves. S.C.Van Someren Greve, A.J.D.Lambert, F.W.Sluijter (Dept. of Appl. Phys., Eindhoven Univ. of Technol., Eindhoven, Netherlands).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.255-68 (1983).
The theory of the weakly non-linear interaction of three coherent longitudinal plasma waves in an unmagnetized plasma is studied and generalized by replacing the exact resonance condition for the real parts of the natural frequencies by a near resonant one. The kinetic description is used. One of the waves has an amplitude much larger than the other two and is assumed to be undamped. Especially the situation in which this large amplitude wave can give rise to instability is considered. The possibility of a small mismatch enables one to study the interaction of three ion waves. The possibility of instability in this case is conjectured. (11 refs.)

107386 Some aspects of transformation of the nonlinear plasma equations to the space-independent frame. S.N.Paul, B.Chakraborty (Dept. of Math., Jadavpur Univ., Calcutta, India).
Physica B & C (Netherlands), vol.122B+C, no.1, p.139-49 (Sept. 1983).
Nonlinear field equations for a cold plasma are transformed from the laboratory frame to the space-independent frame for a transverse wave using a special Lorentz transformation. With the help of this transformation a set of partial differential equations can be reduced to a set of ordinary differential equations in a single independent variable. The equations of Akhiezer and Polovin (1956) for nonlinear plasma oscillations have been generalized and the results of Arons and Max (1974) and others for the wave number shift and the precessional rotation of a strong electromagnetic wave are recovered by analytically finding the nonlinearly developed birefringence effect in a cold, relativistic, collisionless unmagnetized plasma. (22 refs.)

107387 Parametric and combination wave plasma. Processes in the low-hybrid electron frequency range. Excited by high-frequency electric pump field. I. S.A.Aliev, G.S.Kirichenko.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1173-9 (Aug. 1983). In Russian.
Electron low-hybrid potential plasma oscillations were studied. Two ways were used for wave excitation: external high-frequency pumping and electron beam injection along the magnetic field. Aperiodic parametric wave plasma instability for multiple pumping frequencies and beam plasma instability were identified and investigated. (9 refs.)

107388 Collisional damping of plasma cyclotron oscillations. V.Yu.Gonchar, A.F.Korzh, K.N.Stepanov.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1180-5 (Aug. 1983). In Russian.
Damping of the longitudinal electron cyclotron and ion cyclotron oscillations caused by Coulomb particle collisions is found for the arbitrary values of $k\rho_{\mathrm{L}\alpha}$ (k is the wave number, $\rho_{\mathrm{L}\alpha}$ Larmor radius of the electrons and ions $\alpha=e,i$). It is shown that the damping of electron cyclotron oscillations is due to both the collisions between electrons and ions and collisions between electrons. The damping of the ion cyclotron oscillations is caused by ion collisions only. (8 refs.)

Zero-dimensional analysis of burn control with compression-decompression .... See Entry 106159

Instability of fusing plasmas and spin-depolarization processes .... See Entry 106170

Radial flow due to convective cells in drift waves .... See Entry 107355

A linear model for the tearing mode of a Tokamak plasma with flow and a resistive wall boundary condition .... See Entry 107356

Vortex and magnetostatic-mode turbulence produced by a Buchsbaum mode .... See Entry 107389

On the weak turbulence theory of an inhomogeneous plasma .... See Entry 107390

Propagation of electromagnetic waves in a planarly stratified, isotropic, warm plasma with a resonance layer .... See Entry 107392

Coupling mechanism of boundary sheaths and wave launcher in a collisionless plasma .... See Entry 107397

Observations of the backward cyclotron wave in a spiral electron beam-plasma system .... See Entry 107398

Nonlinear relaxation of a beam of relativistic electrons in a plasma: nonlinear damping of sound .... See Entry 107401

Dependence of loading resistance and wave structures on plasma density of ICRF wave using cold slab model .... See Entry 107405

Supersonic radiation waves with motion of plasma .... See Entry 107414

Conical two dimensional plasma acceleration at resonance absorption .... See Entry 107419

Stabilizing and destabilizing influence of the Hall effect in a Z pinch with a step-like volume current profile .... See Entry 107423

Interchange stability of an axisymmetric, average minimum-B magnetic mirror .... See Entry 107431

Space potential profiles in ELMO bumpy torus (EBT) experiment .... See Entry 107432

Thermal magnetic fluctuations and anomalous electron diffusion in a mirror-confined plasma .... See Entry 107433

Transverse modes of a relativistic quantum plasma .... See Entry 107437

Experimental study of high-beta Tokamak stability .... See Entry 107443

Bundle divertor. A review of experimental results .... See Entry 107451

Axial magnetic field measurements and the stability of a vacuum spark plasma .... See Entry 107459

Bias for spectral density estimates of electromagnetic wave field components in a magnetoplasma ....See Entry 110794

An electron cyclotron maser instability for astrophysical plasmas ....See Entry 110899

Towards an artificial comet ....See Entry 110988

52.35R Plasma turbulence

107389 Vortex and magnetostatic-mode turbulence produced by a Buchsbaum mode. H.U.Rahman, P.K.Shukla (Inst. for Theoretische Phys., Ruhr-Univ. Bochum, Bochum, Germany), S.G.Tagare.
Phys. Rev. A (USA), vol.28, no.3, p.1692-9 (Sept. 1983).
It is found that the modulational instability of a finite-amplitude Buchsbaum mode can give rise to enhanced vortex, (convection cells) and magnetostatic modes in a D-T fusion plasma The relevance of the investigation to the anomalous particle and heat losses in a Tokamak device is briefly pointed out. (18 refs.)

107390 On the weak turbulence theory of an inhomogeneous plasma. N.M.El-Siragy, Y.A.Sayed, V.L.Sizonenko (Atomic Energy Authority, Cairo, Egypt).
Physica B & C (Netherlands), vol.122B+C, no.1, p.113-28 (Sept. 1983).
The nonlinear dispersion and kinetic wave equations for drift potential oscillations of a weakly inhomogeneous plasma is obtained. It is shown, that taking into consideration the Coulomb collisions makes it possible to remove divergences in matrix elements, describing the nonlinear wave interaction. (10 refs.)

Nonlinear relaxation of a beam of relativistic electrons in a plasma: nonlinear damping of sound ....See Entry 107401

The macroscopic magnetohydrodynamics of inhomogeneously turbulent cosmic plasmas ....See Entry 110893

52.35T Shock waves

An introduction to the theory of diffusive shock acceleration of energetic particles in tenuous plasmas ....See Entry 107348

Laser-driven shock-wave propagation in pure and layered targets ....See Entry 107391

Effects of giant laser pulses on a quasisteady plasma jet ....See Entry 107418

52.40 PLASMA INTERACTIONS

52.40D Electromagnetic wave propagation in plasma

107391 Laser-driven shock-wave propagation in pure and layered targets. D.Salzmann, S.Eliezer, A.D.Krumbein, L.Gitter (Soreq Nuclear Res. Centre, Yavne, Israel).
Phys. Rev. A (USA), vol.28, no.3, p.1738-51 (Sept. 1983).
The propagation properties of laser-driven shock waves in pure and layered polyethylene and aluminum slab targets are studied for a set of laser intensities and pulse widths. The laser-plasma simulations were carried out by means of the one-dimensional Lagrangian hydrodynamic code. It is shown that the various parts of laser-driven compression wave undergo different thermodynamic trajectories. The shock front portion is on the Hugoniot curve whereas the rear part is closer to an adiabat. It is found that the shock front is accelerated into the cold material till $t \approx 0.8\tau$ (where τ is the laser pulse width) and only later is a constant velocity propagation attained. The scaling laws obtained for the pressure and temperature of the compression wave in pure targets are in good agreement with those published in other works. In layered targets, high compression and pressure were found to occur at the interface of CH_2 on Al targets due to impedance mismatch but were not found when the layers were reversed. The persistence time of the high pressure on the interface in the CH_2 on Al case is long enough relative to the characteristic times of the plasma to have an appreciable influence on the shock-wave propagation into the aluminium layer. This high pressure and compression on the interface can be optimized by adjusting the CH_2 layer thickness. (18 refs.)

107392 Propagation of electromagnetic waves in a planarly stratified, isotropic, warm plasma with a resonance layer. L.P.J.Kamp, M.P.H.Weenink (Dept. of Electrical Engng., Eindhoven Univ. of Technol., Eindhoven, Netherlands).
Physica B & C (Netherlands), vol.122B+C, no.1, p.879-112 (Sept. 1983).
A linear theory is developed for the absorption and conversion of electromagnetic waves in a planarly stratified, isotropic, warm plasma for arbitrary angles of incidence. In particular the case is investigated in which the frequency of the wave is equal to the local plasma frequency somewhere in the plasma (resonance plane). The polarization of the waves considered here is such that the electric field has a component parallel to the gradient of the plasma density (TM-polarization). The temperature is assumed to be constant. The given theory is more general than the existing theories for the following reasons: (1) The unperturbed electric field due to the inhomogeneity has been incorporated. (2) Better approximations away from the resonance plane are given. (3) The theory holds for arbitrary density profiles. Errors in the existing literature are corrected. The problem is studied by means of internal-boundary-layer theory and Langer's method. Explicit expressions for the behaviour of the various field components and the pressure perturbation as well as the linear excitation of a plasma wave are given in the whole region of interest. (17 refs.)

107393 Further observations on resonance cones in non-Maxwellian plasmas. H.Thiemann, N.Singh (Center for Atmospheric & Space Sci., Utah State Univ., Logan, UT, USA).
Radio Sci. (USA), vol.18, no.4, p.615-24 (July-Aug. 1983).
Resonance cones in a hot magnetized non-Maxwellian plasma are investigated. The non-Maxwellian nature of the plasma is described by two electron populations: a background population and an electron beam with variable beam parameters. The theoretical formulation for a finite magnetic field is given. The resonance cone dispersion relation is presented and numerical results on the angular distributions of the potential are given. The propagation of waves outside the resonance cones is also described. (15 refs.)

107394 Scattering and absorption of electromagnetic waves by an inhomogeneous plasma column. S.Yamaguchi, K.Mori, T.Hosono (Coll. of Sci. & Technol., Nihon Univ., Tokyo, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part B (Japan), vol.J66B, no.5, p.575-82 (May 1983). In Japanese.
Analyzes scattering and absorption of electromagnetic waves by an inhomogeneous plasma column with circular symmetry. Main contents and conclusions are: A modified multilayer method in cylindrical coordinates is developed to improve multilayer method, finite difference method, Euler method and Runge-Kutta method. The relation between truncation error and the maximum angular mode number used is shown. Power flow and absorption of electromagnet energy in collisionless plasma column are analyzed and shown in a graph. Power dissipation in lossy plasma column is analyzed and its distribution in the column is shown in a graph. (8 refs.)

107395 Radiation of nonequilibrium active-molecular plasma half-space and layer. P.K.Golubinski, A.G.Zagorodnii, V.S.Pegova, I.P.Yakimenko.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1165-72 (Aug. 1983). In Russian.
A theory of spontaneous emission of electromagnetic waves by semibounded and bounded nonequilibrium active-molecular plasmas has been developed. The influence of the molecular subsystem on the intensity of electromagnetic radiation of a bounded plasma-molecular medium is investigated. (7 refs.)

Thermodynamic parameters and mean radiation path lengths for textolite plasma ....See Entry 107338

Stimulated Brillouin scattering due to laser-plasma interactions ....See Entry 107351

Some aspects of transformation of the nonlinear plasma equations to the space-independent frame ....See Entry 107386

Absorption of microwaves during resonant heating of plasma with a high concentration of electrons inside a waveguide ....See Entry 107407

Conical two dimensional plasma acceleration at resonance absorption ....See Entry 107419

52.40F Antennas in plasma; plasma-filled wave guides

107396 Theory of electromagnetic radiation excitation in a plasma waveguide with an electron beam. V.A.Balakirev.
Radiophys. & Quantum Electron. (USA), vol.25, no.10, p.857-66 (Oct. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.10, p.1198-209 (Oct. 1982). [received: Sept. 1983]
A mechanism of electromagnetic radiation excitation is studied, based upon nonlinear interaction of electron beam charge density waves and plasma and electromagnetic waves of the plasma waveguide. Cases are considered in which the plasma pump wave propagates both in the direction of and opposite to the electron beam. (12 refs.)

Dependence of loading resistance and wave structures on plasma density of ICRF wave using cold slab model ....See Entry 107405

Absorption of microwaves during resonant heating of plasma with a high concentration of electrons inside a waveguide ....See Entry 107407

52.40H Solid-plasma interactions

Heating and breakdown of protective layer at plasma retaining wall ....See Entry 107406

Predicted behaviour of the pumped limiter of INTOR ....See Entry 107450

52.40K Sheaths

107397 Coupling mechanism of boundary sheaths and wave launcher in a collisionless plasma. H.Fujita, S.Yagura (Dept. of Electrical Engng., Saga Univ., Saga, Japan).
J. Plasma Phys. (GB), vol.30, pt.1, p.1-9 (Aug. 1983).
The coupling mechanism of boundary sheaths and a wave launcher immersed in a collisionless plasma is experimentally clarified by the addition of an electron emission from the launcher. The wave amplitude increases rapidly with increasing electron emission. The strong increase in a directly coupled signal is a clear observation of ion-acoustic waves which are simultaneously excited at the sheaths. (15 refs.)

Plasma boundary motion and the ion-acoustic wave ....See Entry 107364

Instability of the boundary layer between a streaming plasma and a vacuum magnetic field ....See Entry 107379

Electrostatic fields and charged particle acceleration in laser produced plasmas ....See Entry 107411

Some corrections for a one-dimensional snow-plow model ....See Entry 107448

52.40M Beam interactions in plasma

107398 Observations of the backward cyclotron wave in a spiral electron beam-plasma system. T.Idehara, N.Sato (Dept. of Appl. Phys., Fukui Univ., Fukui, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2281-4 (July 1983).
The cyclotron waves of higher order ($|n| \geq 2$) are observed in a spiral electron beam-plasma system, in addition to the space charge ($n=0$) and the fundamental cyclotron ($|n|=1$) waves. In the frequency range of $\omega < n\omega_c$, the observed waves are identified to the backward cyclotron waves, by using Fourier and inverse Fourier transformation methods.

107399 Thermodynamic theory of light ion beam propagation in a plasma. T.Kato, T.Ohsawa (Dept. of Appl. Phys., Waseda Univ., Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2720-6 (Aug. 1983).
Propagation of a light ion beam in a plasma is investigated theoretically. The basic principle determining the steady state of the beam transport in a plasma is ascertained from the viewpoints of the theory of the irreversible processes. As a preliminary work to discuss the collisional plasma, the authors consider a state in which the entropy production vanishes and obtain an extended result of Chen and Davidson to include the current due to the drift of the plasma electrons. Two extreme cases are considered: (i) No rotation of the beam around the axis of symmetry or complete neutralization of azimuthal beam current by the plasma electron. (ii) Complete balancing of the electrostatic repulsive force on a beam ion and the magnetically pinching force due to the axial beam current. It is shown that the distribution of ions in a rotational ion beam is given by the Bennett type, provided the current is over-neutralized azimuthally.

107400 Azimuthal current-neutralization of a rotational light ion beam by a plasma. T.Ohsawa, T.Kato (Dept. of Appl. Phys., Waseda Univ., Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2727-35 (Aug. 1983).
The rotational motion of a light ion beam and a plasma immersed in a uniform magnetic field is investigated within the framework of the macroscopic fluid equations including force terms due to radial pressure variations. Drift motion caused by the radial electric and magnetic forces rotates the

beam fluid element and the plasma electron fluid element in the same azimuthal direction. The motion leads to the over-neutralized states. The radial density profiles of the beam are obtained and the condition for radially confined equilibria in those over-neutralized states is examined. (12 refs.)

107401 Nonlinear relaxation of a beam of relativistic electrons in a plasma: nonlinear damping of sound. V.M.Malkin (Inst. of Nuclear Phys., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.83, no.5, p.997-1003 (Nov. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.5, p.1725-37 (Nov. 1982). [received: Sept. 1983]
The authors consider the interaction between a plasma and a beam of relativistic electrons in that range of parameters where the instability of the system against the excitation of Langmuir waves is eliminated by their scattering by the nonlinearly damped sound. They find the distribution function of the beam electrons and the Langmuir wave spectrum. The range of beam densities covered by the quantitative relaxation theory is hereby broadened considerably—now this range stretches up to the limit of applicability of weak turbulence theory. (8 refs.)

General classical scaling of electron-loss cross sections in collisions of atoms with highly charged ions ....See Entry 106579

Theory of electromagnetic radiation excitation in a plasma waveguide with an electron beam ....See Entry 107396

Analysis of target implosion on irradiation by proton beams. I. Beam interaction with target plasma ....See Entry 107402

Spectroscopic measurements of plasma ion density by neutral beam probing ....See Entry 107441

52.50 PLASMA PRODUCTION AND HEATING

107402 Analysis of target implosion on irradiation by proton beams. I. Beam interaction with target plasma. M.Tamba (Inst. of Phys. & Chem. Res., Saitama, Japan), N.Nagata, S.Kawata, K.Niu.
Laser & Part. Beams (GB), vol.1, pt.2, p.121-49 (May 1983).
Numerical simulations and analyses are given for the implosion of a hollow shell target driven by proton beams. The target consists of three layers of Pb, Al and DT. The Pb and Al layers play roles of a tamper and a pusher, respectively. The main part of the beam energy is deposited in the Al layer. But the process of deposition depends strongly on the distribution of incident angles and particle energies. As the Al layer is heated by proton beam, the layer expands and pushes the DT layer toward the target center. This type of implosion motion is examined by using a similarity solution for the slab model. To obtain an optimum velocity for the DT implosion, the optimum target size and optimum layer thicknesses are determined. The Rayleigh-Taylor instability, accompanied by the implosion motion, is investigated, and the implosion is found to be stable with respect to the chosen target structure. The effects of inhomogeneities on implosion are shown to be severe. (12 refs.)

107403 Theoretical modeling of electromagnetically imploded plasma liners. N.F.Roderick, B.J.Kohn, W.F.McCullough, C.W.Beason, J.A.Lupo, J.D.Letterio (Air Force Weapons Lab., Kirtland AFB, NM, USA), D.A.Kloc, T.W.Hussey.
Laser & Part. Beams (GB), vol.1, pt.2, p.181-206 (May 1983).
The generation of high-energy-density plasmas by the electromagnetic implosion of cylindrical foils (i.e. imploding plasma shells or hollow z-pinches) has been explored analytically and through numerical simulation. Those theoretical investigations have been performed for a variety of foil initial conditions (radius, height, and foil mass) for both capacitive and inductive pulse power systems. The development of the theoretical modeling techniques is presented, covering both circuit models and plasma load models. Results from a series of configurations are given, showing the development of modeling techniques used to study the dynamics of the plasma implosion process and the role of instabilities. Interaction between analytic techniques and detailed numerical simulation has led to improvement in all theoretical modeling techniques presently used to study the implosion process. (21 refs.)

107404 Plasma startup patterns in Tokamak reactors. K.Maki (Energy Res. Lab., Hitachi Ltd., Ibaraki, Japan), T.Tone.
J. Nucl. Sci. & Technol. (Japan), vol.20, no.6, p.443-52 (June 1983).
Plasma startup patterns are studied from the viewpoint of net power loss represented by the total power loss less the α-particle heating power. The existence is shown of a critical temperature of plasma at which the net power loss becomes independent of plasma density. Observations are made which indicate that the net power loss decreases with lowering plasma density in the range below the critical temperature and vice versa, whether governed by empirical or trapped-ion scaling laws. A startup pattern is presented which minimizes the net power loss during startup. The net power loss at critical temperature represents the lower limit of heating power required to bring the plasma to steady state in Tokamak reactors. (18 refs.)

107405 Dependence of loading resistance and wave structures on plasma density of ICRF wave using cold slab model. S.Shinohara, M.Naito, K.Miyamoto (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2622-5 (Aug. 1983).
Numerical calculation of an ICRF wave by the cold slab model with a two-ion species plasma is carried out. This model well explains the dependence of experimental loading resistance on plasma density obtained on TFR, JFT-2, JIPP T-II and TNT-A. The dependence of the radial cavity mode on plasma density is also shown. (14 refs.)

107406 Heating and breakdown of protective layer at plasma retaining wall. A.V.Khachatur'yants (M.I. Kalinin Leningrad Polytech. Inst., Leningrad, USSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1097-9 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.581-4 (Oct. 1982). [received: Sept. 1983]
Expressions are derived for estimating the parameters of the boundary layer of cold plasma forming through the action of radiation on the thermal protection in a pulse-type reactor with wall retention of thermonuclear plasma. (7 refs.)

107407 Absorption of microwaves during resonant heating of plasma with a high concentration of electrons inside a waveguide. P.S.Bulkin, S.A.Dvinin, G.S.Solntsev (Dept. of Electronics, Moscow State Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.98-101 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.84-7 (1982).
The authors show the role of resonant absorption and redistribution of a microwave field along the force lines during the interaction of the field with a confined plasma with above-critical electron concentration at low gas pressure. They calculate, and compare with experiments, the absorption and reflection coefficients of microwaves by a plasma column in a waveguide. It is shown that the kinetic processes in the plasma can be controlled effectively by a pulsed microwave heating. (6 refs.)

Bifurcation of thermal equilibria in ohmically heated plasmas ....See Entry 107367

Development of concentric equipotential surfaces in bumpy torus plasma ....See Entry 107422

Modeling TFTR plasma physics ....See Entry 107425

Bundle divertor. A review of experimental results ....See Entry 107451

Towards an artificial comet ....See Entry 110988

52.50J Plasma production and heating by laser beams

107408 Picosecond air breakdown studies at 0.53 μm. W.E.Williams, M.J.Soileau, E.W.Van Stryland (Dept. of Phys., North Texas State Univ., Denton, TX, USA).
Appl. Phys. Lett. (USA), vol.43, no.4, p.352-4 (15 Aug. 1983).
The laser induced breakdown thresholds of laboratory air at 0.53 μm were measured for pulses varying from 30 to 140 ps for a variety of focal spot sizes. The breakdown threshold fields were found to be proportional to $1/\sqrt{t_p}$, where t_p is the laser pulse width. Comparison with an earlier work at 1.06 μm under similar conditions indicates that the breakdown thresholds are higher at 0.53 than at 1.06 μm. However, this increase falls short of the λ^{-2} dependence exhibited by cascade ionization. (13 refs.)

107409 Hot-electron energy deposition around unsupported laser targets. K.Eidmann, A.Maaswinkel, R.Sigel, S.Witkowski (Max-Planck-Inst. fur Quantenoptik, Garching, Germany), F.Amiranoff, R.Fabbro, J.D.Hares, J.D.Kilkenny.
Appl. Phys. Lett. (USA), vol.43, no.5, p.440-2 (1 Sept. 1983).
Free-falling spheres, released by a simple mechanism, are used as a laser targets. Hot-electron energy transport upon one-sided irradiation with 300-ps iodine laser pulses (6×10^{15} W cm^{-2}) is studied by various methods, including X-ray pinhole photography and time-resolved shadowgraphy. Spatial energy deposition is consistent with hot-electron spreading in the presence of self-generated magnetic fields, as suggested by recent experiments and simulations. The insensitivity of the results to the presence of a supporting stalk is attributed to inductive decoupling of the target. Free-falling targets open the possibility of highly symmetric implosion experiments. (10 refs.)

107410 On the ionization freezing in expanding laser-produced plasmas. A.Caruso, G.Gatti, C.Strangio (EURATOM-ENEA sulla Fusione, Roma, Italy).
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.1213-19 (July-Aug. 1983).
Some features of the ionization freezing process are discussed in the framework of the simple model of a uniform sphere expanding with constant velocity. (7 refs.)

107411 Electrostatic fields and charged particle acceleration in laser produced plasmas. H.Hora (Dept. of Theoretical Phys., Univ. of New South Wales, Kensington, Australia).
Laser & Part. Beams (GB), vol.1, pt.2, p.151-70 (May 1983).
The author presents a derivation of the spread double layers in the case of inhomogeneous plasmas. It is concluded that the hydrodynamically expected multi GeV heavy ions for 10 TW laser pulses (generated by relativistic self-focusing and nonlinear forces) should produce super-fast ions up to the TeV range. Further conclusions are drawn from the electrostatically measured upshifted (by 300 keV) DT fusion alphas from laser compressed plasma. An analysis of alpha spectra attempts to distinguish between different models of the stopping power in the plasmas. The analysis preliminarily arrives at a preference for the collective model. (73 refs.)

107412 Two-dimensional ion emission from laser-produced plasmas. G.J.Tallents (Dept. of Engng. Phys., Res. School of Phys. Sci., Australian Nat. Univ., Canberra, Australia).
Laser & Part. Beams (GB), vol.1, pt.2, p.171-80 (May 1983).
The expansion of laser-produced plasmas in two-dimensions is examined analytically using an asymptotic (time→∞) isothermal self-similar model. The ion emission velocity and energy spectra are calculated and expressions given for the number and energy of expanding ions as a function of angle to the target. By relating the total ion kinetic energy of expansion to the temperature of the initial plasma it is shown that ion probe signals give a measure of the initial plasma temperature. The model is extended to a plasma with two digital temperatures (a 'hot' component and a 'cold' component) and it is shown that the ion energy spectra can be used to deduce the initial temperatures of the 'hot' and 'cold' ions and the relative number of the 'hot' ions to the 'cold' ions. The results are used to interpret data from an array of ion probes (at different angles to the target) for a plasma produced by irradiating a 25 μm thick nickel foil with a ~20 ρs neodymium laser pulse. (36 refs.)

107413 The origin of line-free XUV continuum emission from laser-produced plasmas of the elements $62\leq Z\leq74$. G.O'Sullivan (Phys. Dept., Univ. Coll. Dublin, Dublin, Ireland).
J. Phys. B (GB), vol.16, no.17, p.3291-304 (14 Sept. 1983).
The different plasma mechanisms responsible for the continuum emission observed in the 35-2000 Å wavelength region from laser-produced plasmas of targets with $62\leq Z\leq74$ have been studied in detail. The continuum is found to be largely free-bound in origin, especially at shorter wavelengths. The nonappearance of line emission is due to the complexity of the electronic configurations in the ion stages present in the plasma which in nearly every case can contain open 4f subshells. Furthermore 4f, 5p and 4f, 5s level crossing lead to the population of a range of low-lying excited states which increase still further the number of anticipated transitions. As a result, the transitions merge to form narrow bands of quasi-continua which, in the soft X-ray region, enhance the underlying recombination continuum. The XUV emission is observed to be most intense in the 100 Å region where the radiance is estimated to be $>10^{23}$ photons cm^{-2} sr^{-1} Å^{-1} s^{-1}. (31 refs.)

107414 Supersonic radiation waves with motion of plasma. I.V.Nemchinov, M.P.Popova, L.P.Shubadeeva (O.Yu. Schmidt Inst. of Terrestrial Phys., Acad. of Sci., Moscow, USSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1093-7 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.577-81 (Oct. 1982). [received: Sept. 1983]
A numerical solution is obtained to the two-dimensional radiation-gasdynamics problem of plasma formation under laser action. Laser radiation acting on a target produces absorption waves which travel in the opposite direction to the laser beam. The leading role in the wave propagation process can be played here by any of the various mechanisms, heat conduction (slow luminous combustion), hydrodynamics (luminous detonation), or spontaneous thermal radiation of plasma (subsonic and supersonic radiation waves), depending on the density and the composition of the gaseous medium as well as on the flux density and the wavelength of laser radiation and on the duration of the laser pulse. (8 refs.)

107415 Laser irradiation of disk targets at 0.53 μm wavelength. W.Mead, E.M.Campbell, K.G.Estabrook, R.E.Turner, W.L.Kruer, P.H.Y.Lee, B.Pruett, V.C.Rupert, K.G.Tirsell, G.L.Stradling, F.Ze, C.E.Max, M.D.Rosen, B.F.Lasinski (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
Phys. Fluids (USA), vol.26, no.8, p.2316-31 (Aug. 1983).
Results and analyses are presented for laser irradiation of Be-, CH-, Ti-, and Au-disk targets with 0.53 μm light in 3-200J, 600-700 psec pulses, at nominal incident intensities from 3×10^{13} to 5×10^{15} W/cm^2. The measured absorptions are higher than observed in similar 1.06 μm irradiations, and are largely consistent with modeling which shows the importance of inverse-bremsstrahlung and Brillouin scattering. Observed red-shifted back-reflected light shows that Brillouin scattering occurs at low to moderate fluxes of multi-keV X-ray indicate hot-electron fractions of 1% or less, with temperatures of 6 to 20 keV which are consistent with resonance absorption or perhaps $2\omega_{pe}$. Measurements show 30%-50% efficient conversion of absorbed light into sub-keV X-rays, with time-, angular-, and spatial-emission distributions which are generally consistent with non-local-thermodynamic-equilibrium modeling using inhibited thermal electron transport. (41 refs.)

107416 On the influence of surface condition on air plasma formation near metals irradiated by microsecond TEA-CO_2 laser pulses. I.Ursu, I.Apostol, D.Barbulescu, V.Lupei (Central Inst. of Phys., Bucharest, Rumania), I.N.Mihailescu, A.Popa, A.M.Prokhorov, N.I.Chapliev, V.I.Konov.
Rev. Roum. Phys. (Rumania), vol.28, no.4, p.351-3 (1983).
Reports a systematic analysis of the involvement of the main types of defects and impurities in the plasma and vapor initiation stage, with a direct effect on lowering the breakdown threshold in the gas next to the target, which has been pointed out before, as well as in determining the overall evolution of the interaction process. Any complex analysis of the plasma induction process nearby the metal targets should be correlated with a careful scrutiny of the structure and physical-chemical composition of the irradiated surface. (7 refs.)

107417 Thermophysical target properties in ion collection measurements on TEA-CO_2 laser produced high-Z plasmas. E.Cojocaru (Nat. Center of Phys., Inst. for Phys. & Technol. of Radiation Devices, Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.6, p.507-12 (1983).
Some results of ion collection measurement for TEA-CO_2 laser produced plasmas on high-Z metallic targets are presented in this paper. The different signal shapes for low and high fusible targets are explained taking into account the different thermophysical target parameters. At about 10^{10} W/Cm^2 incident laser intensity, for low fusible targets a developed vaporization can take place which is the cause of a rather early appearance of the first high peak in the collector signal. At the same intensity, in the high fusible target case, a gradual vaporization takes place which can explain the two-peak structure of the ion collector signal. (10 refs.)

107418 Effects of giant laser pulses on a quasisteady plasma jet. S.I.Anisimov, V.A.Batanov, V.P.Gorkovskii, N.N.Zhukov, V.P.Kopylov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. Phys.-JETP (USA), vol.83, no.5, p.1010-15 (Nov. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.5, p.1747-55 (Nov. 1982). [received: Sept. 1983]
An investigation was made of the processes occurring in a quasisteady plasma jet formed above a solid target under the action of a neodymium laser pulse, which consisted of quasicontinuous lasing intervals as well as several 'giant' peaks. A plasma-air contact interface was formed and shock waves, created in the plasma by the giant peaks, were reflected from this interface. An analysis of the reflection of shock waves led to a proposal for a new method for plasma diagnostics and measurements were made of the temperature in the jet. Low-threshold optical breakdown of air was observed near the contact surface. (13 refs.)

Photoionization by intense line radiation in laser-produced plasmas .... See Entry 106372

Fast gas-ionization wave in a laser beam .... See Entry 107327

Experimental observation on 3/2 ω_0 harmonic emission from laser plasma .... See Entry 107352

An interferometric electron density estimate of a TE-CO_2 laser sustained plasma in front of a metallic target .... See Entry 107444

52.50L Plasma production and heating by shock wave and wire explosion

107419 Conical two dimensional plasma acceleration at resonance absorption. G.W.Kentwell (Dept. of Theoretical Phys., Univ. of New South Wales, Kensington, Australia).
Laser & Part. Beams (GB), vol.1, pt.2, p.107-19 (May 1983).
By employing analytical solutions for the electromagnetic field at resonance absorption, first derived by N.G. Denisov (1957), the total nonlinear force in the plane of incidence has been evaluated. This 2-D force results in a conical type emission towards the vacuum and into the plasma which depends critically on the collision frequency and the density scale length. It is found that, for neodymium glass laser intensities of 10^{14} W/cm^2, keV ions can be produced by nonlinear force acceleration. The analysis is limited by the following requirements: the dielectric constant varies linearly with distance, the angle of incidence is not too small and most importantly self-consistent and transient wave processes occur at a later time and are neglected. (18 refs.)

52.55 PLASMA EQUILIBRIUM AND CONFINEMENT

107420 The effects of low-ionization-potential contaminants on thermal plasmas. D.C.Johnson, E.Pfender (Dept. of Mech. Engng., Univ. of Minnesota, Minneapolis, MN, USA).
Plasma Chem. & Plasma Process. (USA), vol.3, no.2, p.259-73 (June 1983).
Plasmas consisting of a high-ionization-potential component mixed with a low-ionization-potential contaminant are common in industrial processes. Modeling results are presented for a sodium-contaminated nitrogen plasma column operating either in a free-burning (low-temperature) mode or operating in a constricted (high-temperature) mode. At sufficiently high plasma temperatures, the behavior is dominated by the high-ionization-potential component's properties. The low-ionization-potential contaminant's properties determine the low-temperature plasma behavior even when the contaminant is present in relatively small quantities. (5 refs.)

107421 Helical field of JIPP T-II apparatus. T.Sometani (Dept. of Electrical Engng., Faculty of Engng., Shizuoka Univ., Hamamatsu, Japan), S.Tanahashi.
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.6, p.960-2 (June 1983).
The measured toroidal helical field of the JIPP T-II apparatus does not vanish on the geometrical axis of the helical winding, contrary to the prediction of the usual theory. The result of measurement can be explained only by an improved theory. On account of the nonvanishing part of the helical field, the magnetic axis of JIPP T-II should be nonplanar and should be shifted on the average inwards with respect to the geometrical axis. (2 refs.)

107422 Development of concentric equipotential surfaces in bumpy torus plasma. K.Takasugi, H.Iguchi, M.Fujiwara, H.Ikegami (Inst. of Plasma Phys., Nagoya Univ., Nagoya, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2389-93 (July 1983).
Radial profiles of the plasma space potential are measured in Nagoya Bumpy Torus (NBT-1) by the use of a heavy ion beam probe. Asymmetric potential profiles owing to toroidal drift are observed in high pressure operation (C-mode). As the pressure is decreased, toroidal plasma is effectively heated (T-mode), poloidal precessional frequency overcomes the electron collision frequency and the equipotential surfaces becomes concentric inside the hot electron ring. (12 refs.)

107423 Stabilizing and destabilizing influence of the Hall effect in a *Z* pinch with a step-like volume current profile. U.Schaper (Inst. fur Theoretische Phys., Univ. Dusseldorf, Dusseldorf, Germany).
J. Plasma Phys. (GB), vol.30, pt.1, p.169-78 (Aug. 1983).
A dispersion relation is derived for axisymmetric perturbations of an infinitely extended circular incompressible *Z* pinch with a step-like volume current profile. This profile is characterized by constant but different volume currents in different regions of the plasma and at the step surface there is a sheet current. The stability boundaries are shifted compared with stability limits in ideal MHD theory. For equilibria with current reversal there is a new stable range. The number of solutions of the dispersion relation depends on the equilibrium. The behaviour of the eigenvalues near the stability boundaries is treated in accordance with bifurcation theory. (7 refs.)

107424 Finite element analysis of the magnetomechanical behavior of a toroidal coil with magnetic mirrors. K.Miya, T.Takagi, T.Takaghi (Nuclear Engng. Res. Lab., Univ. of Tokyo, Ibaraki, Japan).
Nucl. Eng. & Des. (Netherlands), vol.74, no.3, p.339-46 (1982).
A toroidal simulator is used to study the magnetomechanical behavior of a superconducting D-shaped coil set at the center between sectored ferromagnetic plates. Since the magnetic field distribution between the two plates is expected to be almost the same as that created by toroidal field coils arranged in a torus, the toroidal simulator may be expected to show almost the same magnetomechanical behavior as that of the full torus coils. To verify its validity experimentally, buckling and vibration tests were carried out in a liquid helium cryostat. In addition numerical analyses were performed for the magnetic field distribution to reveal its similarity and for the experimental results from the toroidal simulator to confirm its validity. Its validity is fully demonstrated in the present study. (17 refs.)

107425 Modeling TFTR plasma physics. C.E.Singer (Plasma Phys. Lab., Princeton Univ., Princeton, NJ, USA).
Nucl. Eng. & Des. (Netherlands), vol.74, no.3, p.347-65 (1982).
Recent studies of plasma transport and particle trajectories expected in the Tokamak Fusion Test Reactor (TFTR) have been used to assess plasma performance, to plan for experimental operations, and to make decisions on hardware design and allocation of resources. These studies include definition of a standard plasma transport model computing the source of fast neutrons which activate the structure, variation of assumptions concerning plasma confinement and impurity influx, definition of the optimum neutral beam pulse length and beamline orientation, investigation of the effects of different heating profiles investigation of pellet injection, and definition of overall plasma performance and its role in extrapolating TFTR results to design more advanced Tokamak reactors. (25 refs.)

107426 Heat flux on limiters in low-*q* discharges. K.Ioki, M.Nagami, H.Yoshida, H.Yokomizo, M.Shimada, S.Izumi, K.Shinya (Div. of Large Tokamak Development, JAERI, Tokyo, Japan), N.Brooks, T.McMahon, A.Kitsunezaki.
Nucl. Eng. & Des. (Netherlands), vol.74, no.3, p.393-7 (1982).
Heat flux on the Doublet III limiters was measured with an infrared camera and thermocouples during low-*q* discharges. The total heat load to the limiters increases with $1/q_a^*$ in both Dee and circular plasmas. The peak heat flux on the limiters in low-*q* discharges of $q_a^*\approx2$ is ≈2 times higher than that in high-*q* discharges of $q_a^*\approx4$. Since a low-*q* discharge is essential in order to have a high-β Tokamak reactor in the future, higher heat flux on the limiters may be an inevitable problem. It is proposed that the increase in peak heat flux during low-*q* discharges can be reduced by modification of the limiter to an asymmetric shape. (5 refs.)

107427 Enhancement of neoclassical transport coefficients by a poloidal electric field in Tokamaks. C.S.Chang (General Atomic Co., San Diego, CA, USA).
Phys. Fluids (USA), vol.26, no.8, p.2140-9 (Aug. 1983).
The effect of an equilibrium poloidal electric field on the neoclassical transport coefficients is studied in the banana regime, and a significant enhancement (a factor of 2 or more) is obtained for the physically interesting case where the magnitude of the electrostatic potential inhomogeneity is of the same order as the magnetic field inhomogeneity in a Tokamak. (9 refs.)

107428 Direct losses in the ELMO Bumpy Torus experiment. D.E.Hastings, J.D.Callen (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Phys. Fluids (USA), vol.26, no.8, p.2150-60 (Aug. 1983).
For resonant ions in the ELMO Bumpy Torus experiment (EBT), the width of the orbits near the resonance scales like $(\partial\Omega/\partial r)^{-1}$, where Ω is the precessional drift frequency. For $(\partial\Omega/\partial r)\approx0$ over most of the plasma, the ions will drift vertically out of the machine due to the toroidal magnetic field. The problem of these directly lost particles is analyzed by considering collisional diffusion into a hole in velocity space. Particle and energy loss rates including boundary layer corrections due to marginally confined particles are obtained. It is shown that these direct loss rates can be comparable to diffusion rates based on banana transport. (10 refs.)

107429 Particle exchange in the plug of a thermal barrier tandem mirror. P.J.Catto, R.Carrera (Sci. Appls. Inc., Plasma Res. Inst., Boulder, CO, USA).
Phys. Fluids (USA), vol.26, no.8, p.2161-6 (Aug. 1983).
The collisional fluxes of trapped electrons escaping from the plug, and the center cell electrons passing over the thermal barrier and becoming trapped, are evaluated for a simple thermal barrier model appropriate to present tandem mirror experiments. (9 refs.)

107430 Use of the stellarator expansion to investigate plasma equilibrium in stellarators. G.Anania, J.L.Johnson, K.E.Weimer (Plasma Phys. Lab., Princeton Univ., Princeton, NJ, USA).
Phys. Fluids (USA), vol.26, no.8, p.2210-18 (Aug. 1983).
A numerical code utilizing a large-aspect-ratio, small helical-distortion expansion is developed and used to investigate the effect of plasma currents on stellarator equilibrium. Application is made to several existing and proposed stellarators. The modification of the equilibrium properties with pressure is strongly dependent on the vacuum-field configuration. The modular stellarator model which is investigated gives somewhat discouraging results because a large rotational transform, and hence large coil deformation, is needed to achieve high-beta equilibria. (34 refs.)

107431 Interchange stability of an axisymmetric, average minimum-*B* magnetic mirror. J.R.Ferron, A.Y.Wong, G.Dimonte, B.J.Leikind (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
Phys. Fluids (USA), vol.26, no.8, p.2227-33 (Aug. 1983).
An axisymmetric magnetic mirror with large diameter and easily variable mirror ratio is described. The magnetic field configuration is a simple mirror with an average minimum-*B* field region on the outer surface. Experimental results are given which demonstrate that the surface field region ensures interchange stability. Stability can be maintained with both positive and negative radial plasma pressure gradients provided that the product of the pressure gradient and specific flux volume gradient is positive. (17 refs.)

107432 Space potential profiles in ELMO bumpy torus (EBT) experiment. F.M.Bieniosek (McDonnell Douglas Astronautics Co., St. Louis, MO, USA), K.A.Connor.
Phys. Fluids (USA), vol.26, no.8, p.2256-62 (Aug. 1983).
Spatially resolved measurements of the electric space potential in the ELMO Bumpy Torus (EBT) have been made by a heavy ion beam probe. The EBT-I device is characterized by positive potentials in the surface plasma the order of 100 V and by a nearly symmetric potential well in the core plasma of up to 3090 V with respect to the surface potential. The EBT-S device has a similar potential structure with well depth and peak potential similar to or greater than that of EBT-I. Peak potential and well depth increase as the edge gas pressure is lowered and as the microwave power is increased. The potential structure is strongly linked to the specific heating geometry. The ambipolar electric field is large enough generally to dominate the core electron neoclassical diffusion. The potential profile is approximately parabolic in the core, which is shown to be a natural consequence of the spatially uniform plasma source function. (16 refs.)

107433 Thermal magnetic fluctuations and anomalous electron diffusion in a mirror-confined plasma. G.Murtaza, H.U.Rahman (Dept. of Phys., Quaid-i-Azam Univ., Islamabad, Pakistan).
Phys. Rev. A (USA), vol.28, no.3, p.1845-7 (Sept. 1983).
The electron test particle cross-field diffusion due to thermally excited magnetostatic modes with ergodic field lines is investigated. Estimate shows that in mirror-confined plasmas, the electron transport (and hence the electron thermal conduction) caused by the magnetostatic mode exceeds the convective as well as the classical transport. (9 refs.)

107434 Theoretical possibility of confining a dense adiabatic plasma using a self-consistent electrostatic field of subsonic solitons. M.Ya.Ivanov.
Sov. Phys.-Tech. Phys. (USA), vol.28, no.2, p.240-1 (Feb. 1983). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.53, no.2, p.387-90 (Feb. 1983). [received: Sept. 1983]
Sagdeev (1964) has pointed out that the hydrodynamic equations of motion describing an isotropic two-temperature plasma admits soliton solutions. These solutions were derived assuming a zero ion temperature, and the ions were assumed to move faster than the characteristic speed of sound. Several experimental studies have recently confirmed the existence of such ion-sound solitons. The authors describe stationary subsonic soliton solutions of a system of hydrodynamic equations governing ion motion using the approximate model of a two-fluid adiabatic plasma in the absence of external fields. At the center of the soliton these solutions imply an infinite potential, particle density, and pressure (the temperature is also infinite if the adiabatic exponent exceeds unity). Because the electric field becomes infinite at the center of the soliton, and infinite negative surface charge density must be introduced for the case of a uniform plasma. For zero ambient velocities these solutions reduce to solitons describing screening of the field of a static negative charge in a dense isotropic plasma. (10 refs.)

107435 Confinement of ions for collision studies. J.B.Hasted (Birkbeck Coll., Univ. of London, London, England).
Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute, Baddeck, NS, Canada, 13-26 Sept. 1981 (New York, USA: Plenum 1983), p.461-500
All collision experiments in which individual impacting particles make more than a single trajectory across a significant part of the collision region are in effect confinement situations and will form the subject of the article. This definition excludes collisional orbiting, and also excludes plasma and afterglow studies of collision processes, provided that the mean free path is smaller than the 'significant part' of the collision region which we choose to consider. The author discusses confinement by electric fields, magnetic confinement, the use of steady magnetic and electric fields in conjunction, and confinement in high frequency electromagnetic fields. (60 refs.)

Instability of fusing plasmas and spin-depolarization processes .... See Entry 106170

The role of atomic collisions in fusion .... See Entry 107336

Neoclassical transport in a multiple-helicity torsatron in the low-collisionality (1/ν) regime .... See Entry 107343

Charged particle motion near a linear magnetic null .... See Entry 107344

Statistical mechanics of a bounded, ideal magnetofluid .... See Entry 107354

A linear model for the tearing mode of a Tokamak plasma with flow and a resistive wall boundary condition .... See Entry 107356

On the ponderomotive effects at the lower hybrid waves excitation .... See Entry 107358

Discrete Alfven eigenmode spectrum in magnetohydrodynamics .... See Entry 107372

Beta and density limits in Tokamaks .... See Entry 107374

Effects of toroidicity on resistive tearing modes .... See Entry 107376

Self-consistent eigenvalue analysis of Rayleigh-Taylor instability in an ablating plasma .... See Entry 107381

Transition to chaos for ballooning modes stabilized by finite Larmor radius effects .... See Entry 107384

Vortex and magnetostatic-mode turbulence produced by a Buchsbaum mode .... See Entry 107389

Thermodynamic theory of light ion beam propagation in a plasma .... See Entry 107399

Plasma startup patterns in Tokamak reactors .... See Entry 107404

Dependence of loading resistance and wave structures on plasma density of ICRF wave using cold slab model .... See Entry 107405

Heating and breakdown of protective layer at plasma retaining wall .... See Entry 107406

Experimental study of high-beta Tokamak stability .... See Entry 107443

Predicted behaviour of the pumped limiter of INTOR .... See Entry 107450

Bundle divertor. A review of experimental results .... See Entry 107451

52.60 RELATIVISTIC PLASMA

107436 Hydrodynamic description of waves in hot relativistic plasma. L.S.Kuz'menkov, P.A.Polyakov, P.B.Podosenov (Dept. of Theoretical Phys., Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.5, p.12-16 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.5, p.12-17 (1982).
It is shown that using the energy-momentum tensor of material in the form $T^{ij}=(\epsilon+\rho)\tau^i\tau^j-g^{ij}\rho$ with wave emission in a relativistic plasma leads to incorrect dispersion of the plasma waves. A closed system of equations for relativistic plasma is constructed in the hydrodynamic approximation, taking the retardation of the radiation into account, and on this basis the dispersion and radiational-damping decrements of the wave are obtained, with results that do not contradict kinetic theory. (8 refs.)

107437 Transverse modes of a relativistic quantum plasma. C.G.Van Weert, M.C.J.Leermakers (Inst. for Theoretical Phys., Univ. of Amsterdam, Amsterdam, Netherlands).
Phys. Lett. A (Netherlands), vol.97A, no.4, p.159-61 (22 Aug. 1983).
The dispersion relation for long-wavelength transverse plasma waves propagating in a one-component relativistic quantum plasma is derived from the relativistic Boltzmann-Vlasov equation. The result is consistent with the one obtained from quantum electrodynamics by the method of dielectric response, but at variance with hydrodynamical calculations. The discrepancy is explained by making a distinction between collective and collision dominated plasmas. (12 refs.)

Field of a test body in a stream of charged particles .... See Entry 107349

Weakly relativistic dielectric tensor and dispersion functions of a Maxwellian plasma .... See Entry 107363

Some aspects of transformation of the nonlinear plasma equations to the space-independent frame .... See Entry 107386

52.65 PLASMA SIMULATION

Laser-driven shock-wave propagation in pure and layered targets .... See Entry 107391

Analysis of target implosion on irradiation by proton beams. I. Beam interaction with target plasma .... See Entry 107402

Theoretical modeling of electromagnetically imploded plasma liners .... See Entry 107403

Use of the stellarator expansion to investigate plasma equilibrium in stellarators .... See Entry 107430

52.70 PLASMA DIAGNOSTIC TECHNIQUES AND INSTRUMENTATION

107438 Spatially resolved laser-induced fluorescence and optical emission spectroscopy of carbon tetrachloride glow discharges. R.A.Gottscho, G.P.Davis, R.H.Burton (Bell Labs., Murray Hill, NJ, USA).
Plasma Chem. & Plasma Process. (USA), vol.3, no.2, p.193-218 (June 1983).
The authors describe the use of laser-induced fluorescence and optical emission spectroscopy to study the chemistry of CCl_4 discharges. Spatially and spectrally resolved plasma-induced emission from six different species—CCl, C, Cl, Cl^+, N_2, and $N_2{}^+$—were constrasted with the CCl free radical concentration profile, determined from spatially resolved laser-induced fluorescence, to arrive at a simple model for the CCl_4 discharge chemistry. Electrons appear to be produced at the electrode surfaces by secondary emission resulting from high-energy ion impact. As the electrons are accelerated across the sheath, they are rapidly attenuated by resonant dissociative attachment to CCl_4 and its plasma-generated products. This mode of decomposition produces bright emission nearest to the electrode surfaces and is conducive to the formation of 'glow polymer'. To test the validity of using N_2 as an actinometer in determining the CCl radical concentration, the authors compared laser-induced fluorescence measurements of the CCl concentration with plasma-induced CCl emission normalized to N_2 emission. (59 refs.)

107439 Chemical relaxation study of the heterogeneous silicon-hydrogen system under plasma conditions. J.J.Wagner, S.Veprek (Inst. of Inorganic Chem., Univ. of Zurich, Zurich, Switzerland).
Plasma Chem. & Plasma Process. (USA), vol.3, no.2, p.219-34 (June 1983).
The chemical relaxation technique consists of measuring the response of a chemical system to a small disturbance of an equilibrium or a nonequilibrium steady state. Since, for a small perturbation, the response of any complex and stable system is linear, rate constants of elementary processes under actual plasma conditions can be evaluated directly from the relaxation data. Applications of this technique to the kinetic study of the formation and decomposition of silane are presented and compared with previous data obtained by a flow method. In addition, relaxation data are presented which show that the main reaction channel of silane decomposition in glow discharges is the electron-impact-induced fragmentation into SiH_2 radicals (or ions) and H_2 molecules. (9 refs.)

107440 Decomposition and polymerization of silicon tetrachloride in a microwave plasma. A mass-spectrometry investigation. R.Manory, A.Grill (Materials Engng. Dept., Ben-Gurion Univ. of the Negev, Beer-Sheva, Israel), U.Carmi, R.Avni.
Plasma Chem. & Plasma Process. (USA), vol.3, no.2, p.235-48 (June 1983).
Mass spectrometry has been used to analyze microwave-induced plasmas of silicon tetrachloride diluted in mixtures of hydrogen and argon. The efects of process parameters such as pressure in the reactor, power input, and the composition of the gas mixture were investigated. Sampling by quadrupole mass-spectrometer along the gas stream showed that the reactions were initiated upstream where the reactants enter the plasma. The input power had an optimal value for the decomposition rate of $SiCl_4$; above that optimum, recombination occurred downstream. Upstream the concentrations of $SiCl_4$ decrease with increasing pressure in the range 1-10 torr, independent of the

input power. The effect of admixing argon to the reaction mixture is discussed, and the results obtained are correlated to experimental results reported in previous works concerning silicon deposition from $SiCl_4$ on a grounded substrate. (31 refs.)

107441 Spectroscopic measurements of plasma ion density by neutral beam probing. Y.Ito, S.Fukumoto, S.Goto, T.Ishimura (Plasma Phys. Lab., Faculty of Engng., Osaka Univ., Osaka, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.6, p.981-6 (June 1983).
A method of determining plasma ion density by spectroscopic measurement of line emission from a probing neutral beam, attenuated by resonance charge transfer interaction with plasma ions, is proposed and tested. A hydrogen plasma produced by an RF discharge was used as the subject of the test. The parameters of the hydrogen probing beam in the region of observations were ~400 eV average energy, $\sim 3\times10^{12}$ cm^{-3} peak density and ~2 μm pulse width. The beam was produced by a Z-pinch-gun, a neutral beam source. From the attenuation rate of Hβ emission and the known cross-section of the interaction, the ion density was determined when it was in the range from 2×10^{14} cm^{-3} to 5×10^{14} cm^{-3}. The value determined agreed well with the electron density measured with an He-Ne laser interferometer. (6 refs.)

107442 An electrodynamic coaxial spectrometer for multichannel plasma pulse analysis. J.Eicher, K.Rohr, H.Weber (Fachbereich Phys., Univ. Kaiserslautern, Kaiserslautern, Germany).
J. Phys. E (GB), vol.16, no.9, p.903-8 (Sept. 1983).
A dynamical particle spectrometer is described, which allows complete and simultaneous analysis of ion energy spectra and charge distributions of transient ion pulses, e.g. from laser-produced plasmas. The system uses a combined time-of-flight arrangement with a coaxial capacitor whose potential is varied as $1/(\text{time})^2$. Compared with dynamically operated parallel plate analysers the cylindrical symmetry offers substantial advantages both in principle and in practical application. A generator was developed which generates the appropriate $1/(\text{time})^2$ deflection potential. The performance of the whole system is tested using laser-produced C plasma pulses. (16 refs.)

107443 Experimental study of high-beta Tokamak stability. M.Machida, G.A.Navratil (Columbia Univ., New York, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.11, p.992-5 (12 Sept. 1983).
The stability properties of high-beta Tokamak equilibria with $\epsilon\beta_p \gtrsim 1$ and $\langle\beta\rangle$ in the range of 10% have been studied with use of a dual beam CO_2 laser interferometer system. Two equilibria with $\langle\beta\rangle$ of 9% and 13% were observed to be stable. Another equilibrium with $\langle\beta\rangle$ of 10% was observed to be unstable with the characteristics of a high-toroidal-mode-number ballooning mode. (13 refs.)

107444 An interferometric electron density estimate of a TE-CO_2 laser sustained plasma in front of a metallic target. D.Apostol, I.Apostol, D.Barbulescu, M.Dinescu, A.Hening, I.N.Mihailescu, V.Stancalie, M.Stoica (Central Inst. of Phys., Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.4, p.355-8 (1983).
A Mach-Zehnder interferometer, using a *Q*-switched ruby laser as a light source was constructed. It was used for the investigation of a TE-CO_2 laser produced plasma in front of a solid target. Plasma refractivity analysis indicates an electron density of 10^{18} cm^{-3} on the detonation front. (6 refs.)

107445 The finite collector effect in obtaining the distribution function and temperature of Maxwellian plasmas measured with plane-parallel retarding potential analysers. G.Dinescu, I.Birna, O.Maris (Space Res. Lab., Astron. & Space Sci. Center, Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.4, p.359-65 (1983).
The finite collector effect is investigated when measuring Maxwellian plasmas with plane-parallel electrostatic analysers. Errors in the distribution function $f(v_z)$ and temperature T, due to the finite collector character, depending on the retarding potential, are estimated for various geometries. The conditions for which plane-parallel analysers measurement results are not relevant are discussed. (4 refs.)

Novel short-pulse photoionization electron source: Li $(1s2s2p)^4P^\circ$ deexcitation measurements in a plasma .... See Entry 106603

Collision operator for a strongly magnetized pure electron plasma .... See Entry 107332

Studies of ion-ion recombination using flowing afterglow plasmas .... See Entry 107337

Two-dimensional ion emission from laser-produced plasmas .. See Entry 107412

Effects of giant laser pulses on a quasisteady plasma jet .... See Entry 107418

Development of concentric equipotential surfaces in bumpy torus plasma .... See Entry 107422

Use of the stellarator expansion to investigate plasma equilibrium in stellarators .... See Entry 107430

Space potential profiles in ELMO bumpy torus (EBT) experiment .... See Entry 107432

Analyzer system of the plasma focus ionic component .... See Entry 107447

Mechanism of formation and decay of some O I levels in the positive column of a glow discharge in O_2 .... See Entry 107469

52.75 PLASMA DEVICES AND APPLICATIONS

(see also 28.52 Fusion reactors, 86.30L Electrogasdynamic and magnetohydrodynamic conversion; for ion sources, see 29.25 Particle sources and targets)

107446 Thermionic converter with conductive oxide covered collector. G.Musa, A.Popescu, N.Niculescu (Inst. for Phys. & Technol. of Radiation Devices, Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.4, p.371-3 (1983).
Preliminary results concerning the behaviour of a thermionic diode with thick conductive oxide covered anode are reported. The obtained values of the anode work function versus T_C/T_R are in good agreement with the published data. (10 refs.)

107447 Analyzer system of the plasma focus ionic component. A.Bocancea (Factory of Nuclear Devices, Bucharest, Rumania), N.Mandache.
Rev. Roum. Phys. (Rumania), vol.28, no.5, p.413-17 (1983).
An analyzer system of protons in the energy range of 1-400 keV used on a plasma focus device is presented in this paper. A combined electrostatic deflection and time of flight technique allows the simultaneous analysis of the protons and impurity ions in different charge states. In the case of a negligible impurity level the energy spectrum of the protons can be obtained on a single discharge. (8 refs.)

107448 Some corrections for a one-dimensional snow-plow model. V.I.Zambreanu (Inst. for Phys. & Technol. of Radiation Devices, Central Inst. for Phys., Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.5, p.419-24 (1983).
The initial mass of the sheath, the electrical resistance of the discharge circuit, the electrical resistance of the plasma sheath and the snow-plow efficiency are taken into account in a one-dimensional snow-plow model for the run-down phase in a plasma focus device. The numerical results are presented and discussed. (4 refs.)

107449 Emission of electrons from the collector of a thermionic converter. V.N.Sidel'nikov.
Sov. Phys.-Tech. Phys. (USA), vol.28, no.2, p.238-9 (Feb. 1983). Translation of: *Zh. Tekh. Fiz. (USSR),* vol.53, no.2, p.385-7 (Feb. 1983). [received: Sept. 1983]
It has been possible to solve a number of applied problems relating to thermionic converters by numerically solving simplified transport equations. It should be noted that these models neglect arc initiation and constriction and hindered regimes. It was therefore found to be advisable to numerically solve the complete charge, momentum, and energy transport equations for the electrons and ions. (8 refs.)

107450 Predicted behaviour of the pumped limiter of INTOR. M.F.A.Harrison, E.S.Hotston.
Report CLM-R 232, UKAEA, Culham, Abingdon, Oxon., England (1982), 24 pp.
Available from HMSO, London, England.
Modelling of the pumped limiter envisaged for INTOR Phase IIA predicts that an effective exhaust of helium can be attained. Assessment of the performance of tungsten and beryllium limiter plates shows that the sputter rate of tungsten is low and that self-sputtering is not likely to be a problem. Sputter erosion of the beryllium plate is large (≈20cm/year) and the helium exhaust pumping requirements for beryllium are about twice as demanding as those for tungsten. In neither case is there evidence of significant atomic radiation cooling by impurity ions which recycle in the immediate vicinity of the plate. Consideration of the scrape-off plasma provides evidence that localised recycling of DT ions in the immediate vicinity of the limiter is a significant transport mechanism when the scrape-off plasma density is $\gtrsim 10^{19}$ m^{-3}. The charged particle power flow necessary to maintain this recycling is at least 4 MW and, since energy is carried to the sheath predominantly by electron conduction along the magnetic field, there is a substantial temperature gradient between the sheath regions at the limiter plate and the bulk of the scrape-off plasma. The temperature at the separatrix distant from the plate may therefore be in excess of 50 eV. (8 refs.)

107451 Bundle divertor. A review of experimental results. K.B.Axon, J.Burt, S.K.Erents, S.J.Fielding, R.D.Gill, D.H.J.Goodall, M.Hobby, J.Hugill, G.M.McCracken, J.W.M.Paul, N.J.Peacock, B.A.Powell, R.Prentice, G.Proudfoot, G.W.Reid, A.D.Sanderson, P.E.Stott, D.D.R.Summers, C.M.Wilson, A.J.Wootton.
Report CLM-R 235, UKAEA, Culham, Abingdon, Oxon., England (1983), 79 pp.
Available from HMSO, London, England.
The authors review the experimental results obtained with a Tokamak, DITE, operated with a bundle divertor. Experiments to determine the magnetic aperture, exhaust and screening properties of the divertor are described. The results are compared with the predictions of various models. A comparison of the plasma parameters produced with and without the divertor is presented. The differences are discussed in terms of the exhaust and screening properties, with the aid of a global model of impurity production. Neutral hydrogen atom injection has been used to heat the plasma; results are presented, together with a discussion of the effect of the magnetic field ripple, produced by the divertor, on confinement. Gross instability characteristics of plasma produced with the divertor are discussed, together with their effect on the divertor properties. Possible explanations for different operational characteristics are considered. Finally, a comparison between the results obtained with the bundle divertor and poloidal divertors is presented. (55 refs.)

Static and buckling analysis of a cryostat outer wall (Bell-Jar) for the whole magnetic system of the INTOR-NET fusion reactor .... See Entry 106167

The impedance of an electrodynamic, coaxial plasma accelerator .... See Entry 106183

Electrical and thermal structure of the argon arc of a two-jet plasmatron .... See Entry 107467

52.80 ELECTRIC DISCHARGES

(see also 51.50 Electrical phenomena in gases)

107452 Electrodeless breakdown in elliptically polarized fields at 60 Hz. D.E.Friedmann, F.L.Curzon, M.Feeley (Phys. Dept., Univ. of British Columbia, Vancouver, BC, Canada).
Can. J. Phys. (Canada), vol.61, no.9, p.1284-90 (Sept. 1983).
Theoretical and experimental results are presented on the frequency of electrodeless breakdown (f_B) of a gas in a spherical glass bulb immersed in an elliptically polarized field of maximum field strength E_A' and frequency f_A (~60 Hz). It is found that the breakdown threshold is independent of the ellipticity and that graphs of f_B versus E_A' are stepped at low fields and linear at high ones. At high fields, $f_B=f_A l/e_0$ where l is the circumference of the phasor and e_0 is the breakdown strength of the gas ($l=2\pi E_A'$ and $4E_A'$ respectively for circular and linear polarization). The implications of the results for measuring environmental fields are given. (5 refs.)

107453 Experimental study of DC coronas in point-to-plane short gap. Chul-Han Oh, Sung-Man Lee (Korean Inst. of Electrical Engrs., Seoul, Korea).
Trans. Korean Inst. Electr. Eng., vol.32, no.5, p.157-63 (1983). In Korean.
Positive and negative coronas in point-to-plane short gap have been investigated with the variations of point radius and gap length. Mainly the onset potentials and current pulses under various conditions were measured with a 70 MHz CRO and a precise-controllable DC power supply. In the case of negative corona, the Trichel pulse corona, glow corona and spark regions were distinguished apparently and the critical gap lengths between them were also found clearly. In the case of positive corona, there are streamer corona, spark regions and the critical gap length between them, too. The current pulse forms of Trichel pulse corona of negative and streamer pulse corona of positive are similar in rising time, peak-to-peak time and pulse width. The glow corona current shows DC component in form. (8 refs.)

107454 Investigation of changeable discharge colour controlled by electronic circuit. Chul-Han Oh, Duck-Kyu Park (Korean Inst. of Electrical Engrs., Seoul, Korea).

Trans. Korean Inst. Electr. Eng., vol.32, no.5, p.164-9 (1983). In Korean.

A method to control the luminous colour of a gaseous discharge tube has been investigated by using the saw-tooth wave of which rise-time was controlled by an electronic circuit. The luminous colour of a Ne-Hg lamp was changed from red to blue continuously and vice versa, and its luminous characteristics are presented. (11 refs.)

107455 Self-sustaining partial discharges in argon at the dielectric surface. J.S.Brzosko, J.Klobukowska (Inst. of Phys., Warsaw Univ., Warsaw, Poland).

IEEE Trans. Electr. Insul. (USA), vol.EL-18, no.4, p.420-8 (Aug. 1983).

The inception voltage of the surface discharges produced by alternating voltage was measured and mathematically analyzed. The specimen thickness, the dielectric material, and ambient argon pressure were varied. A new definition of the inception voltage is proposed. Analysis is based on the simplified equivalent circuit model, Paschen law, and properties of carriers injected-evaporated from the surface of dielectrics. The results are fairly well interpreted and qualitatively described in terms of the modified Paschen law. (36 refs.)

107456 Effect of electrode geometry on the positive impulse breakdown in carbon dioxide. T.V.Rajendran, C.S.Lakshminarasimha, M.S.Naidu (Dept. of High Voltage Engng., Indian Inst. of Sci., Bangalore, India).

IEEE Trans. Electr. Insul. (USA), vol.EL-18, no.4, p.455-7 (Aug. 1983).

Positive impulse (1.2/50 μs) breakdown voltage measurements were carried out in CO_2 under different electric field conditions of varying the sphere diameter in sphere-plane geometry. CO_2 gas pressures up to 1 MPa were used, with the gap distances varying between 5 and 20 mm. It was observed that there exists a 'critical field' (corresponding to the sphere diameter of 20 mm) at which the breakdown voltage is a maximum over the entire range of pressures investigated. This phenomenon is similar to the corona stabilization effect and could be due to presence of negative ion space charge. (7 refs.)

107457 Experimental study of electrode materials for use in a cold-cathode oxygen discharge. M.G.Dowsett, E.H.C.Parker (Dept. of Phys., City of London Polytech., London, England).

Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.299-309 (1 Sept. 1983).

A large range of elements has been evaluated for use as cathode, anticathode and anode materials in an oxygen cold-cathode discharge. The criterion for suitability of a particular material/electrode combination was based on the ability to extract from the source an ion beam suitable for high dynamic range SIMS. The effect of materials on long and short term stability and total beam current was investigated. The best materials were Al (all electrodes), Ni/Fe (cathode) and Ti (anticathode). Magnesium was totally unsuitable as a cathode material in an oxygen discharge and caused extreme instability in both the extracted beam and the discharge. The reasons for beam current instability are related to departure from cylindrical symmetry in the source, and are discussed qualitatively. (8 refs.)

107458 On the random walk of arc cathode spots in vacuum. E.Hantzsche, B.Juttner, H.Pursch (Central Inst. of Electron Phys., Acad. of Sci., Berlin, Germany), J.E.Daalder.

J. Phys. D (GB), vol.16, no.9, p.L173-9 (14 Sept. 1983).

The theoretical basis of the random walk movement of cathode arc spots is reconsidered, and the probable causes of some discrepancies in measured spot movement parameters and in their interpretation are discussed. (16 refs.)

107459 Axial magnetic field measurements and the stability of a vacuum spark plasma. P.Beiersdorfer, E.J.Clothiaux, G.Bell (Dept. of Phys., Auburn Univ., Auburn, AL, USA).

J. Phys. D (GB), vol.16, no.9, p.1635-42 (14 Sept. 1983).

Axial magnetic fields are measured in the vacuum region surrounding a vacuum spark plasma providing information on the stability of the plasma column. The measurements are correlated to the amount and times of X-ray emission showing that X-ray bursts are produced only in linear discharges. (11 refs.)

107460 A model of the cathode of a thermionic arc. L.E.Cram (CSIRO Div. of Appl. Phys., Lindfield, Sydney, NSW, Australia).

J. Phys. D (GB), vol.16, no.9, p.1643-50 (14 Sept. 1983).

A theoretical model of the cathode of a thermionic arc is presented. Attention is focused on the energy balance of the electrode, with the interplay between the cathode and the arc plasma being described by boundary conditions specified on the electrode surface. Physical processes included in the model are thermal conduction and Joule heating in the electrode, radiative energy exchange between the electrode and the arc plasma, thermionic emission, and ion flow in the cathode sheath. A model of the cathode of a 100 A arc burning on tungsten in argon at atmospheric pressure is described in detail. It is shown that the flow of electric current and heat close to the tip of the electrode is controlled by thermionic emission and arc radiation, while the ion current plays a dominant role in the outer parts of cathode spot. (23 refs.)

107461 Material functions of sulphur hexafluoride. H.Dienemann (Inst. 'Pruffeld fur elektrische Hochleistungstech.', Berlin, Germany).

J. Phys. D (GB), vol.16, no.9, p.1651-71 (14 Sept. 1983).

Several material functions of SF_6 were calculated for temperatures between 1000K and 20000K and for pressures of 0.1, 0.5, 1, 2.5, 5 and 10 MPa. In the basic equations for the computation of SF_6 material functions, the authors have also taken into account plasma nonideality effects. They have analysed the SF_6 plasma radiation in high current discharges using an Optical Multichannel Analyser, to determine the dependence on the current and the discharge pressure. (22 refs.)

107462 Modelling of a low-pressure plasma column sustained by a surface wave. C.M.Ferreira (Lab. de Phys. des Gaz et des Plasmas, Univ. de Paris-Sud, Orsay, France).

J. Phys. D (GB), vol.16, no.9, p.1673-85 (14 Sept. 1983).

A complete theoretical description of a low-pressure, cylindrical plasma column sustained by a weakly damped surface wave is derived in which the equations describing the steady-state plasma maintenance conditions are coupled with the surface wave propagation and attenuation characteristics. The present formulation extends a radial theory of the maintenance of the plasma column previously reported to include the axial variation in the radially averaged plasma properties. Simple similarity laws for this type of discharge are proved to exist under quite general conditions. Analytic expressions are derived for the variation of the electron density along the discharge axis and for the length of the plasma column as a function of the operating parameters. The calculation are shown to agree well with available experimental data. (17 refs.)

107463 Ionisation processes in He-CO and He-CO-O_2 glow discharges. Y.M.Kagan, Y.Kaufman (Center for Plasma Phys., Racah Inst. of Phys., Hebrew Univ. of Jerusalem, Jerusalem, Israel).

J. Phys. D (GB), vol.16, no.9, p.1687-99 (14 Sept. 1983).

Ionisation processes in the He-CO and He-CO-O_2 glow discharges are studied. Various models are critically reviewed and an alternative ionisation mechanism is proposed. The populations of the CO and O_2 metastable levels and the rates of direct and step ionisation processes are calculated. It is argued that the metastable level of CO can be efficiently populated by energy transfer due to collisions between vibrationally excited molecules. It is shown that the direct ionisation of CO in the H-CO discharge is replaced by step ionisation of O_2 in the He-CO-O_2 discharge. This explains both the reduced axial electric field and the fact that O_2^+ is the dominant ion in the He-CO-O_2 discharge. (29 refs.)

107464 Comments on the role of space charges in initiation of electrical breakdown of vacuum gaps. V.A.Nevrovskiy (All-Union Scientific Res. Inst. of Metrological Service, State Committee for Standards, Moscow, USSR).

J. Phys. D (GB), vol.16, no.9, p.1701-4 (14 Sept. 1983).

The process of beam spreading of field-emission electrons under the action of space charges, suggested by Maitland (1961) as an explanation of vacuum breakdown initiation, is analysed. This type of space charge effect is shown to be negligible. A plausible model of breakdown initiation as a result of ions focusing within the electron beam is discussed and shown to be unreal. The effects of space charges on the initiation of vacuum breakdown are thus concluded to be very small. (12 refs.)

107465 Monte Carlo simulation of electrons in the cathode region of the glow discharge in helium. M.Ohuchi, T.Kubota (Dept. of Electronic Engng., Faculty of Engng., Tokyo Denki Univ., Tokyo, Japan).

J. Phys. D (GB), vol.16, no.9, p.1705-14 (14 Sept. 1983).

In the cathode fall region of a glow discharge, where the electric field decreases rapidly with distance from the cathode, parameters for electrons obtained in an equilibrium state can not be correctly used in a theoretical study. In this paper, the cathode region in a normal glow discharge has been analysed by a Monte Carlo simulation. Four types of inelastic collisions together with an elastic collision, the reflection of electrons from electrodes and the back-scattering of electrons to the cathode, were taken into account considering the three-dimensional motions of electrons. Results show that α/p (where α is the ionisation coefficient and p is the gas pressure) is in good agreement with Friedland's result. Also, the mean energy of electrons in the negative glow region was found to be about 11 eV, which is much smaller than previous values. The difference in spatial distribution of optical emission between singlet terms and triplets was also indicated. (28 refs.)

107466 Theoretical study of electron concentration distribution in positive column glow discharge with longitudinal gas stream. R.F.Yunusov (A.N. Tupolev Kazan Inst. of Aviation, Kazan, USSR).

J. Eng. Phys. (USA), vol.43, no.4, p.1100-3 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.585-9 (Oct. 1982). [received: Sept. 1983]

A solution is obtained to the system of equations describing the positive column of a glow discharge in a cylindrical channel with a longitudinal gas stream. Expressions are derived for calculating the electron concentration and the electric field intensity. (8 refs.)

107467 Electrical and thermal structure of the argon arc of a two-jet plasmatron. S.P.Polyakov, V.I.Pechenkin (Dnepropetrovsk Metall. Inst., Dnepropetrovsk, USSR).

J. Eng. Phys. (USA), vol.43, no.5, p.1293-6 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.833-7 (Nov. 1982). [received: Sept. 1983]

The thermal structure and the distribution of the axial electric field strength of the arc of a two-jet plasmatron were investigated experimentally. (12 refs.)

107468 Investigation of the temporal development of an electrical discharge localized by laser radiation. V.A.Ageev, S.S.Pryakhin, Yu.V.Khlopkov.

J. Appl. Spectrosc. (USA), vol.37, no.5, p.1224-8 (Nov. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.727-33 (Nov. 1982). [received: Sept. 1983]

A widely used method for increasing the intensity of a spectrum when performing spectral analysis with the use of lasers is to combine the laser with electrical discharge light sources. The simultaneous action of laser radiation with moderate power density and a low-voltage electrical discharge on an electrode together with an increase in the spectral line intensity decreases the size of the damage area in the specimen (localization of the discharge). The results obtained in work in which the discharge was localized by a dielectric plate with an opening apparently suggests that with laser localization of the discharge there is also an intensification of explosive processes removing matter from the surface of the electrode. In this case, the combined action of laser radiation and the electrical discharge on the electrode must decrease the influence of the composition of the specimen on the results of a quantitative determination of its components. In this connection, the authors made high-speed photographs of the flow of erosion products from the surface of electrodes and the spectra of the characteristic emission of the erosion plasma with time resolution of about 1 μsec, obtained using a high-speed photographing setup, and 15 μsec when using a spectrochronograph. The effect of laser localization on the analytic possibilities of the electrical discharge source for exciting spectra was studied for the example of determination of zinc and magnesium in VAL-5 and 85 aluminum alloys of the VNIISO complex. (7 refs.)

107469 Mechanism of formation and decay of some O I levels in the positive column of a glow discharge in O_2. A.I.Maksimov, V.V.Rybkin.

J. Appl. Spectrosc. (USA), vol.37, no.5, p.1233-6 (Nov. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.738-41 (Nov. 1982). [received: Sept. 1983]

Oxygen atoms in the ground and excited states play an important role in the initiation of plasmachemical processes for which a discharge in O_2 is used. For the determination of atom concentrations in nonequilibrium conditions it is essential to know the specific mechanisms of formation and decay of the corresponding states. The authors give such data for the O I levels $3p^5P$, $5s^5S$, $4d^5D$, $3p^3P$, $5s^3S$, $4d^3D$. (15 refs.)

107470 Role of accelerating processes in the formation of volume nanosecond discharges in dense gases. L.P.Babich, I.A.Berezin, T.V.Loiko, M.D.Tarasov.

Radiophys. & Quantum Electron. (USA), vol.25, no.10, p.807-11 (Oct. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.10, p.1131-7 (Oct. 1982). [received: Sept. 1983]

A spectral and space-time analysis of the luminescence of nanosecond volume discharges in atmospheric density air with large overvoltages is performed. It is shown that the electron temperature near the cathode does not exceed 2 eV, in spite of the high current density ($\sim 10^{-5}$ A.cm^{-2}) and high voltage $U_0 = 100$ kV. The volume nature of the discharges is explained by the fact that charge is transported primarily by runaway electrons. The nature of the electrons with energies $\varepsilon > eU_0$ can be explained by self-acceleration on the front of a polarizing streamer, developing in the near-cathode region of the discharges. (20 refs.)

107471 The extremal nature of the dependence of the formation time of breakdown on the magnetic field strength. M.-R.G.Kishov, A.Z.Efendiev (Dagestansk State Univ., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.11, p.896-9 (Nov. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.11, p.1256-9 (Nov. 1982). [received: Sept. 1983]
The dependence of the formation time of breakdown τ_ϕ on the magnetic field strength H is investigated. The extremal dependence obtained $\tau_\phi = f(H)$ for the breakdown of helium in an understressed region and the monotonic increase of τ_ϕ as H increases for the breakdown of nitrogen are interpreted on the basis of the model of overlapping avalanches. Optical investigations of the space-time pattern of development of a breakdown in the coarse approximation correspond to the data of the electrical method. (4 refs.)

107472 Increasing efficiency of the mercury-argon discharge at elevated frequency. V.M.Milenin, N.A.Timofeev.
Svetotekhnika (USSR), no.7, p.17 (1983). In Russian.
The calculation of the resonance level 6^3P_1 Hg population in the alternative current discharge with the help of the theoretical model of the positive column are carried out in this work. It is shown that the high energy levels of mercury atom play an important role in increasing the plasma radiation efficiency of the AC discharge with respect to the DC discharge. (5 refs.)

107473 Onset of discharge in vacuum. V.A.Avrutskii (Power Inst., Moscow, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.28, no.2, p.233-4 (Feb. 1983). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.53, no.2, p.379-81 (Feb. 1983). [received: Sept. 1983]
The conjecture of Trump and Van de Graf (1947) was analyzed by Avrutskii and Koshchienko (1979) and by Bugarev et al. (1969) to determine a condition for discharge initiation in vacuum and can also be used to account for the parameters of discharges caused by breakdown in vacuum. According to theoretical considerations regarding the exchange mechanism of vacuum breakdown, the ion current i_i reaching the cathode at any time t generates an electron current $i_i\gamma_1$, where γ_1 is the ion-electron emission coefficient. The total current in the discharge circuit is equal to $i(t) = i_i(1+\gamma_1)$. After a time Δt_1 is required for the electrons to drift from the cathode to the anode, the electrons produce an ion current $i_i\gamma_1\gamma_2$ from the anode, where γ_2 is the electron-ion emission coefficient. After a time Δt_2, when the ions have reached the cathode, they give rise to an electron current $i_i\gamma_1^2\gamma_2$ from the cathode, and the total current in the discharge circuit after a time $\Delta t = \Delta t_1 + \Delta t_2$ is equal to $i(t+\Delta t) = i_i\gamma_1\gamma_2(1+\gamma_1) = i(t)\gamma_1\gamma_2$. The author's comparisons reveal fairly good agreement between the experimental and calculated values and confirm the conjecture of Trump and Van de Graaf that an exchange mechanism is involved in vacuum breakdown. (4 refs.)

107474 Theory of low-voltage arcs in an inert gas. V.G.Ivanov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.28, no.2, p.249-50 (Feb. 1983). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.53, no.2, p.399-402 (Feb. 1983). [received: Sept. 1983]
A theory of low-voltage arcs in inert gases was worked out by Baksht and Ivanov (1980) and calculations were performed for xenon. The author reports preliminary calculations for low-voltage arcs in argon and neon using the technique of Baksht and Ivanov mention some important features of the calculations. (3 refs.)

107475 Investigation into the time/space behaviour of the cold and the thermal cathode electric arc root. K.Liegmann (Sektion Automatisierungstechnik, Tech. Hochschule Karl-Marx-Stadt, Karl-Marx-Stadt, Germany).
Wiss. Z. Tech. Hochsch. Karl-Marx-Stadt (Germany), vol.25, no.2, p.251-67 (1983). In German.
Arcs of currents under 1 kA at high pressures as well as in vacuum conditions show, depending on discharge, two different types of root. This study is aimed at clarifying conditions which result in this behaviour and to find out how it can be influenced towards one or the other type. Microphotographs show cathode erosion (electrode made of AgPd 30, gap between electrodes 3 μm, spark at 70 V and 2.4 A, duration 0.8 μs) and cathode erosion for similar arc strength. A theoretical model was constructed and theoretical results were compared with those obtained from experiments in which the duration of arc was in the range of nanoseconds. (29 refs.) *G.R.S.*

Spark-discharge energy meter ....See Entry 105333

Λ doubling spectrum of the CH free radical in a RF glow discharge ....See Entry 106396

Electronic energy transfer between state selected metastable argon atoms and ground state krypton atoms ....See Entry 106550

Electron transport parameters and excitation rates in argon ....See Entry 106602

Aspects regarding the behaviour of double circuit 400 kV OHEL three phase conductors from the point of view of corona discharges .... See Entry 106927

Electron mean energy, secondary ionisation coefficients and $(E/p)_{crit}$ in binary mixtures of SF_6-N_2 and CCl_2F_2-N_2 ....See Entry 107325

Ion mobilities and clustering in SF_6 at high pressures ....See Entry 107326

Reactions of carbonyl compounds and Group Ib metals in a plasma in the wake of a spark ....See Entry 107333

Reactions of Group Ib metal ions with selected hydrocarbons in the source of a spark source mass spectrometer ....See Entry 107334

Spatial resolved $K\alpha$ spectra of two-structure plasmas in a vacuum spark ....See Entry 107350

Picosecond air breakdown studies at 0.53 μm ....See Entry 107408

The effects of low-ionization-potential contaminants on thermal plasmas ....See Entry 107420

Spatially resolved laser-induced fluorescence and optical emission spectroscopy of carbon tetrachloride glow discharges ....See Entry 107438

Plasma polymerization of ethane. II. Theoretical analysis of effluent gas composition and polymer deposition rates ....See Entry 109738

60.00 CONDENSED MATTER: STRUCTURE, THERMAL AND MECHANICAL PROPERTIES

61.00 STRUCTURE OF LIQUIDS AND SOLIDS; CRYSTALLOGRAPHY

(see also 68.20 Solid surface structure, 71. Electron states)

107476 Ring asymmetry parameters from out-of-plane atomic displacements. M.Nardelli (Istituto di Chimica Generale e Inorganica, Univ. di Parma, Parma, Italy).
Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.8, p.1141-2 (15 Aug. 1983).
Formulae are given for calculating ring asymmetry parameters and e.s.d.s from the out-of-plane displacements of the atoms of a ring. A Fortran 77 routine has been written to calculate systematically these parameters for rings up to 40 atoms and is currently used in a general program system (Nardelli, 1982). (4 refs.)

61.10 X-RAY DETERMINATION OF STRUCTURES

(see also 61.80 Radiation damage and other irradiation effects; for specific determinations, see 61.55 to 61.80)

107477 Structural crystallography in the 1980s. M.M.Woolfson (Univ. of York, York, England).
Phys. Bull. (GB), vol.34, no.8, p.330-3 (Aug. 1983).
The author outlines the development in structural crystallography in the past thirty years and the present state of the art. (no refs.)

61.10D Theories of diffraction and scattering

107478 On the theory of X-ray and electron dynamical scattering in crystals with defects. F.N.Chukhovskii (Inst. of Crystallography, Acad. of Sci., Moscow, USSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.429-41 (1982). [received: Aug. 1983]
Describes a new approach to the theory of X-ray and electron dynamical scattering based on the 'dispersion surface representation' of dynamical equations. An exact formal solution of the two-wave diffraction scattering problem is constructed with the aid of the scattering matrix (the S-matrix) for which an explicit expression is found. A general formula describing plane-wave diffraction scattering in absorbing crystals in the region of weak distortions is derived, making it possible to determine experimentally the sign of the total variation of the displacement function from the known sign of the mean deviation w of the crystal as a whole from the exact Bragg position. The formation of the diffraction image for a dislocation in a special position, when the dislocation axis is parallel to the diffraction reflection vector, is considered in the quasi-classical approximation. (21 refs.)

107479 Anomalous passage of confined X- and gamma ray beams in three-wave diffraction. A.V.Andreev, V.E.Gorshkov, Yu.A.Il'inskii (Dept. of Quantum Radiophys., Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.49-54 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.43-8 (1982).
The authors consider a three-wave dynamical problem of the diffraction of X- and gamma rays in the case of non-coplanar diffraction, when the two reflected waves do not interact directly with each other. Approximate equations are obtained which describe the propagation of confined beams during three-wave diffraction in perfect crystals. The conditions of applicability of plane-wave approximation are estimated, numerical estimates, are presented. (6 refs.)

Violations of Friedel's law in real elastically bent crystals ....See Entry 107481

On the theory of X-ray and thermal neutron scattering in strongly distorted crystals containing dislocation loops ....See Entry 107696

61.10F Experimental techniques

(inc. apparatus, techniques and calculation methods for analyzing experimental results; see also 07.85 X-ray, gamma-ray instruments and techniques)

107480 The application of micro-area X-ray energy dispersive analysis in investigating barium-rare earth fluorocarbonate minerals. Li Fang-hua, Fan Han-jie (Inst. of Phys., Acad. of Sinica, Peking, China), Zhang Pei-shan, Wang Yi-hua.
Acta Phys. Sin. (China), vol.32, no.4, p.460-5 (April 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)* [received: Sept. 1983]
A simple quantitative method for X-ray energy dispersive analysis in investigating barium-rare earth fluorocarbonate minerals is proposed. The reliability of the method has been tested. It is pointed out that the method might be useful in discovering new members belonging to this series of minerals. (8 refs.)

107481 Violations of Friedel's law in real elastically bent crystals. L.I.Datsenko, V.I.Khrupa (Inst. of Semiconductor Studies, Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.573-81 (1982). [received: Aug. 1983]
A Bragg-Laue-aligned double-crystal spectrometer (FeKα radiation) was employed to examine the variation of normalized integrated intensities I_{RN} with strain ϵ in real silicon crystals containing a uniformly distributed oxygen or arsenic impurity ($n_0 \sim 10^{18}$ cm^{-3}, $n_{As} \sim 190^{20}$ cm^{-3}), dislocation loops and clusters ($\rho\Sigma = 10^6$ cm^{-3}), produced during the decomposition of a solid oxygen solution in silicon, or edge dislocations ($\rho_d \sim 10^4$ cm^{-2}) with various distribution patterns. Experimental I_{RN} values have been found to agree, within the measurement error (~6%), with those calculated in the framework of the generalized Eikonal theory for perfect crystals in the entire range of ϵ only for specimens which contain uniformly distributed oxygen. On the basis of the data obtained, it has been shown that the deviations from Friedel's law as measured by the Y parameter coincide in the general case in perfect and real crystals only in narrow range of ϵ. (17 refs.)

107482 Evaluation of the efficency of the plan of X-ray experiments in constructing inverse pole figures. S.F.Kurtasov, V.N.Serebryanyi.
Ind. Lab. (USA), vol.48, no.11, p.1100-2 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.42-4 (Nov. 1982).
A method is described which makes it possible, in addition to constructing the IPFs, to evaluate the efficiency of the plan of textural experiments and identify cases in which the amount of experimental information is insufficient. The experimental data are used to determine the coefficients C_l^μ of expansion of the polar density of the IPF $T(\Phi,\beta)$ into a series of symmetric spherical functions. (4 refs.)

107483 Formation and observation of Moire distribution of X-ray waves in bicrystal interferometers. P.H.Bezirganyan, V.G.Aslanyan (Dept. of Solid State Phys., Erevan State Univ., Erevan, USSR).
Phys. Status Solidi a (Germany), vol.78, no.2, p.415-21 (16 Aug. 1983).
The formation of Moire patterns in twin-block interferometers is investigated. It is shown that it is not possible to observe by the usual methods the Moire patterns produced by the rotations of atomic planes about the axis perpendicular to the reciprocal lattice vector and the plane of scattering. A method to determine the rotations of atomic planes about all three axes and the change in interplanar distances is elaborated upon. (15 refs.)

107484 Sensitivity of plane wave topography to microdefects. R.Kohler, W.Mohling (Zentralinst. fur Elektronenphys., Akad. der Wissenschaften, Berlin, Germany).
Phys. Status Solidi a (Germany), vol.78, no.2, p.489-96 (16 Aug. 1983).
The sensitivity of plane wave topography to microdefects is checked taking oxidation induced stacking faults of 8, 3.5 and 2 μm widths in silicon as a test object. Applying asymmetric CuK_α 440 reflections in Bragg case geometry, 2 μm wide defects generate so well visible contrast that topographic detection of even smaller defects seems possible. Comparison to topographs for different diffraction vectors proves the validity of the $\mathbf{g}_\odot\mathbf{b}$ criterion. Due to the varying penetration of X-rays along the rocking curve it is possible to analyse the depth distribution of defects within a range of several 10 μm below the surface. (11 refs.)

107485 A small system of programs for plotting of powder diffraction patterns. L.Smrcok, D.Miklos (Inst. of Inorganic Chem., Centre of Chem. Res., Slovak Acad. of Sci., Bratislava, Czechoslovakia).
Silikaty (Czechoslovakia), vol.27, no.3, p.281-6 (1983). In Slovak.
A small system of programs to draw the calculated powder patterns written for the desk-top calculator HP9821A is presented. Besides drawing the powder patterns of single phases, patterns of mixtures up to five components can also be plotted. The diffraction shape has been approximated by a modification Lorentz function. (7 refs.)

X-rays from synchrotron: new challenge for neutron scattering .... See Entry 105435

Structure and bonding of the first η^2-coordinated P_4 ligand: molecular structure of trans-$[Rh(P_4)(PPh_3)_2Cl].2CH_2Cl_2$ at 185K .... See Entry 106628

512-channel X-ray DARK-2.0 diffractometer with a mosaic detector for investigating protein single crystals .... See Entry 110256

61.12 NEUTRON DETERMINATION OF STRUCTURES

(for specific determinations, see 61.55 to 61.80)

107486 Neutron spin echo: ten years after. F.Mezei (Inst. Laue-Langevin, Grenoble, France).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.51-60 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The principle of neutron spin echo (NSE) spectroscopy was discovered just 10 years ago—in April 1972 in Budapest—and the first fully fledged NSE spectrometer, IN11, has been in routine user operation since 1978 at the ILL in Grenoble. By now a whole variety of different types of applications have been successfully explored and well established. The resolutions achieved, such as 4 neV in quasielastic scattering and 1 μeV in phonon linewidth studies, represent more than an order of magnitude improvement with respect to other neutron scattering methods. The fundamental conceptual and practical aspects of NSE are considered, together with a few representative experimental examples. (21 refs.)

107487 Features of neutron spectral modulation (NSM) technique. Y.Ito, M.Nishi, K.Motoya (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.61-5 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The neutron spectral modulation (NSM) employs both the sinusoidal modulation of the incident spectral distribution and the pseudo-random time modulation to incorporate the Fourier technique in the spectral domain as well as the impulse response along the time domain. The unique features of the NSM can be summarised in the following two points. The first is the utilisation of the zero-crossing points (ZCP) in the cross-correlated time spectrum as labels for the dispersive scattering process, from which the accurate dispersion relation can be obtained. The width of the dispersion curve is measured in terms of its Fourier transform. The second is the channel Fourier transform scheme, according to which desired frequency components (of both real and imaginary parts) of any scattering function can be obtained. These features of NSM are discussed with examples studied by the PANSI spectrometer. (3 refs.)

107488 Observation of Pendellosung effect in polarised neutron scattering from a magnetic crystal. J.Baruchel (Lab. Louis Neel, CNRS, Univ. Sci. de Medicale Grenoble, Grenoble, France), J.P.Guigay, C.Mazure-Espejo, M.Schlenker, J.Schweizer.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.80 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Summary form only given. The authors have obtained what they believe to be the first experimental evidence, in neutron diffraction from a magnetic crystal, of the Pendellosung effect predicted by a dynamical theory. They measured the flipping ratio $R=I_+/I_-$ for polarised neutrons as a function of wavelength for the 220 reflection from a carefully selected single crystal of yttrium iron garnet (YIG) in which the main crystal defects, the growth striations, were parallel to the (112) surface of the 0.48 mm thick sample and therefore inoperative in the symmetrical Laue geometry used. By using wavelength between 0.4 and 1.1 Å, they obtained a characteristic oscillating behaviour of $R(\lambda)$, which can be related to the oscillations expected for $I_+(\lambda)$ and $I_-(\lambda)$ in the simple case they chose, where the magnetisation, saturated along [111], was perpendicular to the scattering vector. The measured period is not in conflict with the structure factors found via extinction corrections to the kinematical scattering approximation by Bonnet et al. (1979). (3 refs.)

107489 An application of wide band chopper for small angle neutron scattering. M.Ono, H.Yoshida, S.Okamoto (Res. Reactor Inst., Kyoto Univ., Osaka-fu, Japan), K.Osamura, H.Tsunekawa.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.91-5 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
A wide band chopper was designed to provide polychromatic pulsed neutrons in the range 2-10 Å for small angle neutron scattering (SANS), and has been installed at Kyoto University Research Reactor. In the SANS by means of the time-of-flight technique with this chopper, scattering patterns are provided in the range of the scattering vector κ from 0.01 to 0.1 $Å^{-1}$. The shape of the slit of the rotor was determined after computer calculations of neutron burst shapes and transmission probabilities for various slit shapes. The experimental tests for the rotor have satisfactorily been performed. A practical application of the chopper to SANS was carried out to examine the precipitation in a superconducting composite wire of Ti-Nb alloy during ageing at 643K. (1 ref.)

107490 Neutron diffraction camera method applied in the study of phase transition. M.Hidaka (Dept. of Phys., Kyushu Univ., Fukuoka, Japan), A.F.Wright, S.P.Heathman.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.103 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Summary form only given. The neutron diffraction camera method is used for studying the crystallographic and magnetic phase transitions. Since this method shows a two-dimensional view of the reciprocal space at the same time, it is very useful for observing the pattern of satellite reflections or diffuse scatterings related to any kind of structural phase transitions. And also, since the instrument used is a Laue camera, an oscillating camera and a Weissenberg camera constructed for neutron diffraction, it is possible to determine crystallographic and magnetic structures as by an X-ray diffraction camera method. (no refs.)

Yamada Conference VI on Neutron Scattering in Condensed Matter .... See Entry 105020

X-rays from synchrotron: new challenge for neutron scattering .... See Entry 105435

Cross-sections of materials used as neutron monochromators and filters .... See Entry 105946

Studies of condensed matter with a pulsed neutron source (KENS) .... See Entry 106194

Pulsed neutrons: one year of experience with the new source at Argonne National Laboratory .... See Entry 106195

Condensed matter research at the Los Alamos pulsed neutron source (WNR) .... See Entry 106196

Polarised neutron scattering using pulsed spallation neutron source at KEK .... See Entry 106199

A neutron spin echo triple axis spectrometer .... See Entry 106208

Crystal analyser TOF spectrometer (CAT) .... See Entry 106213

Multi-analyser crystal spectrometer (MAX) for pulsed neutron source and its application to various problems .... See Entry 106214

Position sensitive neutron detectors using ^6Li glass scintillators .... See Entry 106245

On the theory of X-ray and thermal neutron scattering in strongly distorted crystals containing dislocation loops .... See Entry 107696

61.14 ELECTRON DETERMINATION OF STRUCTURES

(for specific determinations, see 61.55 to 61.80)

61.14D Theories of diffraction and scattering

On the theory of X-ray and electron dynamical scattering in crystals with defects .... See Entry 107478

Structure-factor phase information from two-beam electron diffraction .... See Entry 107493

'Nonsystematic' many-beam interactions in high-energy electron diffraction .... See Entry 107497

61.14F Experimental diffraction and scattering

107491 Simple analytical method of determining the positions of traces in electron-diffraction patterns. E.I.Teitel' (Inst. of Metal Phys., Sverdlovsk, USSR).
Ind. Lab. (USA), vol.48, no.11, p.1122-3 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.57-8 (Nov. 1982). (3 refs.)

107492 Some applications of convergent beam electron diffraction in metallurgical research. M.Raghavan, J.Y.Koo, R.Petkovic-Luton (Corporate Res. Sci. Labs., Exxon Res. & Engng. Co., Linden, NJ, USA).
J. Met. (USA), vol.35, no.6, p.44-50 (June 1983).
Crystal structure characterization of materials at very high spatial resolution by convergent beam electron diffraction (CBD) analysis has been receiving increasing attention since the advent of the modern probe forming electron microscopes. The combination of a fine probe and a high diffraction angle in CBD provides, among others, three-dimensional crystal structure and symmetry information from very small regions or second phase particles. Such information is essential to unambiguously determine the crystal structure of complex phases. The authors describe the basic principles of CBD and illustrate how the technique has been routinely and effectively used in the analysis of second phase particles in nickel-base and oxide dispersion strengthened alloys. (16 refs.)

107493 Structure-factor phase information from two-beam electron diffraction. J.Tafto (Metall. & Materials Sci. Div., Brookhaven Nat. Lab., Upton, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.8, p.654-7 (22 Aug. 1983).
The electron-induced characteristic X-ray emission from a noncentrosymmetric crystal shows a pronounced intensity difference when the Bragg condition is fulfilled for the G and $-G$ reflections, respectively, along a polar direction. This two-beam effect is demonstrated for GaAs and InP, and is a direct method of obtaining information about the phase of a structure factor and determining the sense of a polar direction. (14 refs.)

Extinction-contour method in examining bending in thin-film objects [electron microscopy] .... See Entry 107499

61.14H Low-energy electron diffraction (LEED) and reflection High-energy electron diffraction (RHEED)

107494 Application of orthogonal experimental design to LEED crystallography. W.S.Yang (Dept. of Phys., Peking Univ., Beijing, China), F.Jona, P.M.Marcus.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.718-22 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
A description is given of the first application to LEED crystallographic problems of an optimization scheme called orthogonal experimental design (OED) which economizes on selection of trial values. The operational procedures required by the OED method are described, and their use in a LEED intensity analysis of the Si{001}2×1 surface is discussed. This first application to what is undoubtedly one of the most difficult problems in quantitative LEED crystallography was an essential ingredient in finding a satisfactory set of structural parameters for the Si{001}2×1 surface. (11 refs.)

107495 Determination of the incidence and azimuth angles in LEED experiments. S.Mroz (Inst. of Experimental Phys., Univ. of Wroclaw, Wroclaw, Poland), A.Grudniewski, E.Bak.
J. Phys. E (GB), vol.16, no.9, p.858-61 (Sept. 1983).
A method of measuring the incidence angle β and azimuth angle ϕ in LEED experiments is proposed. The sample is positioned in such a manner that, after rotation through the angle δ around the axis parallel to the sample surface, the (hk) beam occupies the place on the luminescent screen occupied by the (00) beam before this rotation. If the basic vectors of the surface structure are known, the angle β can be calculated using the angle δ and electron energy E. The angle ϕ is also known because the projection of the primary beam on the sample surface is parallel to the vector (hk) of the two-dimensional reciprocal lattice. The sources of error are discussed and the total error in single measurement of both β and δ is estimated to be not larger than 1°. The advantages of the method proposed is that one obtains the actual values of angles measured even in the presence of magnetic fields. (2 refs.)

107496 Equivalent beam averaging (EBA) of I-V spectra for LEED analysis. H.L.Davis, J.R.Noonan (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Phys. Scr. (Sweden), vol.T4, p.141-3 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).
An equivalent beam averaging (EBA) procedure is described which has proved to be very useful to enhance *I-V* profile data collected for LEED analyses. Specific analyses are documented where application of EBA has led to improved agreement between calculated and experimental *I-V* profiles. The procedure also has been substantiated by examination of representative *I-V* profiles which were calculated to correspond to the incident beam slightly misaligned from, and exactly aligned with, the surface normal. It then has been inferred from such substantiation that use of EBA in LEED analysis reduces the effects of systematic experimental errors caused by minor misalignment of the incident beam, beam divergence, and certain surface morphologies. (10 refs.)

107497 'Nonsystematic' many-beam interactions in high-energy electron diffraction. A.S.Avilov, V.S.Parmon (Inst. of Crystallography, Acad. of Sci., USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.224-5 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.383-4 (March-April 1983). [received: Sept. 1983]
When fast electrons are diffracted by a thin single crystal layer, reflections may arise due to 'random' incidences on the Ewald sphere. In this case one obtains the so-called 'nonsystematic' many-beam interactions. Thus it is important to allow for these reflections in many-beam dynamic calculations of the reflected intensities in electron diffraction. The use of a scattering matrix for crystallites of different thicknesses arbitrarily oriented relative to the incident beam, together with a knowledge of the law of distribution of the crystallites in the specimen with respect to thicknesses and orientations, enables the authors to make an approximate calculation of the reflected intensities for diffraction of electrons in the many-beam case. The scattered intensity from such a specimen is the sum of the intensities due to the separate groups of crystallites with given thickness and orientation. (5 refs.)

Analysis of surface structural defects using LEED and RHEED ....See Entry 108146

Efficient scheme for calculation of low-energy electron-diffraction intensities in the presence of large superlattices, with application to the structural analysis of benzene adsorbed on Rh(111) ....See Entry 108173

61.16 OTHER DETERMINATION OF STRUCTURES

(for specific determinations, see 61.55 to 61.80)

Anomalous passage of confined X- and gamma ray beams in three-wave diffraction ....See Entry 107479

Structural properties of HNO_3-graphite intercalation compounds studied by neutron diffraction and high energy nuclear photon scattering ....See Entry 107643

61.16D Electron microscopy determinations

107498 Reconstruction of the shape of small particles. S.A.Napiiko, A.P.Ostranitsa (Inst. of Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Instrum. & Exp. Tech. (USA), vol.25, no.6, pt.2, p.1507-10 (Nov.-Dec. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.6, p.172-5 (Nov.-Dec. 1982).
A method is described for reconstructing the shape of small particles by using interference electron microscopy. The curvature of the fringes in the interference pattern is proportional to the dimension of the object in the direction of the electron beam. A crystalline particle of molybdenum oxide MoO_3 reconstructed in this way had the shape of an octahedron and the value of its average internal potential was $U_{MoO_3}=9.6\pm0.5$ V. (9 refs.)

107499 Extinction-contour method in examining bending in thin-film objects [electron microscopy]. I.E.Bolotov, V.Yu.Kolosov (Sverdlovsk Economics Inst., Sverdlovsk, USSR).
Ind. Lab. (USA), vol.48, no.11, p.1117-22 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.53-7 (Nov. 1982).
Quantitative relationships are derived between the positions of the contours and the crystallography, bending, and orientation of the object, and the scope for using these contours in examining lattice bending is shown. Results are illustrated for hexagonal selenium and tellurium growing in thin-film vacuum condensates of amorphous Se-Te and Cu-Te products. (7 refs.)

107500 Structure study of lead oxides used as precursors of lead zirconate-titanate sintering process. F.Constantinescu, I.Zbera, F.Craciun (Inst. of Phys. & Technol. of Materials, Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.5, p.459-61 (1983).
The morphology and phase composition of the lead oxides obtained in different physico-chemical conditions were studied by transmission electron microscopy and diffraction. A survey of the microstructure characteristics was realized, taking into account their importance for the ulterior behaviour of these materials in the PZT powder sintering process. (1 ref.)

107501 UHV-SEM studies of surface processes: recent progress. J.A.Venables, G.D.T.Spiller, D.J.Fathers, C.J.Harland, M.Hanbucken (School of Math. & Phys. Sci., Univ. of Sussex, Brighton, England).
Ultramicroscopy (Netherlands), vol.11, no.2-3, p.149-55 (1983). (Surface Imaging and Analysis with High Spatial Resolution, Wickenburg Inn, AZ, USA, 12-15 Jan. 1983).
Surface processes on bulk samples have been studied using an ultra high vacuum SEM, equipped with a variety of surface-sensitive techniques. Recent studies of Stranski-Krastanov growth systems and the uses of a recently installed computerised data acquisition system are highlighted. (20 refs.)

107502 On the measurement of surface step heights by low-loss imaging in STEM. M.M.J.Treacy (Exxon Res. & Engng. Co., Corp. Res.—Sci. Labs., Linden, NJ, USA), J.Bellessa.
Ultramicroscopy (Netherlands), vol.11, no.2-3, p.173-8 (1983). (Surface Imaging and Analysis with High Spatial Resolution, Wickenburg Inn, AZ, USA, 12-15 Jan. 1983).
The use of a sector magnet spectrometer as a low-energy-loss electron detector for surface imaging in the scanning transmission electron microscopy (STEM) is described. It is shown that analysis of image contrast as a function of electron energy loss allows surface step heights down to about 1 nm to be estimated. (16 refs.)

Thermal chamber for physicochemical experiments in the electron microscope ....See Entry 105423

Theory of the increase of spatial resolution efficiency of the scanning electron microscope in the beta-conductivity regime ....See Entry 105428

Simple analytical method of determining the positions of traces in electron-diffraction patterns ....See Entry 107491

Long-term corrosion tests of materials for thermal decomposition of sulphuric acid ....See Entry 109573

61.20 CLASSICAL, SEMICLASSICAL, AND QUANTUM THEORIES OF LIQUID STRUCTURE

(for kinetic and transport theory, see 51.10; for electronic states, see 71.; for liquid helium, see 67.)

107503 Vibrational relaxation in liquids: quantum states in a classical bath. D.W.Oxtoby (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
J. Phys. Chem. (USA), vol.87, no.16, p.3028-33 (4 Aug. 1983).
Vibrational motion in liquids is highly quantum mechanical: distinct vibrational quantum states are clearly seen and can usually be identified with the corresponding quantum states for molecules in the gas phase. The relaxation of these states occurs through coupling to a bath of rotational and translational degrees of freedom, which can be described through classical mechanics. The author outlines some promising new theoretical approaches to vibrational phase and energy relaxation in liquids and shows their relationship to experimentally determine vibrational line shapes and population relaxation rates. He focuses particularly on the qualitatively new types of behaviors that result when the time scales for vibrational and bath relaxation become comparable. (38 refs.)

107504 Study of multiatomic molecular interaction potentials in liquids using perturbation theory. I. Calculation method and comparison of results with Lennard-Jones potential. D.A.Tolstunov (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1263-7 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.798-803 (Nov. 1982). [received: Sept. 1983]
An algorithm is presented for calculation of the thermodynamic properties of a liquid whose molecules interact in accordance with a specified model potential, using the methods of perturbation theory. (19 refs.)

107505 Exact equations and the theory of liquids. V. G.A.Martynov (Inst. of Phys. Chem., Acad. of Sci., Moscow, USSR), G.N.Sarkisov.
Mol. Phys. (GB), vol.49, no.6, p.1495-504 (20 Aug. 1983).
The exact equations for the unitary and binary distribution functions derived by Martynov (1981) contain infinite functionals $M^{(i)}$, $i=1$, 2, whose calculation encounters considerable difficulties. These equations cannot therefore find practical application. A method has been suggested for an approximation of these functionals. Even in the first approximation, this method leads to an equation which enables the pressure in a system of high-density hard spheres to be calculated with an accuracy ten times higher than that of the Percus-Yevick equation and 25 times higher than the accuracy of the HNC equation. (6 refs.)

107506 Extension of the square-gradient theory to fourth order. R.F.Kayser, H.J.Raveche (Thermophys. Div., NBS, Washington, DC, USA).
Physica A (Netherlands), vol.120A, no.1-2, p.68-76 (1983).
In the square-gradient theory, the Helmholtz free energy density of a nonuniform fluid is approximated by that of a uniform fluid plus a term proportional to the square of the density gradient. Presented here is the extension of this theory (and the corresponding theory of the chemical potential) to fourth order in the gradients. The new results can be applied to study the pair correlation function and interfacial density profile in a fluid near its critical point. (14 refs.)

107507 Calculation of correlation functions of hard spheres in the generalized mean spherical approximation. B.B.Deo, A.C.Naik (Dept. of Phys., Utakal Univ., Bhubaneswar, Orissa, India).
Phys. Rev. A (USA), vol.28, no.3, p.1700-8 (Sept. 1983).
Wiener-Hopf factorization technique as suggested by Baxter (1965) has been used to solve the Ornstein-Zernike equation for a system of hard spheres in the framework of a generalized mean spherical model. The method reported yields unambiguous and accurate values of the radial distribution function $g(r)$, direct correlation function $C(r)$, and the structure function $S(k)$. These thermodynamic quantities have been calculated from low to fairly high densities and, with a normalized $g(R)$, they have been compared with the molecular-dynamics values of Alder and Hecht (1968). (22 refs.)

107508 Structure of polymer solutions: scaling and modelling on an electronic computer. T.M.Birshtein, A.M.Skvortsov, A.A.Sariban (Inst. of Macromolecular Compounds, Acad. of Sci., Leningrad, USSR).
Polymer (GB), vol.24, no.9, p.1145-54 (Sept. 1983).
The computer simulation method has been used to examine the equilibrium characteristics of flexible-chain concentrations in model lattices in θ solvents and good solvents. The mean square radius of inertia, and the radial distribution functions of density of the units around an isolated (average) unit and around the centre of gravity of an arbitrary isolated chain have been calculated. The results of a 'computer experiment' have been compared with those predicted by scaling theory. In general 'experimental' results are in good agreement with the formulae of scaling theory and with the picture of the 'blob' concept. (26 refs.)

107509 Investigation of two-component liquid solutions with the aid of the modified Percus-Yevick equation. D.K.Belashchenko.
Russ. Metall. (GB), no.1, p.29-34 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.29-38 (1982).
Partial structure factors and pair atom radial-distribution functions in binary solutions with a different type of deviation from the ideal are calculated using the modified Percus-Yevick equation. The effects were detected of preferential surrounding of a given atom by particles of the same or the other component, depending on the ratio of the corresponding pair of interatomic potentials. Thermodynamic properties of binary systems are calculated. Strong positive and negative deviations from ideality can be obtained even with the use of purely repulsive interatomic potentials. However, the excess entropy of mixing of the solutions is almost zero. The excess ΔH_{mix} and ΔG_{free} are due mainly to the volume change on mixing. (7 refs.)

107510 Modification of the Percus-Yevick equation for describing dense liquids. D.K.Belashchenko, V.P.Efanova, V.A.Khromusin.
Russ. Metall. (GB), no.2, p.46-53 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.50-7 (1982).
The introduction of correcting terms into the Percus-Yevick equation gives considerably improved calculated values of the thermodynamic properties and structural characteristics of a system with purely repulsive potentials of type $\phi(f)=a/r^{12}$ and a system of hard spheres. For a system with a Lennard-Jones potential, the modified PY equation gives improved agreement with the Monte Carlo data for the radial distribution function but not for the thermodynamic properties. The procedure proposed by Belashchenko et al. (see ibid., no.1, p.51, 1981) for determining the slope of the repulsive part of the interatomic potential in liquid metals hardly differs on going from the PY to the MPY equation. (15 refs.)

The equation of state for the hard sphere fluid at high density. The glass transition .... See Entry 107859

Thermodynamic properties of a hard-sphere fluid near a hard wall at low temperatures .... See Entry 108120

61.25 STUDIES OF SPECIFIC LIQUID STRUCTURES

(see also 61.40 Amorphous and polymeric materials)

107511 Thermodynamics and quantum corrections from molecular dynamics for liquid water. P.H.Berens, D.H.J.Mackay, G.M.White, K.R.Wilson (Dept. of Chem., Univ. of California-San Diego, La Jolla, CA, USA).
J. Chem. Phys. (USA), vol.79, no.5, p.2375-89 (1 Sept. 1983).
In principle, given the potential energy function, the values of thermodynamic variables can be computed from statistical mechanics for a system of molecules. In practice for the liquid state, two barriers must be overcome. The paper treats the first problem, how to quantum correct the classical mechanical thermodynamic values available from molecular dynamics, Monte Carlo, perturbation, or integral methods in order to compare with experimental quantum reality. A simple technique, derived from spectral analysis of the atomic velocity time histories, is presented for the frequency domain quantum correction of classical thermodynamic values. This technique is based on the approximation that potential anharmonicities mainly affect the lower frequencies in the velocity spectrum where the system behaves essentially classically, while the higher spectral frequencies, where the deviation from classical mechanics is most pronounced, involve sufficiently harmonic atomic motions that harmonic quantum corrections apply. Thus, a harmonic quantum correction can be applied at all frequencies: at low frequencies where it is inaccurate it will be small, while at high frequencies where it is large it will also be relatively accurate. The approach is demonstrated by computation of the energy and constant volume heat capacity for water from classical molecular dynamics followed by quantum correction. The potential used to describe the interactions of the system of water molecules includes internal vibrational degrees of freedom and thus strong quantum effects. Comparison of the quantum corrected theoretical values with experimental measurements shows good agreement. The quantum corrections to classical thermodynamics (which are also derived for free energy and entropy) are shown to be important not only for internal vibrational motion, but also for intermolecular hindered rotational and translational motions in liquid water. The approach allows the calculation of thermodynamic quantum corrections for liquids, solutions, and large molecules such as polymers (including proteins and nucleic acids) with full inclusion of both intra- and intermolecular degrees of freedom. (123 refs.)

107512 A cluster theory for electrolytes. A.Tani, D.Henderson (IBM Res. Lab., San Jose, CA, USA).
J. Chem. Phys. (USA), vol.79, no.5, p.2390-4 (1 Sept. 1983).
A simple extension of the Bjerrum theory is formulated and examined. Clusters of trimers as well as dimers are included. The intercluster partition function is evaluated in the mean spherical approximation. At low concentrations this cluster theory gives good results for the thermodynamic functions and for the radial distribution function for unlike pairs. The radial distribution function for like pairs is less satisfactory. The theory is less successful at higher concentrations but is always at least as good as the mean spherical approximation. (9 refs.)

107513 A test of an effective pair potential for liquid water. M.Townsend, S.A.Rice (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA), M.D.Morse.
J. Chem. Phys. (USA), vol.79, no.5, p.2496-8 (1 Sept. 1983).
In previous works the authors have examined the predicted ice structures for a variety of water-water effective pair potentials (1981, 1982). They have determined that the potential of Matsuoka, Clementi, and Yoshimine (1976) (given in their paper under the heading ϵ_{CI}) is generally the most successful in predicting the 0-0-0 angles and hydrogen bonding topology of the various proton-ordered ice structures, but that is overestimates the volume of the unit cell by 20% or more. Subsequent to this work, they learned that most simulations of liquid water and solutions utilize another version of the MCY potential, listed by Matsuoka, Clementi, and Yoshimine under the heading ϵ_{inter} report a comparison of the ice VIII structure supported by this potential to those supported by other models and to experimental data. (15 refs.)

107514 Compensation point in semi-dilute polymer solutions as observed by SANS. K.Okano (Dept. of Appl. Phys., Univ. of Tokyo, Tokyo, Japan), K.Kurita, S.Nakajima, E.Wada, M.Furusaka, Y.Ishikawa.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.413-17 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The angular dependence of the intensity of SANS by semi-dulute solutions of polystyrene in deuterated cyclohexane near θ temperature was measured in order to determine the density-density correlation function of polymer segments. The concentration dependence of the measured screening length was analyzed based on a simple statistical theory in which only the contributions of the diagrams of chain type are taken into account. This theory enables the authors to obtain separately the binary and ternary cluster integrals of polymer segments for each temperature. It was found that the binary cluster integral changes its sign at about 40°C, the θ temperature, whereas the ternary cluster integral is almost independent of temperature near the θ point. Slightly below the θ temperature there occurred, for each concentration, a compensation point at which polymer coils become ideal due to the opposite contribution of the two cluster integrals. (10 refs.)

107515 Small-angle neutron scattering of polymer solutions. R.Koyama (Phys. Lab., Coll. of General Education, Kyoto Univ., Kyoto, Japan).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.418-21 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The angular dependence of the small-angle scattering of concentrated polymer solutions is calculated, using a random coil polymer model consisting of rod-like segments. A Gaussian radial distribution function of the segments is assumed, considering that the local segment density in the solution is almost constant in high concentration. When the segment interaction is weak, the scattering intensity becomes a monotonically decreasing function of the scattering angle. But when the interaction is sufficiently strong, it has a maximum. This maximum point is proportional to the square root of the polymer concentration. This is in agreement with a recent small-angle neutron scattering experiment on polyelectrolyte solutions. Assuming suitable values of the interaction parameters of the segment, a quantitative comparison of the calculated maximum points with the experimental values is made, and from this the segment length and the average end-to-end distance of this polyelectrolyte molecule are determined. (7 refs.)

107516 Neutron quasielastic scattering studies of molecular liquids and polymers by pulsed cold neutron source. K.Inoue (Dept. of Nuclear Engng., Hokkaido Univ., Sapporo, Japan), Y.Kiyanagi, M.Kohgi, K.Kaji.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.422-5 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The authors have developed a neutron quasielastic scattering spectrometer with conventional energy resolution. The spectrometer operates at the spallation cold neutron source in the KENS spallation source at the National Laboratory for High Energy Physics. High efficiency was achieved by adopting large analyser mirrors and the spallation cold neutron source. The spectrometer has demonstrated considerable usefulness in spectral profile analysis studies of molecular liquids and polymers. (7 refs.)

107517 Gelation models of hydrogen bond networks in liquid water. H.E.Stanley, R.L.Blumberg (Dept. of Phys., Boston Univ., Boston, MA, USA), A.Geiger.
Phys. Rev. B (USA), vol.28, no.3, p.1626-9 (1 Aug. 1983).
Cluster statistics of hydrogen bonds networks in water are calculated with the use of molecular dynamics (MD) and are compared with the predictions of gelation models. For small bond networks the MD calculations agree well with Flory theory (which neglects cycles), but they disagree for the larger networks. The MD data for the connectivity of the larger networks agree much better with the authors' ice lattice calculations, providing the first MD test of the ability of Flory theory to describe polyfunctional condensation network statistics. (13 refs.)

107518 Molecular structure and physical properties of rigid polymers in solutions. V.N.Tsvetkov.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.8, p.1571-86 (Aug. 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The results of experimental studies of physical properties of molecules of rigid polymers obtained with the aid of measurements of translational friction, viscosity, dynamic and electrical birefringence in solution are summarized. The main results of theories of hydrodynamic properties and optical anisotropy of chain molecules as well as dynamooptic and electrooptic effects in stationary and dynamic regimes are discussed. Conformational, hydrodynamic, optic and dipole characteristics of rigid molecules are compared with corresponding properties of flexible molecules. (31 refs.)

107519 On structure of liquid polyethylene. 'Computer experiment' and IR-spectroscopy data. P.G.Khalatur, P.M.Pakhomov, A.S.Pavlov.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.8, p.1667-73 (Aug. 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The equilibrium characteristics of systems consisting of many interacting PE chains have been studied by the Monte Carlo method. The dependence of mean-square radii of gyration of chains on the density of units in the system attaining 0.72 of the density of the melt was calculated. The conformational composition of PE macromolecules in the liquid state was studied by Monte Carlo and IR-spectroscopy methods. The average dimensions and local structural characteristics of PE chains were shown to be the same as for isolated chains in θ-conditions. No proofs of existence of long intramolecular folds were obtained. The results of the calculation of conformational composition and average dimensions of chains coincide with experimental data. (36 refs.)

Condensed matter research at the Los Alamos pulsed neutron source (WNR) ... . See Entry 106196

On the vibrational frequency correlation in liquids: Raman study of aqueous thiocyanate solutions .... See Entry 106407

Some neutron experiments on flexible polymers .... See Entry 107565

Configuration of the polyisobutylene chain in bulk and in solution according to elastic neutron scattering .... See Entry 107566

Influence of surface tension of the solvent on duration of induction period of diffusion in methanol-polymethyl methacrylate system .... See Entry 108001

Features of self-diffusion of the solvent in the polymer-low-molecular compound system .... See Entry 108002

Polymer conformation and viscometric behaviour. I. Conformational transition in poly(benzyl methacrylate) in dilute solutions .... See Entry 108005

Properties of the concentrated xanthan gum solutions .... See Entry 108006

Motional behavior of 2,3:5,6-di-O-isopropylidene-α-D-mannofuranose in solution. A ^{13}C spin-lattice relaxation study .... See Entry 108811

Entangled linear polymer chains in melts: n.m.r. and Rouse or reptation models; stress relaxation .... See Entry 108822

Temperature dependence of dielectric properties of water. II. Absorption cell method .... See Entry 108866

Flow birefringence and angles of its orientation in solutions of poly-α-methyl styrene .... See Entry 108919

On the conformation of aromatic polyamide in organic solvent and concentrated sulfuric acid according the data of flow birefringence .... See Entry 108920

A new look at the enhanced low-angle scattering in moderately concentrated polymer solutions .... See Entry 108962

EXAFS study of Ni-Cl bonding in Ni(11) aqueous solutions at increasing Cl^-/Ni^{2+} ratios .... See Entry 109048

Partial molal volumes of some halobenzenes in carbon tetrachloride .... See Entry 109782

61.25M Liquid metals

107520 Concentration dependence of the heat of formation of binary liquid alloys. L.J.Gallego (Dept. de Fisica Fundamental, Univ. de Santiago de Compostela, La Coruna, Spain), J.M.Lopez, J.A.Alonso.
Physica B & C (Netherlands), vol.122B+C, no.1, p.23-7 (Sept. 1983).
A link is established between Miedema's work (1973-80) on heats of formation of metallic alloys and a theory of mixtures that is essentially a version of Guggenheim's quasichemical model (1952) in terms of contact surface interactions. The theory in question, which has been developed by Kehiaian (1978) and applied to organic mixtures, allows a rational derivation of the dependence of the heat of formation of liquid alloys on their composition. The interchange energy, which appears in this theory as a parameter to be fixed experimentally, can be obtained through Miedema's treatment in terms of the electronegativities and the boundary electron densities of the pure metals. (11 refs.)

107521 Neutron multiple scattering on cylindrical samples, diffraction experiments. I.Padureanu, S.Rapeanu, V.Filip, G.Rotarescu, C.Craciun (Inst. for Nuclear Power Reactors, Pitesti, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.5, p.431-8 (1983).
The multiple scattering of nuetrons on cylindrical samples is calculated for the case of diffraction experiments on liquid metals. As the majority of the liquid metals are coherent scatterers, the angular distribution of the scattered neutron intensity is not isotropic and this is taken into account. A general formulation of the various scattering orders is given. The calculations are performed for liquid gallium and bismuth up to the fourth scattering order. It is concluded that the ratio of the second order scattered intensity to the first order one strongly depends on the scattering angle, especially in the region of the small angles. (19 refs.)

Investigation of two-component liquid solutions with the aid of the modified Percus-Yevick equation .... See Entry 107509

Modification of the Percus-Yevick equation for describing dense liquids .... See Entry 107510

X-ray total external reflectance-diffraction as a probe of the structure of the liquid-vapor interface .... See Entry 107893

Electron charge transfer in liquid copper-tin alloys .... See Entry 108381

61.30 LIQUID CRYSTALS

(see also 64.70M Transitions in liquid crystals)

107522 Chiral SmC* liquid crystals obtained by mixing of SmC and cholesteric phase. J.Pavel, M.Glogarova, D.Demus, A.Madicke, G.Pelzl (Inst. of Phys., Czechoslovak Acad. Sci., Prague, Czechoslovakia).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.915-21 (1983).
The binary mixtures of a substance providing SmC phase and a substance providing cholesteric phase exhibit a chiral SmC* phase for certain concentration and temperature range. This phase was verified to be ferroelectric. The temperature dependences of the spontaneous polarisation and the coercive field were determined for three concentrations. The pitch of the helical structure is approximately indirectly proportional to the molar concentration of the cholesteric substance and varies from 3 μm to about 25 μm in the concentration range from 20 mol% to 5 mol% of the cholesteric substance. For the lower concentrations the sample is unwound in planar samples due to the surface anchoring. Two possible unwound planar configurations can be switched by electric field. (14 refs.)

107523 Discontinuous Freedericksz transition in the smectic C phase. P.Schiller, G.Pelzl (Sektion Chemie, Martin-Luther-Univ., Halle-Wittenberg, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.923-31 (1983).
The threshold field of the Freedericksz transition in planar oriented S_C monocrystals possessing positive dielectric anisotropy is calculated for two boundary conditions. It is shown that the threshold field is relatively low when a discontinuous transition is taken into consideration. The effective elastic constant is determined from the experimental data. (11 refs.)

107524 Field dependence of helicoidal pitch and its phenomenological theory. S.Kai, M.Takata, K.Hirakawa (Dept. of Electronics, Kyushu Univ., Fukuoka, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.6, p.938-41 (June 1983).
The field dependence of the helicoidal pitch in the ferroelectric liquid crystal DOBAMBC is studied. Divergence of the pitch is observed at a certain critical field, and two critical fields exist when the field is varied up and down. The dependence of both critical fields on temperature is also obtained experimentally, but the ratio of the critical fields, 3/2, is almost independent of temperature. The Landau expansion of the free energy involving a helicoidal structure is used to interpret the experimental results. (15 refs.)

107525 Anisotropic excluded volume effect and alignment of nematic liquid crystal in a sandwich cell. K.Okano (Dept. of Appl. Phys., Univ. of Tokyo, Tokyo, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.6, p.L343-4 (June 1983).
It is shown that the orientation dependent excluded volume interaction between elongated nematic molecules and the cell walls always favors the planar alignment of nematic liquid crystals. For thermotropic liquid crystals the anchoring energy of this effect amounts to several erg/cm^2. (8 refs.)

107526 Temperature dependence of the Maier-Saupe order matrix from ^{2}H-NMR of fluorene-d_{10} in the nematic, smectic A, B, and C phases. N.A.P.Vaz, J.W.Doane (Dept. of Phys., Kent State Univ., Kent, OH, USA).
J. Chem. Phys. (USA), vol.79, no.5, p.2470-7 (1 Sept. 1983).
From ^{2}H-NMR of perdeuterated fluorene (diphenylenemethane-d_{10}) dissolved in 4-n-butyloxybenzylidene-4-n-octylaniline (4O.8) and in a mixture of 4O.8 with 4.4′-bis-n-heptyloxyazoxybenzene (HOAB, 15.1 wt.%) the authors have measured each of the orientational order parameters of the Maier-Saupe order matrix and their temperature dependence in the nematic, smectic A, smectic B, and smectic C phases, respectively. The fluorene-d_{10} molecule, being a rigid structure of known conformation and one which contains a sufficient number of differently oriented deuterated sites, allows for the complete determination of the order matrix in terms of the measured ^{2}H-NMR spectral splittings. The results show: (1) The principal molecular z axis (most ordered axis) is parallel to a direction which joins the centers of the six membered rings at all temperatures and in each phase studied; (2) nonlinearities are present in the temperature dependence of the ratios of the splittings and are a result of the temperature dependence of the elements of the order matrix, S_{zz} and S_{xx}-S_{yy}, demonstrating that a change in molecular conformation is not necessarily the cause of such nonlinearities as suggested in the literature; (3) splitting ratio vs. ratio plots are linear throughout all phases of 4O.8 and 4O.8+HOAB mixtures; (4) the degree of ordering of the solute (fluorene) is significantly reduced in the smectic phases, in confirmation of that suggested by other solute studies reported in the literature. (29 refs.)

107527 Structural transition at the free surface of the nematic liquid crystals MBBA and EBBA. P.Chiarelli, S.Faetti, L.Fronzoni (Dipartimento di Fisica, Univ. di Pisa, Pisa, Italy).
J. Phys. (France), vol.44, no.9, p.1061-7 (Sept. 1983).
Reports measurements of the angle θ_t between the director and the vertical axis at the free surface of the nematic liquid crystals MBBA and EBBA. The basis of the technique is the same as the one reported by Bouchiat and Langevin-Cruchon (1971) for measurements on MBBA and PAA. However, some important improvements make the technique more suitable and more accurate so that they can measure θ_t to within ±1° over the whole range of the nematic phase. They find a new structural transition occurs in MBBA (and EBBA) when the temperature reaches a critical value T_0 close to the clearing temperature of the nematic LC. Below T_0 the polar angle θ_t tends to zero as $(T_0-T)^\beta$, where $\beta \simeq 0.5$ is a critical exponent. Information about the anchoring energy at the free surface of MBBA is also obtained. (27 refs.)

107528 A molecular field treatment of nematic liquid crystalline mixtures. II. Calculations of nematic-isotropic transition temperatures for binary systems with 4,4′-di-*n*-alkoxyazoxybenzenes. M.Nakagawa, T.Akahane (Dept. of Electrical Engng., Technol. Univ. of Nagaoka, Nagaoka, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2659-65 (Aug. 1983).
For pt.I see ibid., vol.52, no.2, p.399 (1983). The nematic-isotropic transition temperatures for 15 binary mixtures with 4,4′-di-*n*-alkoxyazoxybenzenes are calculated theoretically at a molecular level and compared with experimental phase diagrams. One finds good agreement between then and may confirm the validity of the geometric mean rule for the effective intermolecular attractions. The significance of the intermolecular repulsions and the flexibility of the end chains is pointed out and examined. Finally, the dependence of the nematic ordering in binary mixtures on their molecular lengths is presented. (9 refs.)

107529 The Saupe ordering matrices for solutes in uniaxial liquid crystals: experiment and theory. J.W.Emsley, R.Hashim, G.R.Luckhurst, G.N.Rumbles, F.R.Viloria (Dept. of Chem., Univ. of Southampton, Southampton, England).
Mol. Phys. (GB), vol.49, no.6, p.1321-35 (20 Aug. 1983).
A theory is described for $U(\omega_2)$, the potential of mean torque of rigid solutes at infinite dilution in a uniaxial liquid crystal phase. The general form of $U(\omega_2)$ is an infinite expansion of modified spherical harmonics $C_{Ln}(\omega_2)$, and truncation at the second rank terms produces a practical form for $U(\omega_2)$ which is used to calculate S_{xx}-S_{yy} and S_{zz}, the principal elements of the Saupe ordering matrix of a biaxial solute. The theory predicts that the dependence of S_{xx}-S_{yy} on S_{zz} for a particular solute-solvent mixture is determined entirely by λ, a parameter describing the departure from cylindrical symmetry of the potential of mean torque, and which is independent of temperature. Furthermore, if $U(\omega_2)$ is determined entirely by dispersion forces then λ is predicted to be independent of the solvent and to depend entirely on the anisotropy of the electric polarizability tensor of the solute. These predictions are tested by determining the values of S_{xx}-S_{yy} and S_{zz} by analysing proton NMR spectra of a solute, para-dinitrobenzene (PDNB), in three liquid crystalline solvents: 4,4′-di-*n*-heptylazoxybenzene (HAB), Phase 5 and E5. (18 refs.)

107530 Thermomechanical effects in cholestric liquid crystals. G.S.Ranganath (Raman Res. Inst., Bangalore, India).
Mol. Cryst. & Liq. Cryst. Lett. (GB), vol.92, no.4-5, p.105-10 (1983).
Thermomechanical effects in cholestric liquid crystals are considered in the coarse-grained approximation of Leslie's theory (1969). In certain situations one finds a close analogy with superfluid hydrodynamics. Effects of permeation have also been discussed. (11 refs.)

107531 Diamagnetic anisotropy of liquid crystalline side chain polysiloxanes in the nematic and smectic phases. M.F.Achard, G.Sigaud, F.Hardouin (Centre de Recherche Paul Pascal, Univ. Bordeaux I, Talence, France), H.Finkelmann.
Mol. Cryst. & Liq. Cryst. Lett. (GB), vol.92, no.4-5, p.111-18 (1983).
The authors report the first results on the diamagnetic anisotropy Δχ of some thermotropic side chain polymers (polysiloxanes). Kinetic effects for the bulk orientation of the nematic phase under a strong external field (H=15, 25 10^3 Gauss) are observed to be smaller than with linear polymers. The shorter the flexible spacer between the mesogenic part and the backbone is the stronger these effects are. Concerning the temperature dependence, the saturated magnetic anisotropy increases regularly with decreasing temperature to the same extent as with other nematic phases of LC monomers or linear polymers. (12 refs.)

107532 Calorimetric study of the 4-propionyl-4′-n-alkanoyloxy azobenzene series. E.Fanelli, G.Poeti, M.Braghetti (Dipartimento di Scienze Chimiche, Univ. di Camerino, Camerino, Italy).
Mol. Cryst. & Liq. Cryst. Lett. (GB), vol.92, no.4-5, p.127-34 (1983).
Systematic DSC measurements have been performed on the different terms of the 4-propionyl-4′n-alkanoyloxy azobenzene homologous series. Thermodynamical behaviour as a function of the length of the aliphatic chain and the recrystallization process are considered and discussed. (7 refs.)

107533 Structure of cubic (L_1) mesophases belonging to space group Pm3n. K.F.Fox (Unilever Res., Port Sunlight Lab., Bebington, England).
Mol. Cryst. & Liq. Cryst. Lett. (GB), vol.92, no.4-5, p.135-40 (1983).
It is shown that the structure of the cubic (I_1) mesophase of the C_{12}TACl/water system can be described as 48 sperical micelles per unit cell, with micellar centres at the coordinates of equivalent positions for the general

case of space group Pm3n. This reconciles the X-ray and NMR data for this system. This model can also be applied to the I_1 mesophase of the sodium caprylate/p-xylene/water system. (9 refs.)

107534 Mesomorphic perhydrophenanthrene derivatives. D.Varech, J.Jacques (Lab. de Chimie des Interactions Moleculaires, Coll. de France, Paris, France).
Mol. Cryst. & Liq. Cryst. Lett. (GB), vol.92, no.4-5, p.141-2 (1983).
A series of 2α, 7β-dialkyl-(4aα, 4bβ, 8aα, 10aβ) tetradecahydro-1,2,3,4,4a,4b,6,7,8,8a,9,10,10a-phenanthrenes have been prepared. Several of these hydrocarbons exhibit a nematic phase over a relatively large temperature range. (3 refs.)

107535 Whirl electrohydrodynamic instability in smectic A phase liquid crystals. D.F.Aliev, N.M.Mamedov.
Mol. Cryst. & Liq. Cryst. Lett. (GB), vol.92, no.4-5, p.143-8 (1983).
In planar oriented layers of smectic A phase a new type of instability, appearing as axial whirl, is observed and investigated. The system of lines with homotropic orientation of molecules is necessary for the creation of such a kind of instability. (6 refs.)

107536 Commensurate and incommensurate structures in a nonequilibrium system. M.Lowe, J.P.Gollub (Dept. of Phys., Haverford Coll., Haverford, PA, USA), T.C.Lubensky.
Phys. Rev. Lett. (USA), vol.51, no.9, p.786-9 (29 Aug. 1983).
A layer of nematic liquid crystal that has undergone an electrohydrodynamic instability (and contains nonequilibrium structures with period l_0) is subjected to a spatially periodic electric field with periodicity l_1. The competition between these two length scales is found to result in novel ordered phases similar to those found in equilibrium condensed-matter systems. A simple model is proposed that accounts for most of the observations. (8 refs.)

107537 Breakdown of conventional hydrodynamics for smectic-*A*, hexatic-*B*, and cholesteric liquid crystals. G.F.Mazenko, S.Ramaswamy, J.Toner (Dept. of Phys., Univ. of Chicago, Chicago, IL, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1618-36 (Sept. 1983).
The authors present a detailed analysis of anharmonic effects on the viscous and elastic properties of various systems with one-dimensional order. They show that the nonlinear coupling of the velocity field to thermally excited undulation modes causes four of the five viscosities in these uniaxial systems (including one, η_2, governing shear flow in the layers) to diverge as $1/\omega$ when measured at small frequencies ω. As a result, sound attenuations scale as ω, rather than ω^2 as in most materials. A simple algebraic relation between the divergent parts of three of the viscosities is derived. The authors argue that the divergence in η_2 leads to strongly nonNewtonian flow in the liquid layers of these materials. The calculations here extend the previous work of the authors to include an analysis of irreducible graphs to all orders in perturbation theory in the temperature. Some new results on the nonlinear elastic theory of these systems are also obtained, extending earlier work by Grinstein and Pelcovits. The existing experimental evidence for predictions is discussed, and additional experiments are suggested. (45 refs.)

107538 Influence of physical parameters of a liquid crystal on the steepness of the volt-contrast characteristic of the twist effect. G.A.Beresnev, L.M.Blinov, M.F.Grebenkin, V.A.Tsvetkov (Sci.-Res. Inst. of Organic Intermediate Products & Dyes, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.69-73 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.129-35 (Jan.-Feb. 1983). [received: Sept. 1983]
For a number of nematic liquid crystals, the authors have experimentally studied how the steepness of the volt-contrast characteristic of the twist effect is influenced by the elasticity constant ratio K_{33}/K_{11}, the dielectric parameter $\Delta\epsilon/\epsilon_\perp$, and the optical anisotropy. They show that the steepness increases as K_{33}/K_{11} decreases. The results agree with the theory. (13 refs.)

107539 Submicrostructure of liquid crystals of the *p-n*-alkoxybenzoic acid homologous series in a magnetic field. Ya.I.Dutchak, M.I.Fedyshin, Z.M.Mikityuk, R.N.Veksler (State Univ., L'vov, Ukrainian SSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.102-3 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.180-1 (Jan.-Feb. 1983). [received: Sept. 1983]
The aim of the authors' work was to investigate the dynamics of the process of molecular ordering of the structures of substances in the series in relation to temperature and magnetic field, by means of the method of small-angle X-ray diffraction. They studied the process of molecular ordering during cooling of the substances from the amorphous-liquid phase in magnetic fields of 0, 3600, and 5000 Oe. (9 refs.)

107540 A new type of modulated structure in a smectic *A*. P.-A.V.Kazlauskas, L.S.Klenevskis, Ya.V.Zakhazhevski (State Pedagogical Inst., Vilnius, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.104 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.182 (Jan.-Feb. 1983). [received: Sept. 1983]
Investigates a liquid crystal prepared from a mixture of equal weights of 4-hexyloxyphenyl-4'-butylbenzoate and 4'-nitrophenyl-4'-heptylbenzoate. Calorimetric and polarization investigations revealed that if these components are present in equal weights, at all temperatures at which a mesophase exists their mixture has only a smectic A phase. This was confirmed by investigations of the temperature dependences of the parallel ($\epsilon_\parallel$) and perpendicular ($\epsilon_\perp$) dielectric permittivities. The authors studied the electrooptic properties of the mixture. (2 refs.)

107541 A new kind of instability in the smectic-*C* phase of a liquid crystal. D.F.Aliev (State Univ. Azerbaidzhan, Baku, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.209-11 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.358-62 (March-April 1983). [received: Sept. 1983]
A new type of electrohydrodynamic instability, arising in thin layers of a smectic-*C* phase with initial planar orientation of the molecules, is experimentally discovered and investigated. The dependence of the basic characteristics of the effect on the parameters of the liquid crystal and the applied electric field are established. (12 refs.)

107542 Influence of low concentration of chiral molecules in nematogen on structural organization of nematic-cholesteric mixtures. Ya.I.Dutchak, R.N.Veksler, Z.M.Mikityuk, M.I.Fedyshin (State Univ., L'vov, Ukrainian SSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.233-5 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.395-7 (March-April 1983). [received: Sept. 1983]
Gives the results of an investigation of the influence of a small (0.2 wt.%) content of cholesteric liquid crystal, in nematogenic matrices with various types of structural organization, on the structural properties of the mixture. (7 refs.)

107543 Impurity molecule orientation and order parameter in the neighborhood of an impurity in a liquid crystal. I.P.Pinkevich, V.Yu.Reshetnyak, V.I.Sugakov (State Univ., Kiev, Ukrainian SSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.237-8 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.400-2 (March-April 1983). [received: Sept. 1983]
Owing to the difference between the forces of interaction between molecules of a liquid-crystal matrix and an impurity, the degree of orientation of the impurity molecule need not coincide with the degree of orientation (order parameter) of the matrix molecules. Moreover, for matrix molecules in the neighborhood of an impurity the order parameter (OP) should deviate from its value for molecules remote from the impurity. An answer to the question of how the OP is distributed in the neighborhood of an impurity molecule might be given by a microscopic theory. The authors develop such a theory for impure smectic and nematic liquid crystals in the self-consistent field approximation. The distribution found for the OP is then used to determine the displacement of the phase transition point from a liquid crystal to an isotropic liquid. (7 refs.)

107544 Optics of a chiral liquid crystal far from a Bragg resonance. R.S.Akopyan, B.Ya.Zel'dovich, N.V.Tabiryan (Inst. of Problems in Mech., Acad. of Sci., Moscow, USSR).
Sov. Phys.-JETP (USA), vol.83, no.5, p.1024-7 (Nov. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.5, p.1770-6 (Nov. 1982). [received: Sept. 1983]
The problem of propagation of light across a dielectric medium with a helical structure, for example through a cholesteric or a chiral smectic liquid crystal, is considered. The problem is solved for an arbitrary angle between the wave vector and the helix axis far from a Bragg resonance. The solution is obtained to within terms $\sim\epsilon_a^2$ inclusive, where ϵ_a is the permittivity anisotropy. A full allowance is made for the influence of the longitudinal components of the electric field. A solution is also given of the electrostatic problem of the macroscopic permittivity of a medium with anisotropically correlated tenor fluctuations. (8 refs.)

107545 Fluctuations and scattering of light in nematic liquid crystals. A.Yu.Val'kov, V.P.Romanov (Leningrad State Univ., Leningrad, USSR).
Sov. Phys.-JETP (USA), vol.83, no.5, p.1028-33 (Nov. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.5, p.1777-87 (Nov. 1982). [received: Sept. 1983]
The authors investigate longitudinal and transverse uniaxial and biaxial fluctuations in nematic liquid crystals. They show that the director fluctuations make a singular contribution not only to the longitudinal but also to the biaxial fluctuations. A general expression is constructed in the Gaussian approximation for the fluctuating contribution of the tensor order parameter to the thermodynamic potential of the liquid crystal. When account is taken of the spatial dispersion in the approximation quadratic in the wave vector, this expression contains twelve independent coefficients. In particular, for the difference $K_{33}-K_{11}$ of the Frank moduli it predicts a cubic dependence on the order parameter. The correlation function of the orientation fluctuation is calculated for both the nematic and the isotropic phase. A general analysis is presented of the conditions for the observation longitudinal and biaxial fluctuations in the usual light-scattering experimental geometry. (10 refs.)

Neutron scattering study of convection in a double-diffusive system .... See Entry 107148

Calorimetric investigation of electrohydrodynamic instabilities in liquid crystals .... See Entry 107266

Elastic deformation of nematic liquid-crystal media .... See Entry 107799

A simple method for determining of the elastic coefficient A_{11}-$2A_{21}$>0 of smectic C liquid crystals .... See Entry 107803

Effect of molecular structure on mesomorphism. XVI. Nematic-isotropic thermodynamics for oligomer models of liquid crystalline polymers .... See Entry 107932

Anisotropic steric effects and negative $\langle P_4\rangle$ in nematic liquid crystals .... See Entry 107933

Pretransitional effects in the isotropic phase of a lyotropic nematic liquid crystal .... See Entry 107934

Study of the phase transition in some cholesteryl and B-nor cholesteryl derivatives .... See Entry 107935

Electric field effects on phase transitions in mixtures of cholesteryl esters .... See Entry 107936

Frequency dependence of structural transitions in a smectic-*A* .... See Entry 107938

Properties of the concentrated xanthan gum solutions .... See Entry 108006

Dependence of interfacial tension of plane isotropic liquid-nematic liquid crystal boundary on elastic constants and phase transition parameters .... See Entry 108121

Dye sensitization effects on photovoltaic phenomena in MBBA liquid-crystal cells .... See Entry 108477

Two-dimensional reorientation and magnetic resonance line shapes in semiordered solids .... See Entry 108756

A linear relationship between the ^{13}C ester carbon chemical shift and the melting point or S to N transition temperature of n-alkyl esters of biphenyl-4,4'-dicarboxylic acid .... See Entry 108808

Dielectric relaxation in the crystalline smectic-*B* phase .... See Entry 108869

Optics of a planar cholesteric layer (inclined incidence) .... See Entry 108901

Theory of light scattering in cholesteric blue phases .... See Entry 108966

Use of phase Fourier spectroscopy to investigate dynamic scattering of light in nematic liquid crystals .... See Entry 108968

On defects in different phases of two-dimensional lipid bilayers .... See Entry 109981

61.40 AMORPHOUS AND POLYMERIC MATERIALS

(see also 64.70P Glass transitions 81.20P to 81.20T, and 81.60 Materials science)

107546 Generalisation of P.P. Ewald's intensity function for microparacrystals in colloids and their superstructures. R.Hosemann, M.P.Hentschel (Gruppe Parakristallforschung, BAM, Berlin, Germany), F.J.Balta-Calleja, G.S.Y.Yeh.
J. Phys. C (GB), vol.16, no.25, p.4959-71 (10 Sept. 1983).
The expectation value of the diffraction of an ensemble of paracrystals defined by statistically distributed point defects within their lattices can be calculated by means of the correlation function of bounded point lattices with

the help of their shape function. The result is a convolution product of their shape factor $S^2(\mathbf{b})$ with a lattice peak function $Z(\mathbf{b})$ defined by a three-dimensional convolution polynomial. $S^2(\mathbf{b})$ depends on $Z(\mathbf{b})$ because of the α^* law. For crystals the convolution product ZS^2 degenerates to P.P. Ewald's (1940) intensity function. All existing objections against the theory of paracrystals fail because they do not take into account this shape factor nor the α^* law!. (19 refs.)

107547 The structure of boron in boron fibres. J.Bhardwaj (Carbide Tools Div., TRW Inc., Rogers, AR, USA), A.D.Krawitz.
J. Mater. Sci. (GB), vol.18, no.9, p.2639-49 (Sept. 1983).
The structure of noncrystalline, chemically vapour-deposited boron fibres was investigated by computer modelling the experimentally obtained X-ray diffraction patterns. The diffraction patterns from the models were computed using the Debye scattering equation. The modelling was done utilizing the minimum nearest-neighbour distance, the density of the model, and the broadening and relative intensity of the various peaks as boundary conditions. The results suggest that the fibres consist of a continuous network of randomly oriented regions of local atomic order, about 2 nm in diameter, containing boron atoms arranged in icosahedra. Approximately half of these regions have a tetragonal structure and the remaining half a distorted rhombohedral structure. The model also indicates the presence of many partial icosahedra and loose atoms not associated with any icosahedra. (30 refs.)

107548 Isothermal changes of volume and Young's modulus of amorphous Co-P. G.Dietz, K.Huller, K.Jung (II Phys. Inst., Univ. zu Köln, Koln, Germany).
J. Non-Cryst. Solids (Netherlands), vol.57, no.2, p.265-73 (1 Sept. 1983).
The isothermal shrinkage and the isothermal increase of Young's modulus E of electrodeposited Co-P samples were studied in the amorphous state and during crystallization. The lower limit of the activation spectrum of the elementary processes responsible for these changes is shifted from 0.8 to 1.6 eV by annealing at temperatures ascending from 100°C to 220°C. From the Arrhenius equation a frequency constant of $10^{9.5\pm2.5}$ was derived. On account of the different behavior of the two properties the authors conclude that the changes of E in connection with the relaxation of the amorphous structure is mainly a consequence of the homogenization of the material and the shrinkage is mainly a consequence of the annihilation of free volume. Based on the observations a model is proposed concerning the nature of the elementary processes involved in the different steps of structural relaxation. During crystallization the correlation between the increases in Young's modulus and in density is totally removed. These results show that the observation of temporal and thermal changes of only one physical property does not yield full information about the kinetics of structural relaxation and crystallization. (31 refs.)

107549 Structural studies of amorphous Co-P and Ni-P by EXAFS. P.Lagarde (LURE, Univ. Paris-Sud, Orsay, France), J.Rivory, G.Vlaic.
J. Non-Cryst. Solids (Netherlands), vol.57, no.2, p.275-87 (1 Sept. 1983).
The EXAFS spectra of amorphous Co-P and Ni-P alloys have been recorded and analyzed on both edges of the metal and metalloid. The spectra cannot be directly fitted by the classical neutrons or X-rays results: these appear to be the average values of asymmetric radial distribution functions that the authors have to use in EXAFS analysis. Then they show that the environment of the phosphorus atoms in the amorphous state is very reminiscent of that of the Co2P or Ni3P crystalline materials. (13 refs.)

107550 Application of Miedema's coordinates to the formation of binary amorphous alloys. Z.Bangwei (Basic Courses Dept., Hunan Univ., Changsha, China).
Physica B & C (Netherlands), vol.121B+C, no.3, p.405-8 (Aug. 1983).
It is demonstrated that Miedema's coordinates can describe the formation of binary amorphous alloys quite well. With $|\Delta\phi^*|$ and $|\Delta(1/n_{ws}{}^{1/3})|$ representing the ordinate and the abscissa, respectively, it is found that the formed and nonformed areas of binary amorphous alloys can be separated by a straight line, which is given by $10|\Delta\phi^*|-39|\Delta(1/n_{ws}{}^{1/3})|-1=0$. The results compare well with those obtained from a bond-parametric diagram, whether the alloys under consideration are formed by only melt quenching techniques, or by melt quenching and other than melt quenching techniques, but are not as good as those obtained from bond-parametric diagram including the size factor. (20 refs.)

Otto-Schott-Colloquium on the State of Optical Glass Research 1982 .... See Entry 105025

Internal friction peaks and structural relaxation on some electroless deposited amorphous alloys .... See Entry 107827

Influence of doping on the liquid-amorphous transition induced by picosecond laser irradiation of Si .... See Entry 107873

Mixing of phases in non-crystalline materials: Application to carbon .... See Entry 107948

Study of thermal properties, electrical conductivity, and the crystallization process of the glassy alloy $SeGe_{20}$ .... See Entry 108085

'Hot' crystallization centers in amorphous layers .... See Entry 108128

Structural organisation of amorphocrystalline films of lead tin telluride during annealing in vacuo and in oxygen .... See Entry 108224

On the formation of electroless amorphous layers. I. Phenomenological description of NiP deposited on Cu and Fe substrates .... See Entry 108227

Structure and bonding of hydrocarbon plasma generated carbon films: an electron energy loss study .... See Entry 108232

The structure of amorphous boron films .... See Entry 108236

A study of positron annihilation in the bulk and on the surface of Pd-Si and Pd-Si-Cu amorphous alloys .... See Entry 109036

Constitution of the binary Pd-Si system in the concentration range from 0 to 33.3 at.% Si .... See Entry 109235

61.40D Glasses

107551 Anisotropy of SANS in metallic glasses. A.R.Yavari (ENSEEG, Grenoble, France), M.Maret.
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.21, p.1637-42 (13 June 1983). In French.
SANS in metallic glasses is anisotropic and depends on the ribbons' orientation. Pd-based melt spun and Ni-based electrochemically deposited glasses exhibit different anisotropies. Both glasses contain scattering centers of the order of 40 nm wide in the ribbon plane. In the melt-spun alloy, the scatterers are very thin along the thickness perpendicular to the substrate. In the deposited alloy however, the defects are long along the thickness perpendicular to the electrode. (6 refs.)

107552 Neutron-diffraction investigation of the structure of glassy carbon. V.F.Petrunin, V.A.Pogonin, Yu.G.Andreev, K.P.Vlasov, V.T.Il'in (Moscow Engng. Phys. Inst., Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1091-4 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.L292-5 (Aug. 1982).
As a result of a neutron diffraction investigation, the structural type and parameters of a glassy carbon have been determined. The difference between the structure of this substance and that of graphite has been established. The unit cell parameters along the c-axis are different, the regions of coherent scattering are smaller, and the defect content is higher in the modification in question. These features of the structure are usually characteristic of ultradisperse media. For this reason, and also in view of the dimensions of the morphologic elements (less than 1000 Å), it is concluded that glassy carbon belongs to a new class of materials—ultradisperse media with properties which differ from the characteristics of the same materials in the usual state. (8 refs.)

107553 X-ray scattering studies of glasses in the system ZrF_4-BaF_2. R.Coupe, D.Louer (Lab. de Cristallochimie, Univ. de Rennes, Rennes, France), J.Lucas, A.J.Leonard.
J. Am. Ceram. Soc. (USA), vol.66, no.7, p.523-9 (July 1983).
A Fourier analysis of X-ray scattering by glasses in the system ZrF_4-BaF_2 is presented. The first peak in the radial distribution functions occurs in the range 0.209 to 0.211 nm; the average coordination numbers estimated for the zirconium atom are in the range 7.08 to 8.35, depending on the chemical composition. The second peak has been broken down into two components attributed to two kinds of Ba-F distances, 0.261 to 0.266 and 0.307 to 0.319 nm, with a corresponding coordination number of barium with respect to fluorine atoms ranging from 8.70 to 10.68. Interpretation of the cation-cation region is suggested; the average angle values of the Zr-F-Zr bridge bond, varying from 150° to 160°, prevent two neighboring zirconium atoms from being bonded through two fluorine atoms. Comparative discussions with crystalline structures of fluorozirconates are presented. (43 refs.)

107554 Bond character and properties of the mixed alkali system Na_2O-K_2O-Al_2O_3-SiO_2. A.Klonkowski (Tech. Univ. Clausthal, Clausthal-Zellerfeld, Germany).
J. Non-Cryst. Solids (Netherlands), vol.57, no.2, p.339-53 (1 Sept. 1983).
The mixed alkali glass system Na_2O-K_2O-Al_2O_3-SiO_2 was investigated. Density, transformation temperature, refractive index, and chemical durability were studied. Optical absorption and ESR spectra of the CuO-doped glasses were determined. Calculations of the polarizability of O^{2-}, bonding parameters of the Cu^{2+} complex, and the packing density are presented. It was found that for the mixed alkali glasses, the oxygen-alkali bond has a more ionic character than expected from additivity. This fact enables the non-linear changes of the refractive index, of the shift of the Cu^{2+} absorption band, and of the covalency to be interpreted as the Na mole fraction is varied. It is also possible to explain qualitatively the density, T_g and chemical durability non-linear variations with change of the Na content by the ionicity deviations of the bond character and by postulated pairs of Na^+ and K^+ ions in the mixed alkali glasses. (32 refs.)

107555 Preparation, crystallization, and magnetic properties of amorphous $Fe_{100-x}B_x$ ($18\leq x\leq42$). F.Kanamaru, S.Miyazaki, M.Shimada, M.Koizumi (Inst. of Sci. & Industrial Res., Osaka Univ., Osaka, Japan), K.Oda, Y.Mimura.
J. Solid State Chem. (USA), vol.49, no.1, p.1-5 (Aug. 1983).
Amorphous $Fe_{100-x}B_x$ alloys were prepared by the RF-sputtering method in a chemical composition range of $18\leq x\leq42$. The crystallization temperature of the amorphous alloys increases with the B contents up to near $x=36$, above which the crystallization temperature decreases monotonically. This anomaly is reflected in the composition dependence of the Curie temperature and the coercive force of the amorphous alloys. (23 refs.)

107556 Relaxation processes in amorphous metallic alloys during heating. E.Ya.Malinochka, A.M.Durachenko, V.T.Borisov.
Russ. Metall. (GB), no.3, p.87-90 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.3, p.99-103 (1982).
Differential scanning calorimetry was used to determine the thermal effects corresponding to high-temperature relaxation processes that occur on heating amorphous metallic alloys. The changes in the ratio of the values of the relaxation peaks on the DSC curves as a result of heat-treating these alloys can be attributed to the existence of a number of levels in the internal energy of an amorphous system which are separated by potential barriers, the heights of which correspond to particular activation energies for relaxation phenomena. (10 refs.)

107557 Crystallization properties of lead glasses. L.Sasek, Nguyen Van Tu, M.Bartuska (Dept. of the Technol. of Silicates, Inst. of Chem. Tech., Prague, Czechoslovakia).
Silikaty (Czechoslovakia), vol.27, no.3, p.233-43 (1983). In Czech.
The crystallization was examined in the systemn Na_2O-K_2O-BaO-PbO-SiO_2 by the gradient method after Silvermann. Crystallization was found to affect the viscosity of glass, and this in turn influences the rate of growth of the arising crystallization nuclei. All the glasses followed were found to be subject to surface crystallization which is promoted by the loss of volatile components from the surface of glass melts. The precipitating phases are sanbornite ($BaO.2SiO_2$) and tridymite. Sanbornite is mostly formed in glasses having a low liquidus temperature (below 850°C) and containing 24% PbO and 7% BaO. The crystallization ability of the given system of glasses was further found to depend above all on the content of alkalies and on the total content of PbO+BaO. (9 refs.)

107558 On the formation of transition metal-rich glassy phases in the systems Ni-As, Pd-As and Pt-As. M.El-Boragy, M.Ellner, B.Predel (Max-Planck-Inst. fur Metallforschung, Stuttgart, Germany).
Z. Metallkd. (Germany), vol.74, no.8, p.545-8 (Aug. 1983). In German.
For studying the glass-forming ability, splat-cooling investigations have been made in the systems Ni-As, Pd-As and Pt-As. While in the systems Pd-As and Pt-As metallic glasses were found, the splat-cooled alloys in the system Ni-As were crystalline only. In the ternary system Pd-Pt-As, a limited solubility of the binary metallic glasses $Pd_{80}As_{20}$ and $Pr_{72}As_{28}$ was found. A phase equilibrium investigation in the system Pt-As shows that $PtAs_2$ with FeS_2(h) structure is the only compound in this system. The criteria for the glass-forming ability in the systems with nickel, palladium and platinum as one component and a 3d-element gallium, germanium or arsenic as the second one, respectively, are discussed. (16 refs.)

107559 Laser-generated glassy phases. M.V.Allmen (Inst. of Appl. Phys., Univ. of Bern, Bern, Switzerland).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.691-702
Short laser pulses have recently been discovered to be powerful means for glass formation in binary alloys as well as in some pure elements. Due to relevant cooling rates in excess of 10^{10} K/s, glass formation is achieved in

binary systems over most of the phase diagram, even in systems not previously known as glass formers. The author gives a review of recent progress in laser melt quenching, and then discusses the kinetic conditions of glass formation by laser irradiation. (17 refs.)

Microstructures and crystallization in simulated waste glasses .... See Entry 105997

Pulsed laser melting of metallic glasses .... See Entry 107760

Amorphous Al(Ni) alloy formation by pulsed electron beam quenching .... See Entry 107770

Surface damage and crystallization in amorphous alloys by helium ion bombardment .... See Entry 107783

The elastic properties of some phosphate/vanadate glasses ... See Entry 107805

On the nucleation of melts under microgravity conditions ..... See Entry 107886

The role of TiO_2 and ZrO_2 in Na_2O-MO_2-SiO_2 glasses .... See Entry 107939

Thermal expansion of amorphous $Pd_{0.775}Si_{0.165}Cu_{0.06}$ .... See Entry 107991

Ion transport and structure in silver borate glasses .... See Entry 108036

Study of surface composition of iron-based metallic glasses by means of UV photoemission, angle resolved Auger electron and ion scattering spectroscopy .... See Entry 108140

The influence of small amounts of crystallinity on the transport properties of metallic glasses .... See Entry 108380

The influence of the structure of different arsenic chalcogenide glasses on refractive index and dispersion .... See Entry 108910

Influence of glass structure on refractive index and dispersion .... See Entry 108917

Influence of elementary structure defects on the optical properties of glasses .... See Entry 108986

Irradiation-induced photodarkening in As-Se-Cu amorphous films .... See Entry 109032

Microstructure and imperfections of glassy and glass-ceramic telluride semiconductors on the basis of positron annihilation .... See Entry 109040

Structure and properties of rapidly cooled (superconductive) Pb-Bi alloys .... See Entry 109232

The $TlAsSe_2$-Tl system .... See Entry 109258

The Tl_4AsSe_3-AsSe system .... See Entry 109259

Impinging melt flow and metallic ribbon formation in the single-roll rapid solidification process .... See Entry 109266

Features of formation and breakdown of microcrystalline and amorphous phases in splat-cooled cerium-silver alloys .... See Entry 109272

61.40K Polymers, elastomers, and plastics

107560 X-ray study of the structure of polyvinyl chloride-non-polar plasticizer systems. A.B.Surovtsev, V.P.Lebedev, B.V.Teplov, M.N.Shlykova.
Vysokomol. Soedin. Ser. B (USSR), vol.25, no.7, p.508-12 (1983). In Russian.
Small angle X-ray studies on PVC with differing TNM plasticizer content showed scattering over the 5-60 interval due to inhomogeneity in density distribution at 10-100 Å. Diffuse scattering increased with plasticizer content. With ethereal plasticizers, discrete scattering occurred dependent on the thermal pre-history. Plasticizers produced noticeably lower densities at small angle scattering to give inhomogeneous distribution at 10 Å. It was concluded that the plasticizers did not affect the crystal structure but altered the properties of the amorphous part of PVC. (10 refs.) *R.H.*

107561 Gelation/crystallisation of poly(vinyl chloride). A.Dorrestijn, P.J.Lemstra (DSM, Central Lab., Geleen, Netherlands), H.Berghmans.
Polym. Commun. (GB), vol.24, no.8, p.226-30 (Aug. 1983).
The gel formation of PVC and post-chlorinated PVC samples (CPVC) in DOP (di-(2-ethylhexyl)phthalate) was studied by measuring the storage modulus as a function of time/frequency. Random chlorination of PVC in solution completely suppresses gelation when more than 13 mole % additional chlorine is introduced, which is in contrast with bulk chlorinated samples. These differences are ascribed to the influence of intramolecular chlorine distribution on crystallizability. (14 refs.)

107562 Molecular motion in a poly(vinyl alcohol) crystal. M.Nagura, S.Matsuzawa, K.Yamaura, H.Ishikawa (Faculty of Textile Sci. & Technol., Shinshu Univ., Ueda, Japan).
Polym. Commun. (GB), vol.24, no.8, p.250-3 (Aug. 1983).
To study the molecular motion in a crystal of poly(vinyl alcohol), PVA, the relationship between packing of chains in the crystal and relaxation phenomena was investigated using an X-ray diffractometer, an infra-red spectrophotometer, and a dynamic viscoelastometer. There are two dispersions in the temperature dependence of the dynamic loss tangent at ~90°C and above ~100°C for annealed highly syndiotactic PVA as well as atactic PVA. It was established that the molecular motion in the crystal above 100°C occurred in only the loose packing region, in which the formation of the intermolecular hydrogen bonds was hindered by the molecular configuration such as the high concentration of the head-to-head linkages and the low syndiotacticity. (10 refs.)

107563 EXAFS evidence for local order in the ionic aggregates of halato-telechelic polymers. R.Jerome (Lab. de Chimie Macromoleculaire et de Catalyse Organique, Univ. de Liege, Liege, Belgium), G.Vlaic, C.E.Williams.
J. Phys. Lett. (France), vol.44, no.17, p.L717-23 (1 Sept. 1983).
The ionic aggregates in bulk halato-telechelic polymers, a class of ion-containing polymers with well controlled molecular characteristics, have a high degree of local order, as shown by EXAFS spectroscopy. In zinc neutralized carboxy telechelic polybutadiene each cation is surrounded by an average of 6 oxygen neighbours as well as by a second shell of up to 5 zinc atoms at a distance of 3.22±0.02 Å. The influence of humidity during sample preparation and elaboration is also investigated. (21 refs.)

107564 Small-angle neutron scattering measurement of block copolymer interphase structure. R.W.Richards, J.L.Thomason (Dept. of Pure & Appl. Chem., Univ. of Strathclyde, Glasgow, Scotland).
Polymer (GB), vol.24, no.9, p.1089-96 (Sept. 1983).
The notion of an interfacial layer at the domain boundary in block copolymers is reviewed and the possibility of its measurement by small-angle X-ray and small angle neutron scattering discussed. Values of the interfacial layer thickness and its volume fraction have been obtained for a range of styrene-isoprene copolymers. Interfacial layer thickness is not strongly dependent on molecular weight whilst the volume fraction shows a dependence more in line with the theory of Helfand (1975). (44 refs.)

107565 Some neutron experiments on flexible polymers. P.G.de Gennes (Coll. de France, Phys. de la Matiere Condensee, Paris, France).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.407 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The present review is concerned only with linear chains with a large number N of monomers per chain ($N \sim 10^{14}$). The emphasis is mainly on semilocal properties, i.e. the wavevectors q such that $a^{-1} \gg q > R^{-1}$ where a is a monomer size and R is a coil size. Dilute solutions of polymers are not convenient for neutron studies, but semi-dilute solutions (where the coils overlap) are interesting. The main feature here (for good solvents) is the existence of a single characteristic length $\xi(C)$ which is a decreasing function of the concentration C. For $q\xi > 1$ one still has single chain correlations while for $q\xi < 1$ each chain behaves like an ideal coil. Dynamically, for $q\xi < 1$ one measures a certain cooperative diffusion coefficient, while the $q\xi > 1$ the width Γ_q of the dynamical form factor scales like q^3. This has been seen both by photon beats (using very long chains) and by neutrons (with the spin echo technique). (3 refs.)

107566 Configuration of the polyisobutylene chain in bulk and in solution according to elastic neutron scattering. H.Hayashi, P.J.Flory (IBM Res. Lab., San Jose, CA, USA).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.408-12 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The dimensions and configurations of polyisobutylene (PIB) chains in the bulk and in a θ-solvent have been investigated by elastic neutron scattering at small and at intermediate angles. The z-average radii of gyration, $\langle s^2 \rangle_z^{1/2}$, of protonated PIB were calculated from Zimm plots in the Guinier region. Values of $\langle s^2 \rangle_z^{1/2}$ measured in a deuterated PIB matrix (75±5 Å) and in the θ-solvent (77±5 Å) are in good agreement. Results of scattering measurements at intermediate angles were compared using Kratky plots on an absolute scale. The scattering curves for protonated PIB in the deuterated PIB matrix and in the θ-solvent were in excellent accord in the range of $0 < \mu < 0.6$ Å^{-1} ($\mu = 4\pi \sin \theta/\lambda$), demonstrating that the configuration in the bulk is virtually the same as in a θ-solvent. The experimental data were compared also with theoretical scattering functions. Close agreement throughout the range of μ covered by the covered by the experiments confirms the underlying conformational analysis and demonstrates randomness of configurations in the bulk down to distances of ca. 10 Å. (6 refs.)

107567 Multiplicity of relaxational processes of recrystallized polychloroprene. G.T.Ovanesov.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.8, p.1708-12 (Aug. 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
Crystallization of polychloroprene nairite NTN results in an increase of T_g, while annealing decreases it. The activation energy of the relaxation process is changed symbatically with T_g. Sulfur distributed among polychloroprene monomer units results in appearance of additive relaxational processes in the region of main transition from glassy into rubberlike state. The intensity of the maximum of dielectric loss of crystallized polymer after annealing exceeds the intensity obtained for amorphous elastomer. (10 refs.)

107568 Study of relaxational properties of elastomers by diffusional method. I.S.Yurovskaya, B.S.Grishin, I.A.Tutorskii.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.8, p.1728-33 (Aug. 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The high-temperature relaxational transition in polyisoprene and butyl rubber has been studied by the diffusional method. With increase of MM of a polymer up to some critical value the coefficient of diffusion of solid low-molecular compound is quickly decreased and after attaining of critical value of MM stays constant. The very thin network of cross bonds depresses the high-temperature transition and decreases the coefficient of diffusion. The mechanical treatment results in irreversible decrease of the coefficient of diffusion. The values of relaxation time of reconstruction of polymer structure after mechanical treatment are estimated from diffusional data. (23 refs.)

Molecular structure and physical properties of rigid polymers in solutions .... See Entry 107518

On structure of liquid polyethylene. 'Computer experiment' and IR-spectroscopy data .... See Entry 107519

On the dissolving of polymers and photoresists .... See Entry 107961

Influence of surface tension of the solvent on duration of induction period of diffusion in methanol-polymethyl methacrylate system .... See Entry 108001

Features of self-diffusion of the solvent in the polymer-low-molecular compound system .... See Entry 108002

Influence of defects of chemical structure of polyimides on their thermal resistance .... See Entry 108087

Interpreting light scattering patterns by means of optical diffraction .... See Entry 108238

Features of longitudinal flow of cellulose acetate films in active media .... See Entry 108248

Two-dimensional reorientation and magnetic resonance line shapes in semiordered solids .... See Entry 108756

Flow birefringence and angles of its orientation in solutions of poly-α-methyl styrene .... See Entry 108919

On the conformation of aromatic polyamide in organic solvent and concentrated sulfuric acid according the data of flow birefringence .... See Entry 108920

Properties of plasma-deposited films using ethylene and fluoroethylenes as starting monomers .... See Entry 109168

Quantitative morphology analysis for establishing correlations between morphology and properties of impact resistant PVC .... See Entry 109487

61.50 CRYSTALLINE STATE

(inc. molecular motions in solids; for magnetic structure and spin systems, see 75.25)

107569 ONS investigations of pivalic acid; $(CH_3)_3CCOOH$. S.Urban (Inst. of Phys., Jagellonian Univ., Cracow, Poland), J.Mayer, A.I.Belushkin.
Acta Phys. Pol. A (Poland), vol.A64, no.2, p.161-5 (Aug. 1983).
The results of a quasielastic neutron scattering (QNS) investigation on pivalic acid, $(CH_3)_3CCOOH$, in two solid phases are presented. The neutron spectra obtained for the low temperature phase correspond to the spectrometer resolution function, whereas in the high temperature phase (plastic phase) distinct quasielastic broadening is observed. Based on model calculations it is concluded that this quasielastic broadening is mainly connected with uniaxial rotational jumps over 120° of t-butyl groups with a correlation time 5.10^{-12} sec. (11 refs.)

107570 Rotational states of NH_4^+ in dilute solution in alkali halide lattices. I. Inelastic neutron scattering studies. A.Heidemann, J.Howard, K.J.Lushington, J.A.Morrison, W.Press, J.Tomkinson (Inst. Laue-Langevin, Grenoble, France).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2401-13 (July 1983).
Rotational tunneling and torsional energy states of the NH_4^+ ion in several alkali halide lattices (KCl, KBr, KI, RbI and CsI) have been characterized in the energy range $0<\epsilon<42$ meV. The most detailed spectra are obtained for the specimen KBr/NH_4Br (0.5 mole%) at low energies ($\epsilon<2$ meV) and in the temperature region $1.5<T<30$K. The results are consistent with a model of energy states for a tetrahedron in an octahedral field. An investigation of the ratios of the intensities of neutron energy loss and energy gain peaks in the spectra for $KBrNH_4Br$ (0.5%) leads to the conclusion that conversion between the nuclear spin symmetry species of NH_4^+ occurs with a characteristic time of several hours. Moreover, the heat capacity results display a non-lattice contribution which is much less than that which would correspond to rapid spin conversion. On the other hand, the intensity ratios for the neutron spectra of two specimens prepared by evaporation of aqueous solutions (KI/NH_4I (2.3%) and RbI/NH_4I (2.9%)) suggest that conversion is more facile in them. (6 refs.)

107571 Rotational states of NH_4^+ in dilute solution in alkali halide lattices. II. An NMR study of KBr/NH_4Br. T.Yamamoto, H.Chihara (Dept. of Chem., Osaka Univ., Toyonaka, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2414-18 (July 1983).
For pt.I see ibid., vol.52, no.7, p.2401 (1983). Nuclear magnetic relaxation of the protons of NH_4^+ in dilute solution (0.5 mole%) in KBr is measured between 2 and 259K. The approach to equilibrium at 4.2K is slow, the time constant being 1.5 ± 0.2 hr, owing to conversion between nuclear spin symmetry species. There is a minimum in the spin-lattice relaxation time of 3.8 ± 0.2 s at 5.3K. From the slope of T_1 vs. T^{-1} on the high temperature side, the activation energy is found to be 105 ± 10 J $mole^{-1}$, which approximately corresponds to some average of separations between low-lying rotational levels. The spin-spin relaxation time, T_2, is also long (1.0 ± 0.1 ms) and independent of temperature. The equilibrium value of $\langle I(I+1)\rangle$, the ensemble average of the resultant nuclear spin, is slightly less than 4.3 at 4.2K. Deviations from Curie's Law are observed below about 10K. These results are compatible with a model of the NH_4^+ ion as a three-dimensional quantum rotor placed in a potential field of octahedral symmetry.

107572 Temperature dependence of rotational isomerisation and molecular reorientation rates in plastic succinonitrile. M.Bee (Lab. de Dynamique des Cristaux Moleculaires, Univ. des Sci. et des Tech. de Lille, Villeneuve d'Ascq, France), R.E.Lechner, J.P.Amoureux, R.Fouret.
J. Phys. C (GB), vol.16, no.25, p.4973-83 (10 Sept. 1983).
Using the incoherent quasi-elastic neutron scattering (IQNS) technique, the authors have studied the molecular motions of the succinonitrile molecule $N{\equiv}C\text{-}(CH_2)_2\text{-}C{\equiv}N$ in the plastic phase ($233K<T<331K$). The measurements were done using the backscattering spectrometer IN 10 of the Institut Laue-Langevin. The observed quasi-elastic spectra prove the validity of a model allowing for both motions of isomerisation between two gauche and a trans conformation and rotational motions of the molecule in its trans form from a diagonal of the BCC unit cell to another one. The correlation times found by refining this model to the data are: $\tau_{t\to t}(s)=1/k=(7.67\pm1.43)\times10^{-14}\times\exp[(1762\pm44)/T(K)]$ for the rotational motion, and $\tau_{g\to t}(s)=1/k'=(1.03\pm0.40)\times10^{-15}\times\exp[(3220\pm130)/T(K)]$ for the reaction of isomerisation gauche$\rightleftharpoons$trans. (26 refs.)

107573 Possible invariant unitary crystal-structure types. Y.Sakamoto (Dept. of Materials Sci., Hiroshima Univ., Hiroshima, Japan), A.Kida, K.Hiraga, H.Murata.
J. Sci. Hiroshima Univ. A (Japan), vol.46, no.3, p.371-461 (May 1983).
By the lattice-complex (LC) method all the crystallo-geometrically possible crystal-structure types (CST) are symbolized, classed under a registry number list, and enumerated in regard to the invariant unitary case, and their fundamental properties are described minutely. The main subjects treated are: symbolism and classification (jointly, of pseudoinvariant LCs), orderly register of PIUCSTs with their individual characteristics, interrelation of CSTs among crystal families, isohedral and isogonal (or simple coordination) polyhedra, Patterson-vector set, radial distribution of lattice points, Dirichlet domain, interstices in a cubic LC, correspondence of a LC to a net due to Wells's crystal-net method, relation to the Latin square, lists of possible and known IUCSTs and errata to some quoted works. (76 refs.)

Otto-Schott-Colloquium on the State of Optical Glass Research 1982 ....See Entry 105025

Two-dimensional reorientation and magnetic resonance line shapes in semiordered solids ....See Entry 108756

Effects of restricted molecular motion on the high-resolution solid-state ^{13}C CP MAS NMR spectrum of the nitrile group of the stearonitrile-urea inclusion complex ....See Entry 108803

Formulae for intramolecular nuclear magnetic relaxation in an anisotropic medium ....See Entry 108812

On the intramolecular spin-lattice relaxation in reorienting three-spin $^1/_2$ systems ....See Entry 108823

Light scattering studies of rubidium cyanide under hydrostatic pressure ....See Entry 108955

61.50C Physics of crystal growth

(for techniques of crystal growth and film deposition, see 81.10 and 81.15; for epitaxy, thin films, see 68.55; for whiskers, see 68.70)

107574 Reciprocal crystal and PBC-vector method. Crystal growth of a-sulphur. H.Follner (Inst. fur Mineralogie and Mineralische Rohstoffe, Tech. Univ. Clausthal, Clausthal-Zellerfeld, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.873-80 (1983).
The morphological lattice of α-sulphur (F ddd) has coordinates 1/8, 1/8, 0. The reciprocal crystal is a polyhedron with 15 faces and point symmetry 112. The arrangements of the polyhedra parallel to the crystal faces confirm that (100), (101), (010), (011), (111), (113), (001) are F-faces and (110), (112) S-faces according to Hartman (1980) and Perdok. Under consideration of the extinction rules of the morphological lattice (101) and (011) have to be regarded as S-faces. The size of the polyhedra faces is proportional to the interaction energy given by Hartman. It is shown that the face area of the net planes, divided by the number of molecules per growth layer, represent a good approximation to the attachment energy calculated according to Hartman. The average deviation for α-sulphur is 3% for olivine and SnJ_4 8.5% and for anthracene 10.5%. The Wulff-plots correspond fully to the experimental observations. (12 refs.)

107575 Surface morphology and growth mechanisms of Argyrodite-type Cu_6PS_5Hal crystals. S.Fiechter, J.Eckstein (Kristallographisches Inst., Albert Ludwigs-Univ., Freiberg-Breisgau, Germany), W.J.P.van Enckevort, J.J.M.Binsma.
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.881-7 (1983).
Simple crystals of Cu_6PS_5Hal (Hal=Cl, Br, I) have been grown by dissociative sublimation and by chemical vapour transport with P, S, Hal, CuHal and combinations thereof as transporting agents in the temperature range 800 to 1000K. Microscopic observation of the tetrahedral faces revealed several growth features. Macrosteps, closed loop steps and surface protuberances are always accompanied with the presence of liquid $CuHal/Cu_2S$ droplets on the growing crystal surface. The phenomena are characteristic for a two-dimensional vapour-liquid-solid growth mechanism. In the absence of $CuHal/Cu_2S$ liquid phase, direct growth from the gas phase (VS growth) takes place leading to hillocks and growth spirals with low step heights ($\sim5-10$ Å). (16 refs.)

107576 Crystallization of bismuth telluride from a melt containing excess tellurium. A.D.Galetskaya, V.A.Kutasov, T.A.Smorodina, V.V.Sologub (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1563-6 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1820-3 (Nov. 1982).
The authors propose a model of defect centers arising in the crystallization of Bi_2Te_3 from melts of various compositions. They show that the carrier concentrations in successively grown p-type and n-type specimens increase with the tellurium content of the original melt. At 77K the carrier mobility in p-type specimens close to the transition region is anomalously low in comparison with specimens obtained from stoichiometric melts. (7 refs.)

107577 Evaporation of carbon from the melt during the growth of silicon single crystals. V.V.Voronkov, V.P.Grishin, L.V.Lanier (State Sci.-Res. & Design Inst. of the Rare-Earth-Metal Industry, USSR).
Inorg. Mater. (USA), vol.18, no.9, p.1225-8 (Sept. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.9, p.1440-3 (Sept. 1982). [received: Sept. 1983]
The authors have considered the general features of the evaporation of impurity from the melt and methods of estimating the evaporation coefficient. The analysis shows that evaporation of carbon can be neglected when growing single crystals of silicon by the Czochralski method and by crucible-free zone melting (particularly in the case of the latter). (4 refs.)

107578 Growth and physical properties of Ln_2GeSe_5, $Ln_2Ge_2Se_7$, $Ln_2Ge_3Se_9$ single crystals. I.O.Nasibov, M.M.Alieva, P.G.Rustamov (V.I. Lenin Azerbaidzhan State Pedagogic Inst., Azerbaidzhan SSR).
Inorg. Mater. (USA), vol.18, no.9, p.1282-5 (Sept. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.9, p.1500-3 (Sept. 1982). [received: Sept. 1983]
Chemical transport reactions have given single crystals from polycrystalline materials for selenogermanates of compositions Ln_2GeSe_5, $Ln_2Ge_2Se_7$, and some of the physicochemical properties of these have been examined. Thermal and chemical analyses indicate a mechanism for the formation of the single crystals, and the optimum conditions for producing them from the gas phase have been established. The widths of the forbidden bands in Ln_2GeSe_5 (Ln=La, Ce, Pr) are 1.68, 1.61, and 1.86 eV, while for $Ln_2Ge_2Se_7$ they are 1.19, 1.21 and 1.42 eV, correspondingly. (7 refs.)

107579 The growth mechanism of octahedron faces of potash alum. A.V.Belyustin, I.M.Levina (Res. Physicotech. Inst., Gor'kii, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.109-10 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.190-1 (Jan.-Feb. 1983). [received: Sept. 1983]
For the {111} octahedron faces of crystals of potash alum, the dependences of the growth rates V on the relative supersaturation σ agree with the theory of Burton, Cabrera, and Frank (BCF) for growth from solution, assuming that the crystal is fed by surface diffusion. This theory satisfactorily describes most V(σ) curves obtained for other substances. In order to reconcile the growth rates of prism faces of epsomite crystals with the theory, account must also be taken of direct incorporation of particles from the bulk of the solution. The authors consider how far the BCF model applies to the {111} faces of potash alum. (10 refs.)

107580 Periodic capture of melt by a growing crystal. A.S.Dzyuba (State Univ, Khar'kov, Ukrainian SSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.111-12 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.192-3 (Jan.-Feb. 1983). [received: Sept. 1983]
Gives the results of experiments undertaken with the aim of studying the mechanism and kinetics of formation of inclusions during growth of a single crystal from a supercooled, gas-saturated melt. The author investigated the growth of salol crystals (melting point 41.5°C) from an air-saturated melt, supercooled by $\Delta T=1\text{-}5K$. (5 refs.)

107581 Implications of the lack of wetting at the monotectic growth front. B.Derby (Lab. d'Etude de la Solidification, CEN, Grenoble, France).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.277-80
A number of microgravity experiments have been proposed using monotectic alloys but little is known about the monotectic reaction. A recent ground-based study of monotectics has shown currently held models to be oversimplified and that in most monotectic systems the liquid and solid reaction products do not wet each other as has been previously believed. This lack of wetting results in repulsive forces which may affect the microstructure of microgravity solidified alloys. The magnitudes of these forces are calculated and presented in light of some past and proposed experiments. (13 refs.)

107582 Order of magnitude analysis of solute macrosegregation in crystal growth from the melt. J.J.Favier, D.Camel (CEN, Grenoble, France).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.295-9
The influence of buoyancy driven thermal convection on macrosegregation in a typical horizontal Bridgman crystal growth configuration is analysed for the whole range of possible values of the parameters. Two main reference quantities appear in the analysis L_s, the length scale for the fluid flow field, L_n, the extent of the boundary layer for solute transport. L_2 mainly depends on the geometry of the cell. L_n depends on the data of the problem, and obeys two different scaling laws according to the nature of the controling driving force; accordingly, two basic boundary layer transport regimes are distinguished: a convective-diffusive regime, and a purely diffusive regime. Within this framework, the influence of the experimental parameters and particularly the gravity level on longitudinal macrosegregation is described in a systematic way. The possibility of producing homogeneous crystals of a given size and dope level is discussed as a function of the available gravity conditions. (15 refs.)

Exact solution of a directed-site animals-enumeration problem in three dimensions .... See Entry 105273

Effect of growth conditions on formation of microdefects in dislocation-free silicon crystals .... See Entry 107698

Field equations of a crystallization front .... See Entry 107876

Interaction between platinum and melts of compounds containing bismuth oxides .... See Entry 107958

Influence of an epitaxial substrate on the growth rate of ammonium iodide crystals .... See Entry 108237

Symmetrical contours of deep level EL2 in liquid encapsulated Czochralski GaAs .... See Entry 108328

Antiferromagnetic antimonides $MnSb_2O_4$ and $NiSb_2O_4$ .... See Entry 108642

Preparation, structure, and magnetic properties of isostructural La_3MAlS_7 and La_3MFeS_7 (M=Mg, Mn, Fe, Co, Ni, or Zn) .... See Entry 108657

Growth conditions of $CuBTe_2$ (B=Ga, In) single crystals by the closed tube chemical vapour transport technique .... See Entry 109122

Preparation of III-V compounds by reduction of precursors . See Entry 109124

Czochralski growth of $Ba_6Ti_2Nb_8O_{30}$ .... See Entry 109129

Crystallisation and topochemical processes occurring on the surfaces of crystals of phosphates .... See Entry 109799

61.50E Crystal symmetry; models and space groups, and crystalline systems and classes

107583 Full representations of the double space groups based on the simple cubic lattice. H.W.Kunert (Inst. of Phys., Tech. Univ., Poznan, Poland).
Physica A (Netherlands), vol.120A, no.1-2, p.213-18 (1983).
The generating matrices of the induced (full) representations for the space groups $Pm3m(=O_h^1)$. $Pn3n(=O_h^2)$, $Pm3n(=O_h^3)$ and $Pn3m(=O_h^4)$ have been calculated. The author has considered the representations corresponding to four high-symmetry points Γ, R, X, and M in the Brillouin zone. He gives explicitly the generators and generating relations for the full irreducible representations induced from the small irreducible representations of Miller and Love. Using these generators and generating relations and the program written in ALGOL, for the computer ODRA 1204 he has calculated the matrices of the full irreducible representations of the full space goups $G^{k\Gamma}$, G^{kR}, G^{*kM} and G^{*kX}. (15 refs.)

107584 On sphere packing, interaction field partitions and coordination numbers from point configurations with trigonal symmetry $R\bar{3}m$. E.Zobetz (Inst. fur Mineralogie und Kristallographie, Univ. Wien, Wien, Austria).
Z. Kristallogr. (Germany), vol.163, no.3-4, p.167-80 (1983). In German.
Sphere configurations and partitions of three-dimensional space into Dirichlet domains have been studied for the point configurations of the trigonal lattice complex $R\bar{3}m$ 6(c). In total, 11 sphere-configuration types and 12 types of Dirichlet partitions have been derived. Utilizing the concepts of Hoppe (1970, 1979) and O'Keeffe (1979), coordination numbers for this two-dimensional field have been calculated. (30 refs.)

107585 On the theory of crystallographic orbits. P.Engel (Lab. fur Kristallographie, Univ. Bern, Bern, Switzerland).
Z. Kristallogr. (Germany), vol.163, no.3-4, p.243-9 (1983). In German.
A group theoretical procedure to determine the non-characteristic orbits is described. For the 230 three-dimensional space group types all non-characteristic orbits were determined. Two examples for the space groups $Pbam$ and $P3_112$ are given. (11 refs.)

On the role of spin-orbit coupling and crystal symmetry on the spin-polarization of photoelectrons in nonmagnetic crystals .... See Entry 109108

61.50J Crystal morphology and orientation

Surface morphology and growth mechanisms of Argyrodite-type Cu_6PS_5Hal crystals .... See Entry 107575

Influence of an epitaxial substrate on the growth rate of ammonium iodide crystals .... See Entry 108237

A new type of regular concretion of crystals [gypsum] .... See Entry 109144

61.50K Crystallographic aspects of polymorphic and order-disorder transformations

107586 Crystallography of dislocations inherited in martensitic transformations and twinning. G.E.Brainin, V.A.Likhachev (Leningrad Univ., Leningrad, USSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.489-502 (1982). [received: Aug. 1983]
Presents a theoretical analysis of dislocation inheriting in the diffusionless martensitic transformations FCC⇄BCC, FCC⇄HCP, BCC⇄HCP, CsCl⇄NaCl, and twinning in FCC, BCC, HCP lattice and $CaCo_3$. Matrices are derived showing the correspondence between the Burgers vectors of the initial dislocations and the dislocations in the transformation product. It is shown that the inheriting of dislocations is associated with substantial energy difficulties, because a great many inherited dislocations acquire Burgers vectors that are not characteristic of the transformation product. Moreover, total dislocations are sometimes transformed into partial ones. On the basis of the theoretical analysis, an attempt is made to elucidate or to determine more accurately the nature of phenomena that accompany martensitic transformations and twinning. These include the shape memory effect, different effects of cold working on direct and reverse transformations, oriented microstresses, causes of reversible twinning and crystallographically reversible martensitic transformation. (20 refs.)

107587 The system HfO_2-RE oxide with high RE oxide contents. A.V.Shevchenko, L.M.Lopato (Inst. of Problems in Materials Sci., Acad. of Sci., Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.11, p.1583-6 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1842-6 (Nov. 1982).
Phase diagrams of the systems HfO_2-RE oxide (RE=La, Pr, Nd, Sm, Gd, Tb, Dy, Y, Er, Yb, Lu, and Sc) have been constructed making use of annealing, quenching (cooling rate 10^2-$10^{4\circ}$C/sec), and DTA techniques at temperatures ranging from 1800°C to the melting point in the RE oxide concentration range 60-100 mole %. The effect of the addition of HfO_2 on the high temperature polymorphic transformation of RE oxides has been studied. The findings of the study have been elucidated from the standpoint of crystal chemistry. (8 refs.)

107588 The phase transformations and thermal expansion of the solid electrolyte Cu_3BiS_3 between 25 and 300°C. E.Makovicky (Inst. of Mineralogy, Univ. of Copenhagen, Copenhagen, Denmark).
J. Solid State Chem. (USA), vol.49, no.1, p.85-92 (Aug. 1983).
The phase transformations and thermal expansion of Cu_3BiS_3 wer studied up to 300°C using heated Weissenberg and Guinier cameras. At 118.5°C a transformation takes place from the $P2_12_12_1$ to a modulated $Pn2_1a$ or $Pnma$ polymorph. The modulation changes continuously, with decreasing intensities of X-ray satellites, from $\sim 3.14c$ at 118.5°C toward $\sim 2c$ at 190°C. At 191°C an unmodulated, high $Pnma$ polymorph is formed. The lattice parameters are $a=7.705$, $b=10.400$, and $c=6.720$ Å at room temperature. They expand only slightly in the low form; a and c contract in the intermediate form, and c contracts further in the high form. The unit cell volume remains nearly constant between 25 and 300°C. The observed phenomena result from redistributions of copper atoms over available structural sites and, at above $\sim$135°C, from the conversion of these atoms from a stationary to a mobile state. (13 refs.)

Dependence of the elastic constants of zinc sulfide on the wurtzite/sphalerite phase composition .... See Entry 107807

Polymorphous transformations of graphitic boron nitride of various degrees of crystalline perfection at high pressures .... See Entry 107909

On the phase transition in $[(CH_3)_4N]_2ZnBr_4$ .... See Entry 107912

Thermodynamics of order-disorder transformations in vanadium carbide .... See Entry 107920

Phase transitions in Bi_2WO_6 crystals .... See Entry 107930

Inhibition mechanism of the anatase-rutile phase transformation by rare earth oxides .... See Entry 109279

61.50L Crystal binding

107589 Evaluation of the crystal binding and compressibility of alkali hydrides. B.R.K.Gupta, V.Kumar (Dept. of Phys., G.B. Pant Univ. of Agriculture & Technol., Pantnagar, India).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.9, p.1011-15 (1983).
An analysis is made of the crystal binding and the compressibility of alkali hydrides using an interionic force model in which the long range electrostatic forces are balanced by the short range forces. The first and second nearest neighbour repulsive potentials are evaluated from the knowledge of the overlap integrals. The contribution arising from the Van der Waals potentials is evaluated from the Slater-Kirkwood variational method. Values of the cohesive energy and compressibility are calculated for all the alkali hydrides. The results obtained are in good agreement with experimental values. (17 refs.)

107590 Some peculiarities of the chemical bond in monochalcogenides of elements of subgroup IIIB with a TlSe structure. R.S.Erofeev.
Inorg. Mater. (USA), vol.18, no.11, p.1550-4 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1807-10 (Nov. 1982).
It was established that a peculiarity of the atomic interaction in monochalcogenides of elements of subgroup IIIB with TlSe structure, for example, is the presence of neighbors of the atoms in numbers exceeding the number of overlapping electronic orbitals, which is due to the possibility of the appearance of directed bonds with a multiplicity of the bonds less than 0.5. The ability of the p-orbitals for nonsymmetrical bilateral overlapping leads to their supplementary overlapping according to the type of formation of a π bond, which causes a shortening of the interatomic distances along the c-axis. The distribution of electrons among the electronic orbitals, according to the proposed scheme of their overlapping, is evidence that TlS and TlSe should be semiconductors; while InTe should possess semimetallic p-type conductivity along the c-axis, which agrees with the experimental data. (9 refs.)

107591 Lone-pair electronic effects on the calculated ab initio SCF-MO electric potential and the crystal structures of azabenzenes. D.E.Williams, R.R.Weller (Dept. of Chem., Univ. of Louisville, Louisville, KY, USA).
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4143-8 (29 June 1983).
Molecular charge distribution models for pyridine, pyridazine, pyrimidine, pyrazine, *s*-triazine, and *s*-tetrazine were evaluated from SCF-MO wave functions. Potential-derived net atomic charges and lone-pair electron site charges were obtained from the calculated electrostatic potential around the molecules. The charge site models were tested by using them to predict the crystal structures of pyrimidine, pyrazine, *s*-tetrazine, and two forms of *s*-triazine by molecular packing analysis. (47 refs.)

107592 Elementary methods for the evaluation of electrostatic potentials in ionic crystals. H.Coker (Dept. of Chem., Univ. of South Dakota, Vermillion, SD, USA).
J. Phys. Chem. (USA), vol.87, no.14, p.2512-25 (7 July 1983).
A new and elementary method for the calculation of electrostatic potentials in ionic crystals is presented. The method is applicable to crystals of any symmetry and complexity. It is denoted the method of dipolar addition since it involves an arbitrary pairing of the charges of the unit cell into dipoles. The rate of convergence is rapid with an accuracy suitable for most purposes achieved on the addition of three shells around a central unit cell. The traditional direct-summation methods of H.M. Evjen (1932) and F.C. Franck (1950) have been modified and extended. (23 refs.)

107593 Dynamics of the hydrogen bond in CsH_3O_2 from quasielastic neutron scattering. M.Stahn, R.E.Lechner (Hahn-Meitner-Inst., Bereich Kernchemie und Reaktor, Berlin, Germany), H.Dachs, H.E.Jacobs.
J. Phys. C (GB), vol.16, no.26, p.5073-82 (20 Sept. 1983).
Incoherent neutron scattering results on the layered hexagonal phase of CsH_3O_2 are presented. The elastic incoherent structure factor (EISF) measured at 402K indicates that the protons are dynamically disordered in a double well potential between adjacent oxygen atoms. The dynamics are well approximated by a two-site random jump model with a mean residence time of 1.25×10^{-11} s per site and a jump distance of 1.03 Å. The large value of the latter suggests a non-linear hydrogen bond. (13 refs.)

107594 Structural origin of optical bowing in semiconductor alloys. A.Zunger, J.E.Jaffe (Solar Energy Res. Inst., Golden, CO, USA).
Phys. Rev. Lett. (USA), vol.51, no.8, p.662-5 (22 Aug. 1983).
The principle of conservation and transferability of chemical bonds explains the recent discovery by extended X-ray-absorption fine-structure measurements of two unequal anion-cation bond lengths R_{AC} and R_{BC} in $A_xB_{1-x}C$ zinc-blende semiconductor alloys despite the close adherence of the lattice constant to the average value (Vegard rule). This bond alternator, manifested as a structural distortion to a local chalcopyrite coordination around the anions, explains also most of the observed optical bowing in semiconductor alloys. (24 refs.)

107595 Statistical thermodynamic approach to some hyperstoichiometric dihydrides of lanthanides (La, Ce, Pr, Nd, Sm) and actinides (Np, Pu, Am). N.Shohoji.
Phys. Status Solidi b (Germany), vol.118, no.2, p.811-22 (1 Aug. 1983).
Statistical thermodynamics is applied to available equilibrium hydrogen pressure-temperature-composition relationships for cubic hyperstoichiometric dihydrides, MH_{2+x}($0<x<1$, M=La, Ce, Pr, Nd, Sm; Np, Pu, Am). A statistical model is constructed based on a perfect face centred cubic lattice of metal atoms with fully occupied tetrahedral interstitial sites by hydrogen atoms and partly and randomly occupied octahedral interstitial sites by the rest of hydrogen atoms. Atomic partition function of hydrogen in MH_{2+x} is found to be similar for all MH_{2+x}. On the other hand, the atomic partition function of metals in MH_{2+x} for different M is found to be different. (24 refs.)

107596 Calculation of the Lennard-Jones *n-m* potential energy parameters for metals. S.Zhen, G.J.Davies (Dept. of Metall., Univ. of Sheffield, Sheffield, England).
Phys. Status Solidi a (Germany), vol.78, no.2, p.595-605 (16 Aug. 1983).
A new approach is developed to calculate the Lennard-Jones *n-m* potential energy parameters for metals whose structure are f.c.c., b.c.c., or h.c.p. using available experimental data. The potential parameters are fitted to the cohesive energy, zero point volume, and zero point compressibilty. The results show improved consistency in comparison with previous work. (18 refs.)

EHT calculations for interstitial hydrogen bonding in nickel .... See Entry 106306

Calculation of ordering energy of copper-based solid solutions by the phase shift method .... See Entry 107599

A neutron diffraction determination of the structure of deuterated aluminium nitrate nonahydrate, $Al(NO_3)_3.9D_2O$ .... See Entry 107617

The structure and electron deformation density of $LiNO_2.H_2O$ at 295K .... See Entry 107618

Tetraaquatrinitratoneodymium(III) dihydrate, $[Nd(NO_3)_3(H_2O)_4].2H_2O$ [crystal structure] .... See Entry 107620

Structure of the octachloride of tricadmium calcium 8.5-hydrate, $2[Ca(H_2O)_7].[Cd_6Cl_{16}(H_2O)_2]\infty.H_2O$ .... See Entry 107622

Structure of cesium fac-trichlorotrioxorhenate(VII), $Cs_2[ReCl_3O_3]$ .... See Entry 107626

Structure of solid carbon diselenide (CSe_2) at 17.5, 50 and 200K .... See Entry 107627

Structure of monoclinic nickel sulphate hexadeuterate, $NiSO_4.6D_2O$ .... See Entry 107628

Pentavalent iron stabilized for the first time in sixfold coordination in an oxide .... See Entry 107649

The stability of the phases in the Ln_2O_3-FeO-Fe_2O_3 systems which are stable at elevated temperatures (*Ln*: lanthanide elements and Y) .... See Entry 107872

The oxide β-Ga_2O_3: force field, thermal expansion, and rigidity anisotropy .... See Entry 107990

The electronic structure of non-stoichiometric Pd-rich Pd-Ag hydrides .... See Entry 108274

Evaluation of cohesive energies for NaCl-NaBr mixed crystals .... See Entry 108325

Single-crystal EPR of the ^{17}O-enriched dioxygen adduct of vitamin B_{12r}: reversible oxygen bonding, electronic and geometric structure, and molecular dynamics .... See Entry 108757

Mossbauer effect of ^{57}Fe impurity atoms in TiAl .... See Entry 108842

Raman scattering and fundamental absorption in red-HgI_2 under hydrostatic pressure .... See Entry 108942

Anisotropic absorption of unpolarized X-radiation in copper-intercalated niobium disulfide .... See Entry 109051

61.55 SPECIFIC STRUCTURE OF ELEMENTS AND ALLOYS

61.55D Nonmetallic elements

107597 Effect of twisting of the diffraction net planes on the integral intensities at Laue diffraction of X-rays in elastically bent silicon crystals. L.I.Datsenko, E.N.Kislovskii, V.I.Khrupa, K.M.Shevtsov-Kazmirchuk.
Phys. Status Solidi a (Germany), vol.78, no.2, p.K175-8 (16 Aug. 1983).
Presents the results of an experimental study of the influence of twisting of the diffraction planes on the dependence of Laue diffracted beam integral intensities (I_R) at elastic strain level ϵ. (9 refs.)

X-ray studies of solid *n*-H_2 .... See Entry 108107

61.55F Metallic elements

Recovery of lattice spacing in HCP metals after fast-neutron irradiation at 5K .... See Entry 107779

61.55H Alloys

107598 X-ray study of the kinetics of ordering in the Cu_3 Au alloy. F.A.Awni, S.K.Hassun (Dept. of Phys., Coll. of Education, Univ. of Baghdad, Baghdad, Iraq).
Iraqi J. Sci., vol.23, no.3, p.341-54 (1982). [received: Aug. 1983]
A revised calculation has been made in accordance with the Wilson results (1943) using a slightly modified formula, for the probability of an anti-phase-type boundary of Cu_3 Au alloy (Au atoms may be in contact). It is concluded that the relative importance of this type of boundary is smaller than has been assumed. Using the broadening of the superlattice reflections, the probability for two types of boundaries was measured during isothermal ordering at various temperatures. In accordance with electrical conductivity measurements, this study indicates that two different processes of ordering can occur, the second of which corresponds to the movement of domain boundaries. The activation energy for this movement, for both types of boundaries agrees with the value derived from the resistivity measurements. (7 refs.)

107599 Calculation of ordering energy of copper-based solid solutions by the phase shift method. V.S.Stepanyuk, A.A.Katsnel'son, O.T.Malyuchkov, L.I.Yastrebov (Moscow Univ., Moscow, USSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.483-8 (1982). [received: Aug. 1983]
The phase shifts of conduction electrons under 'muffin-tin' potential of the host and impurity have been calculated. Friedel's rule of sums has been applied to account for the screening effects so that the atom-atom interaction potential could be expressed in terms of the phase shifts. The potential thus determined has been analyzed, and the ordering energies of dilute Cu-Al, Cu-Au, and Cu-Ni solid solutions as well as of CuZn of equiatomic composition have been determined. (11 refs.)

107600 Electronic structure and tetragonality of martensite. A.Sh.Chavchanidze (Technol. Inst. of Food Industry, Moscow, USSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.582-6 (1982). [received: Aug. 1983]
The combination of high strength and high plasticity in steels is largely due to the formation of martensite. High strength of martensite results from tetragonal distortions of its unit cells which impede plastic deformation and shift. The author's aim is to determine the degree of tetragonality of a martensite unit cell, using experimental data on the Mossbauer effect. (12 refs.)

107601 X-ray structure investigation of the Y-{Ti, Cr, Zr, Hf}=Ga alloy system. V.Ya.Markiv, T.G.Zhunkivs'ka, A.M.Belyavina, O.O.Lisenko.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.5, p.81-3 (1983). In Ukrainian.
Alloys of the Y−{Ti, Cr, Zr, Hf}−Ga system are investigated by means of X-ray method. Isothermal sections of constitution diagrams at 800 and 700°C are plotted. The existence of six ternary phases is established. Crystal structure is determined for two compounds: YTi_2Ga_4-($YbMo_2Al_4$ structure type; $a=0.6712$ nm, $c=0.5484$ nm) and Y_2CrGa_3 ($AuCu_3$; $a=0.4289$ nm). (11 refs.)

107602 Structures of Ba_8Ga_7, Sr_8Ga_7 and Sr_8Al_7. M.L.Fornasini (Istituto di Chimica Fisica, Univ. di Genova, Genova, Italy).
Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.8, p.943-6 (15 Aug. 1983).
Ba_8Ga_7, cP60, $M_r=1586.8$, cubic, $P2_13$, $a=12.990$ (6) Å, $V=2192$ Å^3, $Z=4$, $D_x=4.81$ Mg m^{-3}, $\lambda(MoK\alpha)=0.71069$ Å, $\mu(MoK\alpha)=23.4$ mm^{-1}, $F(000)=2660$, $R=0.040$ for 784 reflections. Sr_8Ga_7, $M_r=1189$, $P2_13$, $a=12.484$ (6) Å, $V=1946$ Å^3, $D_x=4.06$ Mg m^{-3}, $\mu(MoK\alpha)=32.7$ mm^{-1}, $F(000)=2084$, $R=0.048$ for 224 reflections. Sr_8Al_7, $M_r=889.8$, $P2_13$, $a=12.753$ (5) Å, $V=2074$ Å^3, $D_x=2.85$ Mg m^{-3}, $\mu(MoK\alpha)=21.6$ mm^{-1}, $F(000)=1580$, $R=0.031$ for 555 reflections. For this last phase a previous structural proposal for equiatomic stoichiometry was revised and the new formula for Sr_8Al_7 determined. The three compounds are isotypic and their structure is characterized by the presence of isolated tetrahedral and triangular clusters of Ga (or Al) atoms included in cages of 16 and 13 alkaline-earth atoms, respectively. (11 refs.)

107603 Structural redetermination of the ThNi phase. M.L.Fornasini (Istituto di Chimica Fisica, Univ. di Genova, Genova, Italy).
Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.8, p.946-7 (15 Aug. 1983).
$M_r=290.8$, orthorhombic, *Pnma*, $a=14.146$ (6), $b=4.286$ (3), $c=5.702$ (3) Å, $V=345.7$ Å^3, $Z=8$, $D_x=11.17$ Mg m^{-3}, $F(000)=944$, room temperature, $\lambda(MoK\alpha)=0.71069$ Å, $\mu(MoK\alpha)=138$ mm^{-1}, final $R=0.049$ for 306 observed reflections. Contrary to the report of Florio et al. (1956), ThNi was found to crystallize in a stacking variant of the CrB-FeB types with trigonal-prismatic coordination of the Ni atoms, and recognized to be isotypic with the SrAg phase, having stacking code $(hc)_2$. (10 refs.)

107604 X-ray diffraction investigation of the structure of deformed samarium-cobalt alloys. Ya.L.Linetskii, Yu.D.Yagodkin (Inst. of Steel & Alloys, Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.120-2 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
An investigation was made of the X-ray diffraction effects due to deformation by grinding of sintered and cast samarium-cobalt alloys. The deformation of sintered alloys resulted in the appearance of anomalous diffuse lines near reflections representing the $SmCo_5$ and Sm_2Co_7 phases and in broadening of the diffraction lines of the Sm_2Co_{17} phase. The intensity of the diffuse lines of the $SmCo_5$ phase and their shift away from the main lines were a function of the samarium content in the phase. The X-ray diffractograms of the deformed cast alloys showed no diffuse lines near the reflections of the $SmCo_5$ phase. It was concluded that the interstitial impurities present in large amounts in sintered alloys initiated changes in the structure of the $SmCo_5$ phase during plastic deformation. (6 refs.) *A.T.*

107605 Structural instability of $Hf_xZr_{1-x}V_2$ Laves phases. A.S.Balankin, Yu.F.Bychkov, E.I.Yakovlev (Engng.-Phys. Inst., Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.128-33 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of the temperature dependences of the elastic parameters of $Hf_xZr_{1-x}V_2$ phases in the temperature range 77-1500K. It was found that a reduction in the elastic moduli during cooling of these compounds began at ~1500K. Low-temperature anomalies in the changes of the elastic characteristics were attributed to a successive occurrence of electronic and structural transitions. A study was made of the influence of the composition of the alloys on the stability of the crystal lattice. The different symmetry of the low-temperature phases rich in Hf and Zr resulted in a fundamentally different behaviour of the elastic properties in the course of structural transitions in alloys with $x\geq0.654$ and $x\leq0.459$. (19 refs.) *A.T.*

107606 Local atomic distribution in solid solutions of iron in α and β modifications of manganese. A.S.Ilyushin, I.A.Nikanorova (Dept. of Solid State Phys., Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.5, p.29-33 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.5, p.27-31 (1982).
The local distribution of atoms in solid solutions of iron in α and β modifications of manganese is studied by the methods of X-ray structural analysis of polycrystals and nuclear γ resonance. Concentrational dependences of the distribution of iron and manganese atoms for α and β solid solutions are obtained, and the ordered distribution of iron atoms in the structures of α and β Mn is experimentally observed. It is established that, at the boundaries of single-phase α and β solid solutions, the distribution of iron atoms in α and β Mn stuctures corresponds to the mean statistical distribution, and on this basis it is concluded that the configurational energy plays the decisive role in the stabilization of α and β phases in Mn-Fe alloys. (7 refs.)

107607 Lattice parameters of some ternary NiCu-based solid solutions. I.Lupsa (Phys. Dept., Polytech. Inst., Cluj-Napoca, Rumania), E.Burzo.
Rev. Roum. Phys. (Rumania), vol.28, no.5, p.463-5 (1983).
Presents the results of X-ray measurements on $Ni_4Cu_{1-u-z}Si_z$, Ni_uCu_{1-u-z}-Al_z and $Ni_uCu_{1-u-z}Si_z$, $Ni_uCu_{1-u-z}Al_z$ and $Ni_uCu_{1-u-z}Zn_z$ solid solutions.

The lattice constants decrease as Cu is substituted by Si of Al and increase when Cu is replaced by Zn. (10 refs.)

107608 Crystal structures of the compounds RNiSb with various rare earth elements. V.K.Pecharskii, Yu.V.Pankevich, O.I.Bodak (State Univ., L'vov, Ukrainian SSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.97-8 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.173-4 (Jan.-Feb. 1983). [received: Sept. 1983]
In investigating the phase equilibrium diagram of the Ce-Ni-Sb system the authors discovered a compound of the composition CeNiSb. Investigations of a number of alloys with the composition RNiSb with various rare earth metals revealed the existence of 11 more new compounds. This article gives the results of a determination of their crystal structures. (5 refs.)

107609 The crystal structure and magnetic susceptibility of $LuNi_2Sn$, $YbNi_2Sn$ and $LuNi_4Sn$. R.V.Skolozdra, L.P.Komarovskaya.
Ukr. Fiz. Zh. (USSR), vol.28, no.7, p.1093-5 (July 1983). In Russian.
The X-ray powder analysis method was used to establish the crystal structures of $LuNi_2Sn$, $YbNi_2Sn$ and $LuNi_4Sn$. It is found that $LuNi_2Sn$ and $YbNi_2Sn$ have a $MnCu_2Al$ type structure (superstructure of type CsCl, space group Fm3m) with a=0.6345 nm and a=0.6355 nm respectively. $LuNi_4Sn$ has a structure of the $MgCu_4Sn$ type (superstructure of type $AuBe_5$, space group F43m, a=0.6981 nms). The magnetic susceptibility has been measured in the temperature interval 78 to 293K. $LuNi_2Sn$ and $LuNi_4Sn$ are found to be Pauli paramagnets whilst the susceptibility of $YnNi_2Sn$ is described by the Curie-Weiss law. (5 refs.) *V.G.P.*

107610 Analysis of unit cell dimensions in terms of frameworks and elemental atomic diameters. I. Phases with the $MgCu_2$ structure. E.Hellner (Inst. fur Mineralogie, Univ. Marburg, Marburg, Germany), W.D.Pearson.
Z. Kristallogr. (Germany), vol.163, no.3-4, p.197-213 (1983).
Structural description in terms of frameworks—three-dimensional periodic arrangements of points which are occupied by atoms—is used as the basis of analysing the cell dimensions of phases with the $MgCu_2$ structure (cubic) in terms of the elemental diameters of the component atoms. The $MgCu_2$ structure is described in terms of interpenetrating homogeneous D and T′ frameworks or the heterogeneous [D+T′] framework. The relative influences of the atoms occupying these three frameworks on the cell dimensions of different groups of phases that show distinct dimensional behaviour are determined. The self-coordination of atoms on the T′ framework is six. Some interesting observations are made on whether the basic diameters of atoms on this framework might correspond to a coordination number of six rather than twelve which is the overall coordination number of the atoms on the framework (T′). (14 refs.)

107611 Analysis of unit cell dimensions in terms of frameworks and elemental atomic diameters. II. The contraction of the framework W in the A15 structure. E.Hellner (Inst. fur Mineralogie, Univ. Marburg, Marburg, Germany).
Z. Kristallogr. (Germany), vol.163, no.3-4, p.215-25 (1983).
For pt.I see ibid., vol.163, p.197 (1983). An equation is proposed to calculate the observed cell constants of β-W-(MN_3) structures in terms of framework W occupied by the N atom with diameter D_N for CN12. A contraction term K_N has to be added. The influence of the M atoms is of diameter D_M minus the size of occupied icosahedral void d_M, multiplied with the inclination factor f_M for each type of N atoms. The f_M factors are taken from the plot a_{obs} against D_M. (13 refs.)

Some applications of convergent beam electron diffraction in metallurgical research .... See Entry 107492

Periodic networks of disclination lines: application to metal structures .... See Entry 107694

Investigation of short-range order in alloy Cu_3Au .... See Entry 107906

On the identification of new and normal phases in the system of cadmium-antimony alloys .... See Entry 107952

Crystal field for ionic and metallic compounds. I. Crystal field theory .... See Entry 108364

Crystal and magnetic structure of the $CoMn_{1-x}Ti_xSi$ system .... See Entry 108643

Investigation of directional short-range ordering in iron alloys by the NGR method .... See Entry 108695

Cu-Ti and Cu-Ti-Al solid state phase equilibria in the Cu-rich region .... See Entry 109234

A study of a cellular phase transformation in the ternary Ni-Al-Mo alloy system .... See Entry 109306

Examination of the structure, magnetic and elastic properties of single crystals of alloy Fe-25% Co-30% Cr-3.4% Mo .... See Entry 109380

61.60 SPECIFIC STRUCTURE OF INORGANIC COMPOUNDS

107612 Structure and electrical properties of new ternary silicides YIr_2Si_2 and $LaIr_2Si_2$. P.Lejay, I.Higashi, B.Chevalier, M.Hirjak, J.Etourneau, P.Hagenmuller (Univ. de Bordeaux I, Talence, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.20, p.1583-6 (6 June 1983). In French.
YIr_2Si_2 has two allotropic varieties with the $ThCr_2Si_2$-type structure (I4/mmm) at low temperature and the $CaBe_2Ge_2$-type (P4/nmm) one which is stable at high temperature. Electrical measurements show that the two polymorphs of YIr_2Si_2 are superconducting below 2.7K, but that $LaIr_2Si_2$, isostructural with the high temperature form of YIr_2Si_2, has a normal metallic behaviour at least down to 1.7K. (8 refs.)

107613 Remarks on the La_2O_3-Li_2O binary system between 750° and 1000°C. F.Abbattista, M.Vallino (Istituto di Chimica Generale e Applicata e di Metall., Politecnico di Torino, Torino, Italy).
Ceram. Int. (Italy), vol.9, no.2, p.35-8 (1983).
The La_2O_3-Li_2O binary system has been re-examined between 750° and 1000°C where $LaLiO_2$ occurs as the only binary compound. It is characterized by a monoclinic cell (a_0=5.88 Å; b_0=6.22 Å; c_0=5.84 Å; β=102.53°) and is isomorphous with α-$EuLiO_2$. Any orthorhombic polymorph of this compound is excluded between 750° to 1000°C. Moreover, the cubic phase (a_0=12.22 Å) reported by previous researchers and said to have a composition close to the $LaLiO_2$ formula, actually belongs to the La-Pt-Li-O system. It has a variable composition: $LaPt_xLi_{1-x}O_{2+1.5x}$ (x=0.14-0.25) and its lattice parameter varies from 12.215 Å (x=0.14) to 2.284 Å (x=0.25). An isomorphous ternary cubic phase, in which titanium replaces platinum, has also been prepared and the lattice parameter of the $LaTi_{0.16}Li_{0.84}O.2_{24}$ compositions is 12.21 Å. (13 refs.)

107614 Study of Ge-Si solid solution crystals by X-ray topography and neutron diffraction. M.L.Kozhukh (Leningrad Inst. for Nuclear Phys., Acad. of Sci., Leningrad, USSR), I.N.Belokurova, S.B.Vakhrushev, A.N.Titkov, I.L.Shul'pina.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.2-3, p.483-7 (1 Aug. 1983).
The structure of Ge-Si solid solution crystals with a gradient of silicon concentration to be used for a thermal neutron monochromator is studied by X-ray topography and neutron diffraction. The effect of the Si-distribution on the crystal structure and such parameters as the rocking curve halfwidth and the peak thermal neutron reflectivity is discussed. (8 refs.)

107615 An X-ray study of an ordered zirconium monocarbide modification. M.P.Arbuzov (Acad. of Sci., Ukrainian SSR), B.V.Khaenko, E.T.Kachkovs'kaya, S.I.Makhovitskaya.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.8, p.73-5 (1983). In Ukrainian.
An ordered zirconium carbide δ′-modification with 40.7 at % C was studied by the X-ray method using crystalline fragments isolated from an ingot. A set of reflections of the ordered zirconium carbide is analogous to the recorded one for the ordered titanium carbide modification in case of isolation of the trigonal TiC_x structure ordered relative to a cubic matrix in all equivalent positions. The conclusion is reached that the ordered zirconium carbide modification is of trigonal structure, the lattice parameters being as follows: $a=\sqrt{2}a_0=0.6638$ nm; $c=2\sqrt{3}a_0=1.6261$ nm. (8 refs.)

107616 Structures of $Pb_3GeGa_{10}O_{20}$ and $Ba_3SnFe_{10}O_{20}$. M.C.Cadee, G.C.Verschoor, D.J.W.Ijdo (Gorlaeus Labs., Leiden State Univ., Leiden, Netherlands).
Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.8, p.921-5 (15 Aug. 1983).
$Pb_3GeGa_{10}O_{20}$: $M_r=1711.3$, $I2/m$, $a=14.751$ (5), $b=11.695$ (5), $c=5.106$ (3) Å, $\beta=90.23$ (3)°, $V=881$ (1) $Å^3$, $Z=2$, $D_x=6.45$ Mg m^{-3}, λ(Mo$K\alpha$)=0.71069 Å, T=291K, single-crystal X-ray diffraction, $R=0.031$ for 1161 observed reflections. The compound is isostructural with $Pb_3GeAl_{10}O_{20}$ and $Ba_3TiAl_{10}O_{20}$. The crystal structure of the also isostructural $Ba_3SnFe_{10}O_{20}$ was determined by a Rietveld refinement of neutron powder diffraction data collected at 873K, with the results of the structure determination of $Pb_3GeGa_{10}O_{20}$ as starting parameters: $M_r=1409.2$, $I2/m$, $a=15.4430$ (5), $b=11.9068$ (4), $c=5.2473$ (2) Å, $\beta=90.945$ (2)°, $V=964.7$ (1) $Å^3$, $Z=2$, $D_x=4.85$ Mg m^{-3}, $R_I=0.051$ for 208 measured reflections, $\mu R=0.275$. The structure consists of a framework of six-membered rings of tetrahedra, which form a ribbed plane. These planes are connected by a string of octahedra and by an M^{2+} ion in octahedral coordination. The other M^{2+} ion is situated inside the rib of the ribbed plane and has irregular seven or eight coordination, which is best described as a mono- or bicapped trigonal prism (M^{2+} is Pb^{2+} or Ba^{2+}). (14 refs.)

107617 A neutron diffraction determination of the structure of deuterated aluminium nitrate nonahydrate, $Al(NO_3)_3.9D_2O$. K.Hermansson (Inst. of Chem., Univ. of Uppsala, Uppsala, Sweden).
Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.8, p.925-30 (15 Aug. 1983).
$M_r=393.26$, monoclinic, $P2_1/c$, $a=13.8937$ (14), $b=9.6258$ (7), $c=10.9127$ (7) Å, $\beta=95.66$ (1)°, $V=1452.3$ (2) $Å^3$, T=295K [the cell parameters were determined from the refinement of 39 θ values from a Guinier-Hagg X-ray powder film (Cr$K\alpha$ radiation, λ=2.28975 Å, using a CoP_3 standard: $a=7.70778$ Å)], $Z=4$, $D_x=1.80$ Mg m^{-3}, final $R_w(F^2)=0.069$ for all 4480 independent reflections collected out to sinθ/λ=0.69 $Å^{-1}$. The crystal structure of $Al(NO_3)_3.9D_2O$ has been studied by three-dimensional neutron diffraction data collected at 295K. The asymmetric unit contains $Al(D_2O)_6{}^{3+}$ octahedra, $NO_3{}^-$ ions and three D_2O molecules which are not coordinated to Al^{3+} ions. All nine water molecules in the formula unit are crystallographically independent and the 19 hydrogen bonds donated have O...O distances in the range 2.650 (2)-3.054 (2) Å. The hydrogen bonds donated by the D_2O molecules which are coordinated to Al^{3+} ions are shorter than the other hydrogen bonds. A distinct correlation exists between the O-D and D...O distances. (13 refs.)

107618 The structure and electron deformation density of $LiNO_2.H_2O$ at 295K. K.Hermansson, J.O.Thomas (Inst. of Chem., Univ. of Uppsala, Uppsala, Sweden).
Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.8, p.930-6 (15 Aug. 1983).
$M_r=70.959$, monoclinic, $P2_1/c$, $Z=4$, $a=3.3387$ (3), $b=14.2980$ (10), $c=6.3961$ (5) Å, $\beta=105.10$ (1)°, $V=294.79$ (4) $Å^3$, $D_x=1.60$ Mg m^{-3}, Mo$K\alpha$, λ=0.71069 Å, $\mu_{calc}=0.154$ mm^{-1}, T=295 K, $F(000)=144$. Two data sets were collected out to sinθ/λ=0.91 $Å^{-1}$: one on a twinned crystal, the other on a single crystal. Positional and thermal parameters from the two data sets show only random deviations. Somewhat high $R_w(F^2)$ values of 0.084 and 0.081, respectively, resulted from the refinement of a spherical-atom model. This reflects the inadequacies of such a model. Introduction of multipolar deformation functions for the single-crystal data set brought the $R_w(F^2)$ value down to 0.029. The crystal contains one independent Li^+ ion with fivefold coordination, a tetrahedrally coordinated H_2O molecule and an $NO_2{}^-$ ion which accepts two medium-strength hydrogen bonds [O-H...O 2.755 (1); O-H...N 2.890 (1) Å] and has three Li^+-O contacts. The static deformation density for the $NO_2{}^-$ ion shows N-O bond maxima of 0.50 e $Å^{-3}$; O lone-pair maxima of 0.20-0.30 e $Å^{-3}$ are situated in the molecular planes at approximately 90° to the N-O bonds. The lone-pair density associated with the water O is markedly asymmetric; no support for this effect has been found in theoretical model calculations, however. (27 refs.)

107619 Structure of the triple orthophosphate of magnesium and sodium, $NaMg_4(PO_4)_3$. M.Ben Amara, M.Vlasse, R.Olazcuaga, G.Le Flem, P.Hagenmuller (Lab. de Chimie du Solide, Univ. de Bordeaux I, Talence, France).
Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.8, p.936-9 (15 Aug. 1983). In French.
$M_r=405.2$, orthorhombic, $Pnma$, $a=9.883$ (2), $b=6.345$ (2), $c=15.240$ (3) Å, $V=955.7$ $Å^3$, $Z=4$, $D_m=2.84\pm0.05$, $D_x=2.82$ Mg m^{-3}, room temperature, λ(Mo$K\alpha_1$)=0.70942 Å, $\mu=10.16$ cm^{-1}, $F(000)=800$. The structure has been refined with 1325 single-crystal diffractometer data to $R=0.053$. The three-dimensional lattice is made up of isolated $[PO_4]$ tetrahedra linked together by Mg and Na atoms. A strong $[MgO_5]$ polyhedral sublattice appears with voids occupied by the Na atoms. (11 refs.)

107620 Tetraaquatrinitratoneodymium(III) dihydrate, $[Nd(NO_3)_3(H_2O)_4].2H_2O$ [crystal structure]. D.J.Rogers, N.J.Taylor, G.E.Toogood (Dept. of Chem., Univ. of Waterloo, Waterloo, Ontario, Canada).
Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.8, p.939-41 (15 Aug. 1983).
$M_r=438.35$, triclinic, $P\bar{1}$, $a=9.307$ (1), $b=11.747$ (1), $c=6.776$ (1) Å, $\alpha=91.11$ (1), $\beta=112.24$ (1), $\gamma=109.15$ (1)°, $V=639.0$ (2) $Å^3$, $Z=2$, $D_m=2.27$, $D_x=2.278$ Mg m^{-3}, λ(Mo$K\alpha$)=0.71069 Å, $\mu=4.192$ mm^{-1}, $F(000)=426$, T=298K. Final $R=0.020$ (including H atoms) for 3311 observed reflections. Three symmetrically bidentate nitrates and four coordinated water molecules produce a formally ten-coordinate neodymium. However, the structure is best visualized as a tetragonal base-trigonal base seven-coordinate arrangement, with each nitrate considered as occupying only

one coordination site. Two additional water molecules per unit are hydrogen-bonded, both inter- and intramolecularly, but are not directly coordinated to the metal. The overall arrangement is very nearly mirror-symmetrical. (15 refs.)

107621 Calcium cesium triazide monohydrate, $CaCs(N_3)_3.H_2O$ [crystal structure]. H.Krischner, F.A.Mautner (Inst. fur Phys. und Theoretische Chem., Tech. Univ. Graz, Graz, Austria), C.Kratky.
Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.8, p.941-3 (15 Aug. 1983).
$M_r=317.06$, triclinic, $P\bar{1}$, $a=6.846$ (1), $b=7.557$ (1), $c=8.810$ (1) Å, $\alpha=71.59$ (1), $\beta=82.80$ (1), $\gamma=81.09$ (1)°, $V=425.82$ Å^3, $Z=2$, $D_x=2.47$ Mg m^{-3}, $F(000)=304.01$, Mo$K\alpha$, $\lambda=0.71069$ Å (graphite monochromator), $\mu=4.9$ mm^{-1}, $T=298$K. The crystal structure was solved by Patterson and Fourier methods and refined to $R=0.034$ for 1475 independent counter reflections. Ca is seven-coordinated to six N atoms of azide groups and to one water molecule. The polyhedra around Ca are pentagonal bipyramids sharing one edge. Cs is nine-coordinated to eight azide groups and one water molecule. The mean N-N distance is 1.17 (2) Å. (9 refs.)

107622 Structure of the octachloride of tricadmium calcium 8.5-hydrate, $2[Ca(H_2O)_7].[Cd_6Cl_{16}(H_2O)_2]\infty.H_2O$. H.Leligny, J.C.Monier (Lab. de Cristallographie, Univ. de Caen, Caen, France).
Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.8, p.947-52 (15 Aug. 1983). In French.
$Cd_3CaCl_8.8.5H_2O$, $M_r=814.02$, $P\bar{1}$, $a=12.257$ (2), $b=12.212$ (2), $c=14.790$ (1) Å, $\alpha=83.28$ (1), $\beta=73.75$ (1), $\gamma=78.12$ (1)°, $V=2075.67$ Å^3, $Z=4$, D_m (flotation)$=2.59\pm1$, $D_x=2.606$ Mg m^{-3}, Mo$K\bar{\alpha}$, $\gamma=0.71069$ Å, $\mu=4.29$ mm^{-1}, $T=293$K, $F(000)=1540$. The structure was refined by least-squares calculations to a final $R=0.022$ for 4300 measured independent reflections with $I>4\sigma(I)$. Crystals were obtained from an evaporated aqueous solution of calcium chloride and cadmium chloride. Cd atoms are octahedrally coordinated to either $CdCl_6$ or $CdCl_5O_w$; Ca atoms are surrounded by seven O atoms of water molecules located on triangular prisms with monocapped tops; one water molecule is not coordinated to cations. The structure is described as infinite octahedra of double $CdCl_6$ chains packed along $[1\bar{1}0]$, connected by cross-bars of two $CdOCl_5$ octahedra making up two-dimensional layers (111) linked by Ca coordination polyhedra via OH...Cl hydrogen bonds. The question of $P1$ or $P1$ symmetry is discussed. (19 refs.)

107623 Structure refinement of strontium nitrate, $Sr(NO_3)_2$, and barium nitrate, $Ba(NO_3)_2$. H.Nowotny (Inst. fur Mineralogie und Kristallographie, Univ. Wien, Wien, Austria), G.Heger.
Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.8, p.952-6 (15 Aug. 1983).
$Sr(NO_3)_2$: $M_r=211.63$, cubic, $Pa3$, $a=7.7813$ (2) Å (McMurdie et al., 1975), $U=471.15$ Å^3, $Z=4$, $D_x=2.98$ Mg m^{-3}, μ[neutrons $\lambda=0.8972$ (2) Å]$=0.002$ mm^{-1}, room temperature. $Ba(NO_3)_2$: $M_r=261.35$, $Pa3$, $a=8.1184$ (2) Å (Swanson et al., 1974), $U=535.07$ Å^3, $Z=4$, $D_x=3.24$ Mg m^{-3}, $\mu=0.002$ mm^{i-1}, room temperature. The atomic arrangements were refined at room temperature with single crystal neutron diffraction data: $Sr(NO_3)_2$ to $R=0.020$ ($R_w=0.019$) for 330 reflections and $Ba(NO_3)_2$ to $R=0.024$ ($R_w=0.022$) for 351 reflections. The N-O bond lengths (uncorrected for thermal vibration) are 1.2467 (5) and 1.2465 (6) Å, the deviations of the N atoms from the planes defined by the O atoms of the nitrate groups are 0.005 (1) and 0.006 (1) Å, respectively. The amplitudes of the thermal vibrations have normal values. (33 refs.)

107624 Calcium sulphate subhydrate, $CaSO_4.0.8H_2O$ [crystal structure]. W.Abriel (Fachbereich Chem., Philipps-Univ., Marburg, Germany).
Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.8, p.956-8 (15 Aug. 1983). In German.
$M_r=150.6$, trigonal, $P3_121$, $a=6.968$ (8), $c=6.410$ (4) Å, $V=269.5$ Å^3, $Z=3$, $D_x=2.63$ g cm^{-3}, λ(Mo$K\alpha$)$=0.7107$ Å, $\mu=20.24$ cm^{-1}, room temperature, $F(000)=228$. Using 286 reflexions with $I>3\sigma(I)$, including Friedel pairs, one of the two possible enantiomorphous space groups could be rejected by statistical methods (final $R=0.05$). Chains of alternating Ca^{2+} and $SO_4{}^{2-}$ ions parallel to the c axis form the framework of a tunnel structure in which four water molecules are randomly distributed over five tunnel positions. The Ca^{2+} ion is surrounded by six $SO_4{}^{2-}$ groups (similar to the arrangement in anhydrite) and one water molecule, counting the nine nearest O atoms (distances 2.45-2.66 Å). (19 refs.)

107625 Dithallium trisulphur trinitride-tetrasulphur pentanitride, $Tl_2S_7N_8$ [crystal structure data]. H.Martan, J.Weiss (Anorganisch-Chem. Inst., Univ. Heidelberg, Heidelberg, Germany).
Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.8, p.959-60 (15 Aug. 1983). In German.
$M_r=745.2$, orthorhombic, $Pmnb$, $a=9.281$ (2), $b=11.380$ (2), $c=11.714$ (2) Å, $V=1237$ Å^3, $Z=4$, $D_x=4.00$ g cm^{-3}, Mo$K\alpha$ radiation, $\lambda=0.71096$ Å, $\mu=274$ cm^{-1}, room temperature, $F(000)=1320$, final $R=0.047$ for 1225 unique reflections. The structure consists of Tl^+ cations and $(S_3N_3)^-$ and $(S_4N_5)^-$ anions. (12 refs.)

107626 Structure of cesium fac-trichlorotrioxorhenate(VII), $Cs_2[ReCl_3O_3]$. T.Lis (Inst. of Chem., Wroclaw Univ., Wroclaw, Poland).
Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.8, p.961-2 (15 Aug. 1983).
$M_r=604.4$, orthorhombic, $Pnam$, $a=10.499$ (9), $b=12.57$ (1), $c=7.000$ (6) Å, $V=923.8$ Å^3, $Z=4$, $D_x=4.36$ Mg m^{-3}, λ(Mo$K\alpha$)$=0.71069$ Å, $\mu=22.6$ mm^{-1}, $F(000)=1040$, $T=296$ (2)K. Final $R=0.066$ for 1378 non-zero reflexions. The $[ReCl_3O_3]^{2-}$ anion has crystallographic point symmetry m (C_s) but approximates closely to $3m$ (C_{3v}) symmetry. The average bond lengths and bond angles are: Re-Cl 2.50 (1), Re-O 1.70 (2) Å, Cl-Re-Cl 81.5 (3), O-Re-O 103.1 (9)°. (9 refs.)

107627 Structure of solid carbon diselenide (CSe_2) at 17.5, 50 and 200K. B.M.Powell (Chalk River Nuclear Labs., AECL, Chalk River, Ontario, Canada), B.H.Torrie.
Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.8, p.963-5 (15 Aug. 1983).
$M_r=169.9$, orthorhombic, $Cmca$, $Z=4$. At 17.5K: $a=6.5021$ (4), $b=5.7599$ (4), $c=8.9907$ (7) Å, $V=336.71$ (9) Å^3, $D_x=3.35$ Mg m^{-3}, $R_{wp}=9.7\%$. The crystal structure of CSe_2 has been determined at 17.5, 50 and 200K using neutron powder profile refinement with a wavelength of 1.9887 Å. The C-Se bond length is 1.689 (3) Å, oriented at 41.60 (10)° to the b axis in the bc plane. The structure is similar to that of CS_2 and the lattice parameter c shows the same anomalous temperature dependence. (7 refs.)

107628 Structure of monoclinic nickel sulphate hexadeuterate, $NiSO_4.6D_2O$. H.Ptasiewicz-Bak, G.J.McIntyre, I.Olovsson (Inst. of Chem., Univ. of Uppsala, Uppsala, Sweden).
Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.8, p.966-8 (15 Aug. 1983).
$M_r=274.92$, monoclinic, $C2/a$, $c=9.880$ (3), $b=7.248$ (4), $c=24.171$ (9) Å, $\beta=98.46$ (3)°, $V=1712.0$ Å^3, $Z=8$, $D_x=2.133$ g cm^{-3}, Mo$K\alpha$, $\lambda=0.71069$ Å, $\mu=25.4$ cm^{-1}, $T=295$K, $F(000)=1088$, final $R=0.061$ for 354 reflections. The structure was solved using constrained refinement of the orientations of the NiO_6 and SO_4 groups. Eleven of the twelve crystallographically independent hydrogen bonds are between water and sulphate O atoms; the twelfth is between two water O atoms. (9 refs.)

107629 Structure of the ordered phase of gallium sesquiselenide, Ga_2Se_3. G.Ghemard, S.Jaulmes, J.Etienne, J.Flahaut (Lab. de Chimie Minerale Structurale, Faculte des Sci., Paris, France).
Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.8, p.968-71 (15 Aug. 1983). In French.
$M_r=376.32$, monoclinic, Bb, $a=b=6.66$ (1), $c=11.65$ (1) Å, $\gamma=108.12$ (1)°, $V=491.1$ Å^3, $Z=4$, D_m(flotation)$=4.95$ (2), $D_x=5.09$ g cm^{-3}, λ(Mo$K\bar{\alpha}$)$=0.7107$ Å, μ(Mo$K\bar{\alpha}$)$=328$ cm^{-1}, $F(000)=656$, room temperature. The entirely ordered monoclinic phase of Ga_2Se_3 is a superstructure of the basic distorted sphalerite-type. The structure has been solved by Fourier methods and refined by full-matrix least-squares calculations, to a final $R=0.067$, for 804 observed reflexions collected with a four-circle diffractometer. Ordering of metal vacancies involves two different Se-atom surroundings, infinite chains of vacancies, running in the **b** direction, and the particular stacking sequence *abca′b′c′* derived from *ABC* cubic close packing, for Ga atoms. (9 refs.)

107630 On III-V-VI compounds: structural study of thallium antimony disulphide, $TlSbS_2$. N.Rey, J.C.Jumas, J.Oliveier-Fourcade, E.Philippot (Lab. de Chimie Minerale C, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
Acta Crystallogr. Sect. C (Denmark), vol.C39, pt.8, p.971-4 (15 Aug. 1983). In French.
$M_r=390.2$, triclinic, $P\bar{1}$, $a=6.123$ (6), $b=6.293$ (10), $c=11.838$ (13) Å, $\alpha=101.34$ (7), $\beta=98.39$ (5), $\gamma=103.21$ (19)°, $Z=4$, $V=427$ Å^3, D_m(pycnometry)$=6.09$, $D_x=6.07$ Mg m^{-3}, λ(Mo$K\alpha$)$=0.71069$ Å, μ(Mo$K\alpha$)$=45.17$ mm^{-1}, $F(000)=1000$. The crystal structure was solved by the symbolic addition method and refined by least squares to a final $R=0.064$, $R_w=0.097$ (1160 observed reflections). The structure is built up from sheets, parallel to the (010) plane, formed by SbS_4E trigonal bipyramids which are linked together. Sb atoms have four bonds to S atoms of 2.41-2.96 Å. The Sb lone pair of electrons (E) is stereochemically active. These sheets are linked together by weak Tl...S (3.50-3.66 Å), Tl...Sb (3.60-3.73 Å) and Tl...Tl (3.62 Å) interactions. (19 refs.)

107631 New compounds with the structure of tetragonal potassium-tungsten bronze. Z.V.Bondarenko, V.S.Filip'ev, V.G.Kryshtop, R.U.Devlikanova, E.G.Fesenko (Rostov-on-Don State Univ., Rostov, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1116-18 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.,* vol.18, no.8, p.1320-2 (Aug. 1982).
Sixteen new compounds have been synthesized for the first time and their unit cell parameters have been determined. Anomalies were found in the behaviour of ϵ and tan δ with temperature in the compounds $Ba_6Nb_8Sn_2O_{30}$, $Ba_6Nb_9InO_{30}$, and $Ag_2Pb_4Nb_{10}O_{30}$. It was established that $Ag_2Pb_4Nb_{10}O_{30}$ is ferroelectric. The difficulties in the synthesis of ternary strontium-containing niobates with a tetragonal potassium tungsten bronze structure are due to the formation of stable phases based on $Sr_2Nb_2O_7$ and $SrNb_2O_6$ in the first step of the synthesis. The structure can be stabilised in this case by introducing more electropositive elements into the A-positions. (5 refs.)

107632 Predicting cation distribution in spinels by the potential-function method. V.M.Talanov, L.A.Frolova (Sergo Ordzhonikidze Novocherkassk Polytech. Inst., USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1171-3 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.,* vol.18, no.8, p.1380-2 (Aug. 1982).
The possibility of predicting cation distribution in AB_2O_4 spinels with the potential-function method has been demonstrated. (6 refs.)

107633 Investigation of the structure of hematite on the basis of an analysis of the physical broadening of X-ray lines. V.I.Fadeeva, L.A.Panchenko (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1193-6 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.,* vol.18, no.8, p.1399-401 (Aug. 1982).
The mean Fourier coefficients of the broadening of X-ray lines for each compound with a similar structure are expressed by the formula $K_{hkil}=[d_{hkil}(a'\alpha_1+b'\alpha_2+c'\beta).\ |l|]/c^2$, where α_1, α_2, and β are the probabilities of the formation of packing defects due to half- and quarter-dislocations and twins; a', b', and c' are the coefficients of the contribution of each type of packing defect taken from the total Fourier coefficients; c is the lattice constant; and d_{hkil} is the interplanar distance. The values of K_{hkil} for some diffraction reflections of hematite powders with the constants of the hexagonal cell $a=5.034\pm0.001$ Å and $c=13.744\pm0.001$ Å are given. The $(01\bar{1}2)$, $(11\bar{2}3)$, $(02\bar{2}4)$, $(30\bar{3}0)$, and $(22\bar{4}6)$ lines were selected for the differentiated determination of the parameters of the fine crystal structure. The procedure for calculating the parameters of the substructure was experimentally tested on hematite powders known to contain nonequilibrium defects. (6 refs.)

107634 Crystal chemistry of rare-earth phosphates. K.K.Palkina (N.S. Kurchatov Inst. of General & Inorganic Chem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.9, p.1199-22 (Sept. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.,* vol.18, no.9, p.1413-36 (Sept. 1982). [received: Sept. 1983]
In the series of simple rare-earth phosphates, with an increase in the degree of condensation of the anion the author observes a degree of connectedness of the cation polyhedra, ranging from complete connectedness in orthophosphates to discreteness in ultraphosphates. In compounds of the type $M^IM^{III}(PO_3)_4$, with an increase in the difference between the sizes of the cations of the alkali metal and the trivalent metal (in favor of a relative decrease in the size of M^{III}), the possibility arises for complication of the shape of the polyphosphate chains and formation of rings. Thus, from the sizes of the cations one may also predict the probability that the phosphate anions will appear in the form of large rings. The author has pointed out promising systems with an increased alkali metal content for possibly obtaining compounds which contain large rings. A correlation between the structural characteristics and the luminescent properties of double poly- and cyclophosphates of Nd and alkali metals has been found. (49 refs.)

107635 A neutron diffraction study of the zeolite edingtonite. A.Kvick (Dept. of Chem., Brookhaven National Lab., Upton, NY, USA), J.V.Smith.
J. Chem. Phys. (USA), vol.79, no.5, p.2356-62 (1 Sept. 1983).
A neutron diffraction study at 294K of a single crystal of edingtonite ($Ba_2Al_4Si_6O_{20}.7H_2O$; **a** 9.537(3) **b** 9.651(2) **c** 6.509(2) A; $P2_12_12$) utilized 1876 diffraction intensities from the Brookhaven National Laboratory high-flux beam reactor. The agreement factor $R(F^2)=0.055$ for conventional anisotropic refinement was reduced to 0.045 for a Gram-Charlier expansion up to fourth order for the thermal factors of the water atoms. The Si-O and Al-O distances correlate inversely with the Si-O-Al angle as in scolecite. There is no indication of substitutional disorder. The barium atom is coordinated to three pairs of framework oxygens (2.89, 2.96, and 3.04 Å) and two pairs of water oxygens (2.79 and 2.79 Å). Two framework oxygens have weak hydrogen bonds to both water molecules [0(4)−OW(1) 2.87, −OW(2) 2.96; O(5) −OW(1) 3.02, −OW (2) 3.02 Å] and the other three framework oxygens are each bonded to a Ba atom. The OW−H...O angles (163.5°, 165.1°, 173.9°, and 178.0°) are fairly close to 180°, the H...O distances are long (1.91, 2.02, 2.09, and 2.10 Å) and the observed uncorrected OW−H

distances range from 0.928(6) to 0.959(4) Å. Only seven out of the eight water positions are occupied [W(1) 84% occupancy; W(2) 91%]. The average r.m.s. displacement of each hydrogen (0.32, 0.29, 0.27, and 0.24 Å) correlates approximately with the hydrogen bond length (2.09, 2.10, 2.02, and 1.91 Å). Third- and fourth-order tensor components in the displacements of the water molecules may result from anharmonic or curvilinear vibrations; however, the effect of the static displacements of the center-of-motion from interaction with unoccupied water sites may also be important. (29 refs.)

107636 X-ray diffraction study of monoclinic RbD_2PO_4. S.Suzuki, K.Arai (Dept. of Appl. Phys., Sci. Univ. of Tokyo, Tokyo, Japan), M.Sumita, Y.Makita.

J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2394-400 (July 1983).

The crystal structure of monoclinic RbD_2PO_4 at room temperature was determined by use of an automatic four-circle X-ray diffractometer, and the superlattice structure was examined. The crystal, which undergoes phase transitions at 44°C and 104°C, belongs to the space group $P2_1$ in the lowest (III) phase and $P2_1/m$ in the highest (I) phase. The former space group is consistent with the recent result that the crystal in the phase III is approximately antiferroelectric, but weakly polar along the *b* axis. There are two kinds of hydrogen (deuterium)-bond chains: one along the *b* axis and the other along the *c* axis. It is suggested that the deuterium atoms in the former chains along the *b* axis are ordered in the phase III and disordered in the phases I and II, while those along the *c* axis are ordered even in the phase I. The space group of the intermediate (II) phase is suggested to be $P2_1/n$.

107637 A model for in-plane structure of high-stage alkali-metal graphite intercalation compounds. M.Suzuki (Dept. of Phys., Ochanomizu Univ., Tokyo, Japan), H.Suematsu.

J. Phys. Soc. Jpn. (Japan), vol.52, no.8 p.2761-8 (Aug. 1983).

The authors propose a unified picture for the intercalant-layer ordered structure of the high-stage alkali-metal graphite intercalation compounds; the in-plane structure is described in terms of a $(\sqrt{7}\times\sqrt{7})R19.11°$ superlattice which is modulated by honeycomb-like domains (discommensuration structure). In this model, the domain size and the rotation angle of the domain structure relative to the graphite lattice are uniquely determined by the magnitude of the fundamental reciprocal lattice vector of the intercalant layer.

107638 Three crystalline polymorphs of $KFeSiO_4$, potassium ferrisilicate. J.J.Bentzen (Inst. of Ceramics, Tech. Univ. of Denmark, Lyngby, Denmark).

J. Am. Ceram. Soc. (USA), vol.66, no.7, p.475-9 (July 1983).

Orthorhombic α-$KFeSiO_4$ ($a=0.5478$, $b=0.9192$, $c=0.8580$ nm), hexagonal β-$KFeSiO_4$ ($a=0.5309$, $c=0.8873$ nm), and hexagonal γ-$KFeSiO_4$ ($a=0.5319$, $c=0.8815$ nm) were synthesized by devitrification of $KFeSiO_4$ glass. Powder X-ray diffraction data are given for all three polymorphs. Alpha $KFeSiO_4$, the high-temperature polymorph, melts congruently at 1197°±2°C. Mossbauer spectroscopy of the α phase indicates that Fe^{3+} occupies two tetrahedral sites in the lattice. Beta $KFeSiO_4$, the low-temperature polymorph, and γ-$KFeSiO_4$, a metastable polymorph, appear to be isomorphous with kalsilite, $KAlSiO_4$, and synthetic kaliophilite, $KAlSiO_4$, respectively, and it is proposed that β- and γ-$KFeSiO_4$ are linked by Si-Fe order-disorder. Beta $KFeSiO_4$ transforms slowly into α-$KFeSiO_4$ above 910°C but the transformation was not shown to be reversible in the present dry-heating experiments. (16 refs.)

107639 The crystal structure of $Ba_2Ti_9O_{20}$: a hollandite related compound. G.D.Fallon, B.M.Gatehouse (Chem. Dept., Monash Univ., Clayton, Victoria, Australia).

J. Solid State Chem. (USA), vol.49, no.1, p.59-64 (Aug. 1983).

$Ba_2Ti_9O_{20}$ crystallizes in the triclinic system with unit cell dimensions (from single crystal data) $a=14.358(4)$, $b=14.095(4)$, $c=7.477(1)$ Å, $\alpha=95.53(3)$, $\beta=100.55(3)$, $\gamma=89.95(2)°$, and space group $P\bar{1}$, $z=4$. The structure was solved using Patterson ('P1' method) and Fourier techniques. Of the 8625 unique reflections measured by counter techniques, 3767 with $I\geq 3\sigma(I)$ were used in the least-squares refinement of the model to a conventional R of 0.057 ($R\omega=0.054$). The structure of $Ba_2Ti_9O_{20}$ is very similar to that of hollandite except that additional barium ions replace oxygen ions and disrupt the tunnel walls resulting in the formation of cavities, rather than tunnels, that contain two barium ions per cavity. (24 refs.)

107640 A neutron powder diffraction study of the κ phase in the Fe-W-C system. A.Harsta, S.Rundqvist, J.O.Thomas (Inst. of Chem., Univ. of Uppsala, Uppsala, Sweden).

J. Solid State Chem. (USA), vol.49, no.1, p.118-22 (Aug. 1983).

The crystal structure of the κ-carbide in the Fe-W-C system has been refined from neutron powder diffraction data using the Rjetveld profile analysis method. κ-(Fe-W-C) is isostructural with κ-(Co-W-C); space group $P6_3/mmc$; unit cell dimensions $a=7.7982(2)$ Å, $c=7.8298(4)$ Å. The structure refinement indicates Fe/W substitution at two of the tungsten sites, and 46% vacancies at one of the carbon sites. The composition corresponds to the formula $Fe_{3+x}W_{10-x}C_{4-y}$, with $x=0.57(3)$ and $y=0.46(1)$. (17 refs.)

107641 A study on the morphological changes due to reduction of WO_3 to α-W. Chae Gyoo Chang (Seoul Nat. Univ., Seoul, Korea), Hyong Yong Ra.

J. Korean Inst. Met., vol.21, no.5, p.489-99 (May 1983). In Korean.

Morphological changes of intermediate tungstic oxide particles, prepared by reducing WO_3 with hydrogen and a mixture of hydrogen and nitrogen over the temperature range from 800°C to 1000°C, were studied using a scanning electron microscope. Two different morphologies of $W_{18}O_{49}$, bundles of needle crystals and short pole-type particles, were obtained at 800°C, whereas $W_{18}O_{49}$, obtained at 900°C and above, consisted of pole-type particles and fine whiskers. The growth of $W_{18}O_{49}$ particles was faster in length than width with increasing reduction temperature. The size and morphologies of $W_{18}O_{49}$ particles were greatly influenced by those of WO_3 particles. Transformation of $W_{18}O_{49}$ to WO_2 and WO_2 to α-W was accompanied by the rounding of $W_{18}O_{49}$ particles and the recrystallization of α-W in spherical shape respectively. Extremely fine α-W powder was obtained by reduction of WO_3 powder at 500°c for 4 hrs in hydrogen followed by immediate reduction at 650°C for 1 hr. (21 refs.)

107642 Microstructure and stability of iron chloride graphites. R.Schlogl, P.Bowen, G.R.Millward, W.Jones (Dept. of Phys. Chem., Univ. of Cambridge, Cambridge, England), H.P.Boehm.

J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.8, p.1793-818 (Aug. 1983).

Two methods have been used to prepare iron chloride intercalates of natural graphite. Ferric chloride intercalates are demonstrated to be both extremely air sensitive and also to undergo gradual physical and chemical changes upon storage, solvent treatment, heating and washing. Gradual interconversion to higher staging or direct deintercalation are the two observed reaction pathways. The ferrous chloride intercalates (obtained by H_2 reduction) are found to be even more air sensitive than their ferric precursors, decomposing to yield disordered graphite and crystalline iron chloride hydrates and oxyhydrates. The limitations of different techniques to the study of graphite intercalates (including Mossbauer spectroscopy, X-ray powder diffraction, thermogravimetric analysis, weight-uptake measurements and electron microscopy) are discussed. (43 refs.)

107643 Structural properties of HNO_3-graphite intercalation compounds studied by neutron diffraction and high energy nuclear photon scattering. H.Pinto, M.Melamud, O.Shahal (Phys. Dept., Nuclear Res. Center-Negev, Beer Sheva, Israel), R.Moreh, H.Shaked.

Physica B & C (Netherlands), vol.121B+C, no.1-2, p.121-6 (1983).

The results of a study of the orientation of the NO_3^- planes in a second and third stage normal HNO_3 intercalate in highly oriented pyrolytic graphite are reported. Two different techniques were used: (i) Neutron diffraction and (ii) high energy nuclear resonance photon scattering. The latter is a novel technique, developed recently, which utilizes the ^{15}N isotope. It senses the anisotropy in the molecular vibrations of ^{15}N through the Doppler broadening of the 6.324 MeV nuclear level. Using a second stage sample, at room temperature, the two techniques yielded the unambiguous result that the NO_3^- planes are perpendicular to the graphite planes. Another sample consisting of a third stage intercalate together with a second stage admixture was studied using the photon scattering technique and was found to have essentially the same perpendicular configuration. (11 refs.)

107644 X-ray diffraction study of the crystal structures of K_2CuF_4 and $K_2Cu_xZn_{1-x}F_4$. M.Hidaka, K.Inoue (Dept. of Phys., Kyushu Univ., Fukuoka, Japan), I.Yamada, P.J.Walker.

Physica B & C (Netherlands), vol.121B+C, no.3, p.343-50 (Aug. 1983).

The investigation of the crystal structures of K_2CuF_4 and its diluted system $K_2Cu_xZn_{1-x}F_4$ has been made by means of an X-ray camera and counter method. Both the pure ($x=1$) and the diluted compounds were found to have two kinds of structures, an ordered and a disordered type. The ordered K_2CuF_4 generally shows a multi-domain structure, which means that a single domain sample is orthorhombic, $D_{2h}{}^{18}$-Bbcm. On the contrary, the ordered $K_2Cu_xZn_{1-x}F_4$ with $x<\approx 0.9$ has a tetragonal symmetry due to the absence of a correlation between the displacement of F^- ions around the body-centered Cu^{2+} ion with respect to those in the basal plane. Some comments concerning the magnetic structures of the pure and the diluted systems are given on the basis of the present crystallographic analyses. (12 refs.)

107645 X-ray- and neutron-diffraction measurements on $BaMnF_4$. D.E.Cox, S.M.Shapiro (Brookhaven Nat. Lab., Upton, NY, USA), R.J.Nelmes, T.W.Ryan, H.J.Bleif, R.A.Cowley, M.Eibschutz, H.J.Guggenheim.

Phys. Rev. B (USA), vol.28, no.3, p.1640-3 (1 Aug. 1983).

X-ray- and neutron-diffraction measurements on powder and single-crystal samples of $BaMnF_4$ have failed to show any evidence for the distortion with wave vector, in reciprocal-lattice units, $\vec{q}=(0.4, 0, 0.5)$ recently reported by Scott, Habbal, and Hidaka. The distorted phase which is observed below 247K is described by a wave vector $\vec{q}=(\zeta, 0.5, 0.5)$ with ζ incommensurate. There is a small (~1%) increase in the magnitude of ζ as the temperature is lowered to 100K, and the detailed temperature dependence of ζ is found to be different on heating and on cooling. The low-temperature distortion is characterized by a single wave vector $\vec{q}=(\zeta, 0.5, 0.5)$ rather than by a pair of wave vectors $(\zeta, 0.5, 0.5)$ and $(\zeta, -0.5, 0.5)$. (9 refs.)

107646 Structure of synthetic alkali yttrium silicates. B.V.Merinov, B.A.Maksimov, L.N.Dem'yanets, V.A.Timofeeva, N.V.Belov (Inst. of Crystallography, Acad. of Sci., USSR).

Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.92-4 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.166-9 (Jan.-Feb. 1983). [received: Sept. 1983]

By varying the $Na_2O:Y_2O_3:SiO_2$ ratios and by an appropriate choice of method, a number of alkali silicates have been synthesized with increasing Na_2O/Y_2O_3 ratios (1:1, 3:1, 5:1 (moles)) with various values of Y_2O_3/SiO_2 (1:2, 1:4, 1:6): $NaYSiO_4$, $Na_3YSi_2O_7$, $Na_5YSi_4O_{12}$, $NaYSiO_4.0.25NaF$, and $Na_3YSi_3O_9$. The first three compounds were first synthesized by the hydrothermal method, and the last two by crystallization from solution in a melt. The preparation of a number of silicates with various Na/Y and Y/Si ratios enabled the authors to follow the changes of structure with composition in the Y phases. (12 refs.)

107647 The crystal structure of fedorite. G.V.Sokolova, A.A.Kashaev, V.A.Drits, V.V.Ilyukhin (Geological Inst. Acad. of Sci., USSR).

Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.95-6 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.170-2 (Jan.-Feb. 1983). [received: Sept. 1983]

The parameters of the triclinic unit cell of fedorite are: $a=9.676(2)$; $b=16.706(1)$; $c=13.233(2)$ Å; $\alpha=93.35$; $\beta=114.96$; $\gamma=90.03°$; space group $C\bar{1}$ ($\rho_{exp}=2.43$ g/cm^3); they were measured in a Syntex diffractometer, and permitted the chemical analysis to be transformed to a structural formula. All the calculations in the structural determination were made with the aid of the RENTGEN-75 program. (5 refs.)

107648 Structure of α-GeTe-based solid solutions in the GeTe-InTe system. G.V.Gorne, A.A.Koz'ma, A.N.Melikhova, E.I.Rogacheva (Polytech. Inst., Khar'kov, Ukrainian SSR).

Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.225-6 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.385 (March-April 1983). [received: Sept. 1983]

The authors have made a detailed X-ray diffraction investigation of the structure of the α-solid solution. On the basis of an analysis of the relative integral intensities of the lines, they have established that addition of InTe or GeTe leads to a decrease in the displacement of the cations from their ideal positions in the NaCl-type structure, and also stimulates the process of filling of tetrahedral gaps by cations. The reduction in unit-cell parameter observed when up to 12 mole % of InTe is added is due to a decrease in the rhombohedral distortion of the lattice with increasing InTe concentration. (3 refs.)

107649 Pentavalent iron stabilized for the first time in sixfold coordination in an oxide. B.Buffat, G.Demazeau, M.Pouchard, P.Hagenmuller (Univ. of Bordeaux, Talence, France).

Silikaty (Czechoslovakia), vol.27, no.3, p.253-6 (1983). In Czech.

It might be expected that iron (V), which probably adopts an isotropic electronic configuration $(t_2{}^3{}_g e_g{}^0)$, could be stabilized in a small site of O_h symmetry. The perovskite structure stable under pressure with octahedral sites occupied by small cations appeared to be suitable for such stabilization. For this reason the authors attempted to prepare the compound La_2LiFeO_6 for which the covalency of the σ (Fe-O) bonds is supported by the absence of antibonding σ^* electrons and by the existence of Li-O bonds with prevailing ionic contribution. The preparation of La_2LiFeO_6 was done in two steps. The starting mixture of nitrates was at first calcinated at 700°C and then annealed under the pressure of oxygen 60 kbar at 900°C. The existence of Fe+V in La_2LiFeO_6, possessing slightly rhomboelectrically distorted perovskite structure ($a_R=5371$ Å, $\alpha=60,66°$), was confirmed by the determination of the oxidation state of iron by chemical analysis, magnetic susceptibility measurement and study of Mossbauer spectra and EPR. (13 refs.)

107650 A new bismuth containing $Bi_{14}B_4O_{31}$ crystal. T.V.Panchenko, V.F.Katkov, V.Kh.Kostyuk, N.A.Truseeva, A.V.Shmal'k.

Ukr. Fiz. Zh. (USSR), vol.28, no.7, p.1091-3 (July 1983). In Russian.

The authors have obtained macroscopically perfect monocrystals in the Bi_2O_3-V_2O_5 system with a formula of $BI_{14}V_4O_{31}$. The crystals possess a monoclinic structure with the following unit cell parameters: $a=19.720$ Å, $b=11.459$ Å, $c=80.160$ Å, $\beta=90.5°$. Structural phase transitions in the temperature interval 373 to 1273K are not observed. The crystals are optically transparent in the wavelengths interval 0.42 to 6 μm, do not have a domain structure and are characterised by large refractive indices: $n_x=2.2641$, $n_y=2.4902$, $n_2=2.4585$. (11 refs.) *V.G.P.*

107651 Refinement of the structure of ikaite, $CaCO_3.6H_2O$. K.-F.Hesse, H.Kuppers (Mineralogisches Inst., Univ. Kiel, Kiel, Germany), E.Suess.
Z. Kristallogr. (Germany), vol.163, no.3-4, p.227-31 (1983).
Ikaite, $CaCO_3.6H_2O$, is monoclinic, *C2/c*, with $a=8.792(2)$, $b=8.310(2)$, $c=11.021(2)$Å, $\beta=110.53(5)°$, $Z=4$. With 2205 independent reflections taken at −25°C of a naturally grown crystal specimen the structure was refined to a weighted $R_w=0.028$. The CO_3 group is planar with C-O distances 1.279(2) and 1.290(1)(2×) Å. The hydrogen bond network is determined. The optical behaviour is explained by structural characteristics. (17 refs.)

107652 X-ray study on polymorphism of ilvaite, $HCaFe_2^{2+}Fe^{3+}O_2[Si_2O_7]$. Y.Takeuchi, N.Haga (Mineralogical Inst., Univ. of Tokyo, Tokyo, Japan), M.Bunno.
Z. Kristallogr. (Germany), vol.163, no.3-4, p.267-83 (1983).
The crystal structure of the monoclinic form of ilvaite has been investigated. A crystal from Tsumo, Japan, was characterized by space group $P2_1/a$, with $a=13.009(1)$ Å, $b=8.8008(3)$ Å, $c=5.8589(2)$ Å, $\beta=90.324(9)°$, whereas a crystal from Techukhe, Siberia, had $P2_1/a$, $a=13.013(3)$ Å, $b=8.8197(6)$ Å, $c=5.8424(5)$ Å, $\beta=90.03(1)°$. In the structure, the octahedra formed by oxygen atoms about Fe(11) and those about Fe(12) are alternately linked together, sharing edges to form a chain of octahedra parallel to *c*. The monoclinic symmetry of ilvaite is characterized by ordering of Fe^{2+} and Fe^{3+} which are distributed over these two Fe sites with a ratio of 1:1. The atomic contents in the Fe(11) site, estimated from mean Fe(11)-O length, are: Tsumo ilvaite 0.85 Fe^{2+} and 0.15 Fe^{3+}, and Techukhe ilvaite 0.53 Fe^{2+} and 0.47 Fe^{3+}. From these atomic occupancies, the order parameter, σ, of Tsumo ilvaite is calculated to be 75%, while that of Techukhe ilvaite 6%. From the two cases of monoclinic ilvaites, a relation between β and σ has been deduced; the result permits predicting $\beta\approx90.45°$ for an ilvaite crystal having $\sigma=100\%$. The orthorhombic form of ilvaite may be defined as a form of ilvaite having $\sigma=0$. (19 refs.)

107653 The structural properties of synthetic Sr-akermanite, $Sr_2MgSi_2O_7$. M.Kimata (Inst. of Geosci., Univ, of Tsukuba, Ibaraki, Japan).
Z. Kristallogr. (Germany), vol.163, no.3-4, p.295-304 (1983).
The crystal structure of $Sr_2MgSi_2O_7$ with tetragonal, $a=7.9957(10)$, $c=5.1521(9)$ Å, $Z=2$, space group $P\bar{4}2_1m$ has been refined to $R=4.3\%$ from three-dimensional single-crystal, X-ray diffraction data by full-matrix least-squares calculations, This compound is completely isomorphous with akermanite, $Ca_2MgSi_2O_7$, and the mg and Si atoms are distributed respectively in the T(1) and T(2) sites of the melilite structure. The tetrahedral Mg-O bond length (1.942 Å) is clearly longer than that in $Ca_2MgSi_2O_7$ (1.915 Å), which exhibits the flexibility of T(1) site in melilite structures. In the system $Ca_2MgSi_2O_7$-$Sr_2MgSi_2O_7$ the tetragonal parameters of the solid solutions are linear functions of molar compositions, which implies that this solid solution is continuous. All of the rare silicates with tetrahedrally coordinated Mg cations contain alkali or alkali-earth cations in their structures and the ratios Mg:Si are below one. (35 refs.)

Observation of Pendellosung effect in polarised neutron scattering from a magnetic crystal .... See Entry 107488

A test of an effective pair potential for liquid water .... See Entry 107513

Dynamics of the hydrogen bond in CsH_3O_2 from quasielastic neutron scattering .... See Entry 107593

Structural origin of optical bowing in semiconductor alloys ... See Entry 107594

Doping of germanium telluride with bismuth and copper .... See Entry 107725

Dependence of the elastic constants of zinc sulfide on the wurtzite/sphalerite phase composition .... See Entry 107807

The Li sites in the RT and low temperature phases of $LiKSO_4$ crystals .... See Entry 107902

Phase transition in $Hg_3In_2Te_6$ .... See Entry 107907

Solubility of silicon carbide in tin and gallium .... See Entry 107943

Structural transformations in polycrystalline cadmium selenide films .... See Entry 108223

Study of the crystalline structure of HgTe thin layers .... See Entry 108231

Crystal field for ionic and metallic compounds. I. Crystal field theory .... See Entry 108364

Electrical and structural properties of iron-doped β-alumina .See Entry 108482

Preparation, structure, and magnetic properties of isostructural La_3MAlS_7 and La_3MFeS_7 (M=Mg, Mn, Fe, Co, Ni, or Zn) .... See Entry 108657

Double coordination of iron in the phase Fe_xZrSe_2 ($0<x<0.25$): magnetic properties and Mossbauer characteristics .... See Entry 108658

The magnetism of the NiAs-type solid solution $Cr_xFe_{2-x}Te_3$ .... See Entry 108661

On the ferroelectric phase transition in $Li_2Ge_7O_{15}$ .... See Entry 108886

New inorganic material with a high concentration of Nd^{3+} ions for obtaining stimulated emission at the $^4F_{3/2}\rightarrow{}^4I_{11/2}$ and $^4F_{3/2}\rightarrow{}^4I_{13/2}$ transitions .... See Entry 108978

X-ray photoelectron spectroscopy study of the ionic configuration of the spinel $CuMnCoO_4$ .... See Entry 109099

Phase diagram of the PbSe-CdTe system .... See Entry 109250

Interaction of phosphorus with zirconium and cobalt .... See Entry 109252

A molybdenum sulfur binary phase diagram .... See Entry 109264

Investigation of compounds of the type $(A_{0.5}{}^{2+}Bi_{0.5})(B_{0.5}{}^{2+}Nb_{0.5})O_3$ .... See Entry 109281

Neutron diffraction study of cubic ice nucleation in a porous silica network .... See Entry 109790

61.65 SPECIFIC STRUCTURE OF ORGANIC COMPOUNDS

107654 Symmetry in N-H...N bonding, the structure of β-iminoamines and their salts. S.Brownstein, E.J.Gabe, L.Prasad (Div. of Chem., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
Can. J. Chem. (Canada), vol.61, no.7, p.1410-13 (July 1983).
Crystals of 2-*N*-phenylamino-4-*N*-phenylimino-2-pentene are orthorhombic, $a=8.7283(6)$, $b=8.8369(5)$, $c=18.8798(8)$ Å, $Z=4$, space group $P2_1ab$. It is resolved to $R_F=0.053$ for 684 observed reflections. Crystals of 2-*N*-phenylamino-4-*N*-phenylimino-2-pentene hydrochloride are monoclinic, $a=14.6120(9)$, $b=5.2736(7)$, $c=20.708(1)$ Å, $\beta=102.287(5)°$, $Z=4$, space group $P2_1/c$. The final residual is 0.054 for 1255 reflections. Crystals of 2-*N*-methylamino-4-*N*-methylimino-2-pentene hydrochloride are trigonal, $a=7.1666(7)$, $c=15.3299(8)$ Å, $Z=3$, space group $P3_121$. The final residual is 0.044 for 343 observed reflections. The free base exists, in the solid, as the amino-imino form and not as a symmetrical structure. The N-H bond distances in the six-membered ring of the free base are equal as are the N-H bond distances in the infinite chains of the hydrochloride salts. (16 refs.)

107655 The structure and conformation of cis-2-phenylcyclobutanecarboxylic acid and cis-3-(p-fluorophenyl)cyclobutanecarboxylic acid. G.M.Reisner, J.D.Korp, I.Bernal, R.Fuchs (Dept. of Chem., Univ. of Houston, Houston, TX, USA).
Can. J. Chem. (Canada), vol.61, no.7, p.1422-7 (July 1983).
The structure of *cis*-2-phenylcyclobutanecarboxylic acid (**1**) and *cis*-3-(*p*-fluorophenyl)cyclobutanecarboxylic acid (**2**) have been determined by X-ray diffraction methods. Crystals of **1** are monoclinic, space group *C2/c* with $a=15.420(8)$, $b=11.687(6)$, $c=11.226(5)$ Å, $\beta=112.45(4)°$, and eight molecules in the unit cell. Crystals of **2** are monoclinic, space group $P2_1/n$, $a=8.038(5)$, $b=5.405(4)$, $c=22.69(1)$ Å, and $\beta=97.30(4)°$, with four molecules in the unit cell. In both compounds the cyclobutane ring is puckered, with dihedral angles of 27° and 31°. The bond joining the substituted ring atoms in **1** is significantly longer (1.581(2) Å) than the other three (average 1.535(2) Å), due to crowding of substituents. In **2** both the carboxyl and phenyl substituents are close to the bisecting geometry, whereas in **1** both substituents deviate from this conformation, the carboxyl more than the phenyl. (18 refs.)

107656 Crystal structures of two methylmercury complexes with 1-methylimidazoline-2-thione. A.R.Norris, S.E.Taylor, E.Buncel (Dept. of Chem., Queen's Univ., Kingston, Ontario, Canada), F.Belanger-Gariepy, A.L.Beauchamp.
Can. J. Chem. (Canada), vol.61, no.7, p.1536-41 (July 1983).
$[CH_3Hg(C_4H_6N_2S)]NO_3$ belongs to space group $P\bar{1}$, $a=7.146(2)$, $b=7.783(3)$, $c=10.184(5)$ Å, $\alpha=72.95(3)$, $\beta=71.09(3)$, $\gamma=81.83(2)°$, and $Z=2$. The structure was refined to $R=0.039$ (1850 nonzero reflections). The crystal contains complex cations in which the CH_3Hg^+ ion is bonded to the exocyclic sulfur atom by a Hg-S bond of 2.382(2) Å. The nitrate ions form secondary bonds to mercury and hydrogen bonds to the acidic proton attached to N(3). $[CH_3Hg(C_4H_5N_2S)]$ is monoclinic, space group *Cc*, $a=7.734(1)$, $b=17.125(3)$, $c=6.061(3)$ Å, $\beta=99.66(3)°$, and $Z=4$. Refinement converged to $R=0.039$ (678 nonzero reflections). The crystal consists of individual monomeric molecules in which the CH_3Hg^+ ion forms a Hg-S bond of 2.338(7) Å. The molecular packing is considered as unusual, since Hg forms no intermolecular secondary bonds in the equatorial plane, even though N(3) has an available lone pair. (29 refs.)

107657 The crystal and molecular structures of 1,2,7,9-tetrathia-3,6,8,10-tetra-aza-cyclohept(e)indene, a novel tricyclic carbon-sulphur-nitrogen ring system. P.W.Codding, H.Koenig, R.T.Oakley (Dept. of Chem., Univ. of Calgary, Calgary, Alberta, Canada).
Can. J. Chem. (Canada), vol.61, no.7, p.1562-6 (July 1983).
The crystal and molecular structures of 1,2,7,9-tetrathia-3,6,8,10-tetra-aza-cyclohept(*e*)indene, a novel carbon-sulphur-nitrogen heterocycle based on the phenazulene ring system, are reported. Crystals of the compound are orthorhombic, space group *Pbca*, $a=7.1334(8)$, $b=14.761(2)$, $c=16.677(2)$ Å, $V=1756.0(3)$ Å^3, $Z=8$. The structure was solved by direct methods and refined by full-matrix least-squares procedures to a final $R=0.044$ and $R_w=0.027$. Molecules of the title compound consist of a five-membered ring and a seven-membered C ring fused to a benzene ring. Internal structural parameters and the cell packing pattern suggest a dipolar charge distribution. The molecules are stacked in parallel planes in a head-to-tail fashion; the interplanar separation is 3.39 Å and the angle between the molecular planes and the *a* axis is 18°. (23 refs.)

107658 The crystal and molecular structure of 2,3,12,13-tetrathia[4,4]metacyclophane. K.A.Beveridge, G.W.Bushnell, R.H.Mitchell (Dept. of Chem., Univ. of Victoria, Victoria, BC, Canada).
Can. J. Chem. (Canada), vol.61, no.7, p.1603-7 (July 1983).
Conformations in a variety of cyclophane structures are discussed, as determined by X-ray diffraction in crystals and by ^1H NMR in solution. Established nomenclature is brought forward (syn/anti and synclinal/anticlinal) and used to deal with an intermediate case which has been examined by both techniques. The crystal and molecular structure of $C_{16}H_{16}S_4$ is determined and refined to $R=0.0497$. The crystal is orthorhombic, space group *Pbca*, $a=16.593(2)$, $b=10.018(2)$, $c=19.407(3)$ Å at 25(2)°C, $Z=8$, $D_{calc}=1.386$ g cm^{-3}. The molecular conformation in the crystal is anticlinal with a dihedral angle between the benzene rings of 101°. The benzene rings are displaced laterally by 0.727 Å and the sequence of torsion angles is similar in the two bridging chains. (18 refs.)

107659 Crystalline conformation and structure of lichenan and barley β-glucan. I.Tvaroska, K.Ogawa, Y.Deslandes, R.H.Marchessault (Dept. of Chem., Univ. de Montreal, Montreal, Quebec, Canada).
Can. J. Chem. (Canada), vol.61, no.7, p.1608-16 (July 1983).
An investigation based on X-ray fiber diffraction and conformational analysis methods has provided a proposed chain conformation and crystalline structure for lichenan, a poly $\beta(1\rightarrow3)$ cellotriose. The analysis of the fiber diagram of the hydrated form of lichenan led to a trigonal unit cell of dimension $a=b=9.92$ Å and *c* (fiber axis)=42.03 Å, with cellotriose as the asymmetric unit and six cellotriose residues per unit cell. A unit cell of the dry form is also trigonal with $a=b=9.36$ Å and $c=42.03$ Å. A right-handed threefold helix made up of three cellotriose residues was derived. A virtual bond approach was also used to arrive at the proposed conformation which is stabilized by intramolecular hydrogen bonds between all carbohydrate units. The refinement of geometrical and packing parameters produced results consistent with an antiparallel arrangement of the two chains corresponding to a space group symmetry of $P3_1$. (27 refs.)

107660 Alkylammonium hexachlorostannates(IV), $(R_nNH_{4-n})_2SnCl_6$: crystal structure, infrared spectrum and hydrogen bonding. O.Knop, T.S.Cameron, M.A.James (Dept. of Chem., Dalhousie Univ., Halifax, NS, Canada), M.Falk.
Can. J. Chem. (Canada), vol.61, no.7, p.1620-46 (July 1983).
The authors have determined the room-temperature crystal structures of $(Me_2NH_2)_2SnCl_6$ and $(Me_3NH)_2SnCl_6$ (variants of the antifluorite structure); $(EtNH_3)_2SnCl_6$ and $(n\text{-}PrNH_3)_2SnCl_6$ (anti-CdI_2 type, with orientational disorder in the Et compound); and $(n\text{-}Pr_3NH)_2SnCl_6$. They have also studied the infrared spectra in the regions of the NH and ND stretching fundamentals between 10 and 293K, of these five compounds and of $(MeNH_3)_2SnCl_6$, $(Me_3NH)_2SnBr_6$, $(Et_2NH_2)_2SnCl_6$, $(n\text{-}Bu_3NH)_2SnCl_6$ and, in less detail, the mixed-anion salt $(n\text{-}Pr_2NH_2)_3(SnCl_6)Cl$. The specific results for the ten compounds studied are discussed in detail. The discussion also includes the limits of usefulness of the isotopic dilution technique; symmetry aspects of the

cation-anion packing in alkylammonium hexahalometallates(IV); symmetries of the arrangements of the $SnCl_6$ octahedra; the geometry of hydrogen bonding in $(R_nNH_{4-n})_2SnCl_6$; and the possibility of detection of the presence of hydrogen bonding from molecular volume trends. (62 refs.)

107661 X-ray diffuse scattering in Wolffram's red salt. S.Iida, T.Iwazumi, H.Terauchi (School of Sci., Kwansei-Gakuin Univ., Hyogo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2769-71 (Aug. 1983).
X-ray diffuse scattering passing through $(00\ L+1/2)$ and extended perpendicularly to the c*-direction is observed in the ground state of the Wolffram's red salt at room temperature. The chain structure $\text{-Pt}^{4+}\text{-Cl-Pt}^{2+}\text{-Cl-}$ is confirmed, however, it is not long range. The short range correlation shows the one-dimensional character. (6 refs.)

107662 Structural analysis of β-form poly(p-xylylene) starting from a high-resolution image. S.Isoda, M.Tsuji, M.Ohara, A.Kawaguchi, K.Katayama (Inst. for Chem. Res., Kyoto Univ., Kyoto, Japan).
Polymer (GB), vol.24, no.9, p.1155-61 (Sept. 1983).
The crystal structure of β-form poly(p-xylylene) is analysed starting from a high-resolution image of a single crystal of this polymer. The high-resolution image corresponding to the projection of molecules onto the *ab*-plane along the chain axis shows clearly the mutual position of each molecule in a unit cell. The molecules are aligned wavily in the direction along the *a*-axis and the rough positions of their centres in a unit cell can be determined from the image. The refinement of the structure is carried out by the usual least-squares method using the intensities of electron and X-ray diffractions. The space group of the β-form is trigonal, P3, and the lattice dimensions are $a=2.052$ nm, $c=0.655$ nm and $\gamma=120°$. The unit cell contains 16 molecules and one of them is considered to occupy statistically one of three equivalent orientations so as to satisfy the P3 symmetry. (10 refs.)

107663 Determination of the spin-Peierls distortion in N-methyl-N-ethyl-morpholinium ditetracyanoquinodimethanide [MEM(TCNQ)$_2$]: neutron diffraction study at 6K. R.J.J.Visser, S.Oostra (Labs. of Chem. Phys., Univ. of Groningen, Groningen, Netherlands), C.Vettier, J.Voiron.
Phys. Rev. B (USA), vol.28, no.4, p.2074-7 (15 Aug. 1983).
The authors have carried out a crystallographic study of the spin-Peierls distorted phase ($T_c=17.4$K) of N-methyl-N-ethyl-morpholinium ditetracyanoquinodimethanide [MEM(TCNQ)$_2$]. Neutron-diffraction data were collected at 6K from a deuterated sample. At the transition the unit cell axis along the dimerized TCNQ stack is doubled, hence giving rise to tetramers. Refinement of rigid molecules converged on $R=0.162$ for 340 super-reflections. The structural change consists of a transverse shift $\Delta\vec{v}=0.17\vec{L}+0.10\vec{M}$ of every second dimer in the stack. Calculations of transfer integrals confirmed the significance of the distortion. (17 refs.)

107664 Improving the resolution of electron density maps of proteins by refining the model structure. I. Numerical experiments. V.Yu.Lunin, A.G.Urzhumtsev (Sci.-Res. Computing Center, Acad. of Sci., USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.181-4 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.310-15 (March-April 1983). [received: Sept. 1983]
The authors describe numerical experiments to extend and refine the set of phases determined in X-ray structural investigations of proteins. The set of phases is improved by constructing and refining a trial model of the structure. (3 refs.)

107665 The structure of perdeuteronaphthalene $C_{10}D_8$ at 12K by neutron diffraction. I.Natkaniec, A.V.Belushkin (Joint Inst. of Nuclear Res., Dubna, USSR), W.Dyck, H.Fuess, C.M.E.Zeyen.
Z. Kristallogr. (Germany), vol.163, no.3-4, p.285-93 (1983).
The molecular and crystal structure of perdeuteronaphthalene was refined from neutron diffraction data collected at 12K on an automatic four-circle diffractometer. The monoclinic space group $P2_1/a$ remains unchanged, lattice constants at 12K are: $a=8.096(7)$, $b=5.941(5)$, $c=8.648(7)$ Å, $\beta=124.63(5)°$, $Z=2$, $\mu(\lambda=1.26\ Å)=0.095\ cm^{-1}$. 907 symmetry-independent reflections up to $\sin\theta/\lambda=0.72\ Å^{-1}$ refined to $R_w(F)=0.044$. The $C_{10}D_8$ molecule is planar with a maximum distance of atoms from a least-squares plane of 0.008 Å. Mean distances are $C-C=1.371-1.432$ Å, $C-D=1.091-1.095$ Å. The refined structure is compared to a structure calculated from atom pair potentials. (18 refs.)

Lone-pair electronic effects on the calculated ab initio SCF-MO electric potential and the crystal structures of azabenzenes ....See Entry 107591

Charge orderings and lattice distortions in complex TCNQ salts ....See Entry 108316

Single-crystal EPR of the ^{17}O-enriched dioxygen adduct of vitamin B_{12r}: reversible oxygen bonding, electronic and geometric structure, and molecular dynamics ....See Entry 108757

Phase transition in $\{N(CH_3)_4\}_2MnBr_4$ ....See Entry 108891

61.70 DEFECTS IN CRYSTALS

(see also 61.80 Radiation damage, 62. Mechanical and acoustic properties, 71.55 Impurity and defect levels, 76.30M EPR of colour centres and other defects, 78.50 Impurity and defect absorption in solids, 81.40 Treatment of materials)

107666 Observation of defects in an InSb single crystal by neutron topography. B.Chalupa, R.Michalec, B.Haskova, J.Vavra (Nuclear Phys. Inst., Czechoslovak Acad. of Sci., Rez, Czechoslovakia).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.K65-7 (1983).
Neutron diffraction topography (NDT) is a promising method for nondestructive investigations of nearly perfect crystals. A small neutron absorption in most materials is of interest when working with thick samples. However, it is possible to observe defects in samples having absorption coefficient of the order of $10^2\ m^{-1}$. Such a situation is met in the case of an InSb crystal. Its absorption coefficient is about $2\times10^2\ m^{-1}$ for neutron wavelength of 0.16 nm. In this case a suitable pattern may be obtained for a sufficiently long exposure time. As compared to some other materials investigated (e.g. Fe, Si, etc.) a strong radioactivity is induced in this sample. (4 refs.)

107667 New morphological types of CuSi precipitates in silicon and their electrical effects. R.Gleichmann, H.Blumtritt, J.Heydenreich (Inst. fur Festkorperphys. & Elektronenmikroskopie, Akad. der Wissenschaften, Halle (Saale),, Germany).
Phys. Status Solidi a (Germany), vol.78, no.2, p.527-38 (16 Aug. 1983).
By combined SEM/EBIC and TEM observations the defect structure of long-time processed copper-contaminated floating zone silicon is investigated. Besides the dominant compact precipitates of CuSi, different types of extended planar precipitates are found, which occur in form of large defect complexes with extremely low density. The observations indicate the different defect types to represent stages of a common transformation process of the metastable CuSi phase. The analysis of the EBIC contrasts shows all defects to be electrically active but with strong qualitative and quantitative differences. (11 refs.)

On the theory of X-ray and electron dynamical scattering in crystals with defects ....See Entry 107478

Periodic capture of melt by a growing crystal ....See Entry 107580

Investigation of the structure of hematite on the basis of an analysis of the physical broadening of X-ray lines ....See Entry 107633

Effect of beam energy and anneal history on trivalently bonded silicon defect centers induced by ion beam etching ....See Entry 107780

Diffusion-induced changes in the defect structure of solids (review) ....See Entry 108012

The effect of cure on thermally stimulated discharge measurements in epoxy resin coatings ....See Entry 108442

A mechanism for $1/f$ noise in metals ....See Entry 108483

Emission and transmission cathodoluminescence analysis of InGaAsP/InP double heterostructures emitting at 1.3 and 1.6 micron ....See Entry 109022

Defect structures close to the surface in metals investigated by slow positrons ....See Entry 109043

Control of superplastic cavitation by hydrostatic pressure .....See Entry 109406

Development of forming limits for superplastic formed fine grain 7475 Al ....See Entry 109407

61.70B Interstitials and vacancies

(exc. colour centres)

107668 Kinetics of interstitial supersaturation during oxidation of silicon. S.M.Hu (IBM General Technol. Div., East Fishkill Facility, Hopewell Junction, NY, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.449-51 (1 Sept. 1983).
The kinetics of the supersaturation of self-interstitials during the thermal oxidation of silicon is reexamined by considering a finite diffusivity of these interstitials. The rate of interstitial generation is assumed to be proportional to the rate of oxidation, and the rate of surface annihilation is assumed to be a first order reaction. The result from an analytical solution shows that within a reasonable oxidation time span, a suitable power-law kinetics is obtained, with an exponent that falls within the range of most of the reported experimental values. (33 refs.)

107669 Vacancy formation enthalpies in $A^IB^{III}C_2^{VI}$ chalcopyrite semiconductors. H.Neumann (Sektion Phys., Karl-Marx-Univ., Leipzig, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.901-6 (1983).
Formation enthalpies ΔH_v of single vacancies in all $A^IB^{III}C_2^{VI}$ chalcopyrite structure compounds are estimated using the macroscopic cavity model. A comparison with atomic sublimation enthalpies ΔH_{sub} of the B^{III} and C^{VI} atoms derived from existing partial vapour pressure data shows that within the accuracy of this data and the theoretical calculations the relation $\Delta H_v \lesssim \Delta H_{sub}$ is fulfilled as expected from general considerations. (21 refs.)

107670 Interaction of an interstitial impurity with a divacancy. M.P.Shetbaeva, V.V.Kirsanov, N.S.Okhrimenko (Inst. of Nuclear Phys., Acad. of Sci., Alma-Ata, Kazakh SSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.14-17 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The method of dynamic modeling on a computer is used to study the reactions of interstitial helium with divacancies in an α-Fe crystal. The analysis is applied to a microcrystallite (micrograin) consisting of 855 elastically coupled iron atoms. Consideration is given to reactions between interstitial helium and three different divacancies with components at the lattice sites in the positions of the first-, second-, and third-nearest neighbours. The binding energies of these divacancies are found to be 0.21, 0.47, and 0.10 eV, respectively. The zone of spontaneous interaction of an (He+2 V) complex is found for each divacancy. The most stable divacancy of the ⟨100⟩ type corresponds to a zone of 63 unstable positions of a helium atom. In the case of the ⟨111⟩ and ⟨110⟩ divacancies these zones consist of 69 and 71 unstable helium positions, respectively. Three types of mechanism of the interaction of helium with a divacancy are established. (5 refs.) *A.T.*

107671 Dynamics of absorption of host interstitial atoms by vacancy pores. S.I.Golubov, A.M.Minashin.
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.47-52 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
An analysis is made of the dynamics of the process of absorption of host interstitial atoms with the [100] dumb-bell configuration in a metal with a face-centred cubic lattice by pores which are bounded by (100) and (111) planes. It is shown that the capture of interstitial atoms occurs by a chain of substitutions along the [110] close-packed direction. This increases the efficiency of the capture of interstitial atoms by pores. (9 refs.) *A.T.*

107672 Volume changes and dipole tensors for point defects in crystals. A.M.Stoneham (Theoretical Phys. Div., AERE, Harwell, England).
J. Phys. C (GB), vol.16, no.25, p.L925-8 (10 Sept. 1983).
Results for the volume change and dipole tensors for point defects are derived using a generalisation of the Betti reciprocity theorem. These results incorporate the correction terms derived by Flynn (1971) by Lidiard (1981) and by Gillan (1983) in a simpler way, and allow some more general results to be obtained straightforwardly. (10 refs.)

107673 Interstitial type defects in ion implanted silicon. N.I.Berezhnov, V.F.Stelmakh, A.R.Chelyadinskii (Dept. of Phys., Belorussian State Univ., Minsk, Belorussian SSR).
Phys. Status Solidi a (Germany), vol.78, no.2, p.K121-5 (16 Aug. 1983).
To determine the temperature intervals of interstitial type defect annealing and to estimate their concentration, ion implanted Si crystals heavily doped during growth with boron ($\rho_0=0.005\ \Omega$ cm) were investigated by the X-ray diffraction method by measuring the lattice period. The results indicate that the concentrations of the stable interstitial type defects generated by ion implantation are comparable with the concentration of vacancy type defects. The preponderated interstitial type complexes are annealed at ≈140 and $\approx500°C$ when Si crystals were implanted with boron ions (implantation with light mass ions). The annealing stages are shifted up to ≈180 and $\approx560°C$ in case of the medium mass ion implantation (phosphorus ions). (14 refs.)

107674 Total energy of isolated point defects in solids. G.A.Baraff, M.Schluter (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2296-8 (15 Aug. 1983).
Total-configurational-energy calculations have already been very successfully carried out for periodic structures and for isolated molecules, allowing one to study, e.g. crystal structures, reconstructions, and vibrational frequencies. The authors describe for the first time a method for calculating the total energy of isolated, charged, point defects in an infinite crystal. It uses the self-consistent

Green's function technique. They demonstrate its quantitative utility by applying it to two defects in GaP. (19 refs.)

107675 Possibility of antistructural defects in undoped cadmium telluride. V.N.Martynov, S.P.Kobeleva (Inst. of Steel & Alloys, Moscow, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.232-3 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.394 (March-April 1983). [received: Sept. 1983]
The region of homogeneity in CdTe is calculated on the assumption that the main intrinsic point defects in the material are Frenkel pairs in both sublattices. The deviation from stoichiometry δ is $\sim 10^{18}$ cm^{-3}. The neutral centers determining the rather large values of δ at the boundary of the region of homogeneity of CdTe on the side with excess Te are antistructural defects Te_{Cd}. (4 refs.)

107676 Studies of point defects by positrons and positive muons. M.Doyama (Dept. of Metall. & Materials Sci., Univ. of Tokyo, Tokyo, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.3-10
Positron annihilation and positive muon spin relaxation techniques can be applied to the study of point defects. By positron annihilation the formation energies of a vacancy have been measured in many pure metals and alloys. Positron annihilation is quite sensitive to small vacancy clusters which cannot be observed by electron microscopy. Positive muons can also be used to study vacancy type defects. Quenched-in vacancies in pure aluminum and aluminum dilute alloys have been quantitatively studied. These techniques can be used as one of the nondestructive testing techniques. (24 refs.)

107677 Observation of monovacancies in iron by/ the μSR technique. A.Moslang, H.Graf, E.Recknagel, A.Weidinger, T.Wichert, R.I.Grynszpan (Faultat fur Phys., Univ. of Konstanz, Konstanz, Germany).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.11-14
A muon-spin-rotation (μSR) experiment was performed on electron irradiated iron. A new frequency (30 MHz) was found which is distinctly different from the 50 MHz line observed in unirradiated iron. Symmetry considerations indicate that the new frequency is due to muons trapped at monovacancies. The complete disappearance of this line above stage III is interpreted as evidence for vacancy migration at 220K in Fe. (5 refs.)

107678 PAC study of point defects in metals. T.Wichert (Fakultat fur Phys., Univ. Konstanz, Konstanz, Germany).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.19-26
Recent advances in the study of point defects and small defect clusters by the perturbed angular correlation technique (PAC) are discussed. The formation of impurity defect complexes becomes visible via a defect specific electric field gradient, which allows one to recognize the trapped defect in further experiments and to deduce information about the microscopic structure of the complex. Experimental data on interstitials, vacancies and their agglomerates as obtained in isochronal annealing experiments and by defect-antidefect reactions are presented. (35 refs.)

107679 Nuclear magnetic resonance study of point defects in aluminium and copper. C.Minier, R.Minier (Dept. de Recherche, Centre d'Etudes Nucleaires de Grenoble, Grenoble, France).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.27-32
The principles of nuclear magnetic resonance for the determination of electrical field gradients on successive nuclei shells around a point defect are given. Results in copper and aluminium containing specific impurities or monovacancies are discussed. Measurements in electron irradiated copper shows unambiguously that monovacancies migrate during stage III. (12 refs.)

107680 X-ray studies of interstitials in metals. H.Peisl (Sektion Phys., Ludwig-Maximilians Univ., Munchen, Germany).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.41-6
Interstitial atoms in a crystal lattice cause a distortion field, which can be studied by X-ray or neutron scattering methods. The Bragg peaks are shifted due to an average lattice parameter change, their intensities are attenuated by a static Debye-Waller factor and a diffuse intensity distribution close to the Bragg peaks (Huang scattering) and between the Bragg peaks (Zwischenreflexscattering) occurs. In an X-ray investigation of niobium with interstitial hydrogen all effects have been observed consistently. The defect volume, the long-ranged distortion field, the defect site and structure and the displacements of the nearest neighbours are determined. (9 refs.)

107681 Self-interstitial-atoms and their agglomerates in HCP metals. P.Ehrhart (Inst. fur Festkorperforshung, KFA Julich, Julich, Germany), B.Schonfeld.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.47-52
After electron irradiation at 4K the defect structures in HCP metals have been investigated by measurement of the diffuse scattering of X-rays (Huang Diffuse Scattering), the change of the lattice parameter and the change of the electrical resistivity. Measurements were performed on metals with a large c/a ratio (Cd, Zn) and with nearly an ideal c/a ratio (Co, Mg, Zr). Large differences were found for the properties of self interstitial atoms (SIA) and their agglomerates in different HCP metals: the relaxation volume of the SIA varies from 0.6 atomic volumes for Zr to 3.5 atomic volumes for Zn; the anisotropies of the long range displacement fields are very different (even different signs !); interstitial mobility is below the irradiation temperature of 4.5K for Cd and Mg. (13 refs.)

107682 Nature of point defects and their interactions revealed by electron-microscope observation of their clusters. M.Kiritani (Dept.of Material Phys., Osaka Univ., Osaka, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.59-66
Type of defects formed by the aggregation of point defects is discussed. The interaction of interstitials with dislocations is viewed from the growth of dislocation loops. Annihilations process of defect clusters is also discussed. Primary damage process by high energy electrons is analyzed from the localized formation of vacancy clusters. Free migration of vacancies, especially in α-iron, is discussed from interstitial loop growth during high temperature electron irradiation, and the aging experiment of low temperature irradiation induced interstitial clusters indicates the vacancy motion at 220K. Irradiation induced segregation of solute elements in dilute alloys is detected by impurity sensitive nucleation of point clusters. (16 refs.)

107683 Ultrasonic studies of dipolar point defects. A.V.Granato (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.67-72
Dipolar point defects interaction strongly with ultrasonic shear stress. Measurements of ultrasonic attenuation and velocity as a function of polarization, frequency, temperature and defect density display both dielastic and parelastic behaviour. Effects are readily detected for defect densities in the ppm range, where defect interaction effects can be avoided. Measurements have been made in irradiated Al and Cu alloys, and in Nb with H and D. In general, multiple peaks are found. Evidence for the mixed dumbbell configuration is obtained for Al-Zn and Al-Ag. The ultrasonic technique is particularly useful for low temperature peaks showing quantum effects which would not be detectible at lower frequencies. For example, it is found that the mixed dumbbell tunnels between equivalent configuration in Al-Zn, while for Nb/H, the relaxation occurs in an excited state with an enormous isotope effect in the relaxation time. By using specimens containing both weak and strong impurity trapping centers, it can be determined whether the weakly bound complex diffuses or dissociates. (12 refs.)

107684 Unsolved problems concerning point defects. J.S.Koehler (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.143-4
The unsolved problems are as follows: the structure and properties of small vacancy clusters; the structure and properties of self interstitials in body centered and in hexagonal metals; interstitial impurity interactions. (12 refs.)

107685 Computer studies on self-interstitials in magnesium. M.Imafuku, R.Yamamoto, M.Doyama (Dept. of Metall. & Materials Sci., Univ. of Tokyo, Tokyo, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.145-8
The configurations of self-interstitial atoms (SIA) in magnesium were studied by using the Lennard-Jones (LJ) potential. It was found that a split interstitial along the a-axis and an octahedral interstitial have the smallest formation energies. The dynamic properties of these interstitials were also investigated by the recursion method. (7 refs.)

107686 X-ray diffraction studies on the interstitials in high-purity iron. N.Tsukuda, K.Kitajima (Res. Inst. for Appl. Mech., Kyushu Univ., Fukuoka, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.171-3
X-ray diffraction studies on interstitials in high-purity iron were performed. Examinations of single crystals were carried out by topography and by double-crystal diffraction techniques. Lattice parameter change $\Delta a/a$ and diffuse scattering intensity (Huang scattering) I_H were measured for electron-irradiated iron at 77K. The volume relaxation of the interstitials $\Delta V/V_c$ was estimated at 1.5. The intensity distributions of I_H against q in double-logarithmic scale show clustering of the interstitials. (12 refs.)

107687 Experimental determinations of the concentration and the mobility of interstitials in pure ice crystals. K.Goto, T.Hondoh, A.Higashi (Dept. of Appl. Phys., Hokkaido Univ., Sapporo, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.174-6
Improved X-ray diffraction topographic method to determine the equilibrium concentration of interstitials in ice is described. The formation energy and the formation entropy of self-interstitials in ice were determined to be 0.40 eV and 4.2×10^{-4} eV/K, respectively from exact values of the concentration thus determined at various temperatures above -30°C. Auxiliary results of diffusion coefficient of the interstitials and of the calculation of criteria for the formation of secondary defects in ice crystals by cooling are presented. (3 refs.)

107688 Atomic defects in BCC transition metals. H.Schultz (Inst. fur Phys., Max-Planck-Inst. fur Metall., Stuttgart, Germany).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.183-90
New experimental results, obtained by resistivity investigations on BCC transition metals (Nb, Ta, Mo, W, Fe) following low-temperature electron irradiation or quenching in superfluid helium are summarized. Defect properties have characteristic trends related to the position of the element in the periodic table. The low temperature recovery reactions show deviations from the Corbett-Smith-Walker scheme of FCC metals. It is discussed what kind of additional assumptions are necessary to incorporate the new observations into this model. (61 refs.)

107689 Mean-square displacement of an interstitial impurity atom. M.Kaneko, Y.H.Ohashi, M.Fukuchi (Faculty of Sci. & Technol., Keio Univ., Kanagawa, Japan), K.Ohashi.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.319-21
The dynamics of an interstitial H atom in a FCC Al metal have been investigated by the pseudopotential method and Green function technique. The interionic force constant between a pair of Al ions and the H-Al atom force constant are determined by means of the pseudopotential. The coupling between Al and H is considerably weak, so that one may expect the low frequency resonance which leads to especially large thermal displacement of an interstitial H atom. (11 refs.)

107690 Study of self-interstitial-atom solute-atom-complexes by mechanical relaxation. K.-H.Robrock (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.353-9
The reaction of migrating self-interstitial-atoms with solute-atoms in solid solution leads to the formation of a so-called self-interstitial-atom solute-atom (SIA-SA)-complexes. The complexes may consist either of solute-atoms in interstitial sites or self-interstitial-atoms bound to substitutional solute-atoms. Internal friction experiments have been performed on some dilute Al, Cu and Ni alloys after electron irradiation and subsequent thermal annealing treatments. Internal friction peaks are observed in each of the alloys, which do not exist in the pure solvent material and which appear after self-interstitial atom

migration in stage I. They are therefore attributed to the local reorientation of SIA-SA-complexes. The peak-properties are critically discussed in terms of recent defect-models with particular emphasis on atomic jump modes, configurations, binding- and migration energies of SIA-SA-complexes. (15 refs.)

107691 Channeling studies of defect trapping configurations in aluminum. M.L.Swanson, L.M.Howe (AECL Res. Co., Chalk River Nuclear Labs., Chalk River, Ontario, Canada).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.364-7
In dilute Al alloys, channeling measurements were made as a function of He^+ ion fluence in order to study both self-interstitial and vacancy trapping configurations. It was found that (a) Al self-interstitials were trapped by Ag or Mn atoms, creating simple ⟨100⟩ mixed dumbbells at low fluences; in the case of Ag solute atoms, this configuration was altered at higher fluences where multiple trapping occurred; (b) Al self-interstitials which were trapped by In or Sn atoms did not create mixed dumbbells; (c) vacancies were trapped by In or Sn atoms to form trivacancy-solute, tetravacancy-solute and hexavacancy-solute atom complexes, in which the solute atoms were located at interstitial sites $(1/3, 1/6, 1/6)a_0$, $(1/4, 1/4, 1/4)a_0$ and $(1/2, 1/2, 1/2)a_0$, respectively. (18 refs.)

107692 Vacancies in carbon-doped iron. P.Hautojarvi, J.Johansson (Lab. of Phys., Helsinki Univ. of Technol., Espoo, Finland), P.Moser, L.Pollanen, A.Vehanen.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.504-7
Electron and neutron irradiated carbon-doped iron is studied by positron lifetime measurements. The results show that stable carbon-vacancy pairs are formed at stage III when migrating vacancies are captured by C atoms. The pairs dissociate at 480K causing a second release of free vacancies. Correlated vacancy migration within collision cascades is shown to take place in neutron-irradiated specimens. (10 refs.)

Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V ... See Entry 105037

Crystallization of bismuth telluride from a melt containing excess tellurium ... See Entry 107576

X-ray diffraction investigation of the structure of deformed samarium-cobalt alloys ... See Entry 107604

Structure of the ordered phase of gallium sesquiselenide, Ga_2Se_3 ... See Entry 107629

A neutron powder diffraction study of the κ phase in the Fe-W-C system ... See Entry 107640

Nucleation and growth process of dislocation loops in electron-irradiated β-Nb-3.1 wt.% Zr alloy ... See Entry 107702

Doping of germanium telluride with bismuth and copper ... See Entry 107725

Trapping of hydrogen by substitutional and interstitial impurities in α-iron ... See Entry 107737

Calculation of interaction energy between atomic defects in BCC transition metals: vacancy-vacancy, vacancy-vacancy cluster, and vacancy impurity pairs ... See Entry 107739

Pseudopotential formulation of point defect interactions in metals ... See Entry 107740

Interactions between point defects in HCP metals ... See Entry 107741

Dipolar point defect interactions with stress fields ... See Entry 107742

Interstitial-impurity interactions in aluminum and copper alloys ... See Entry 107743

Molecular dynamics study of interstitial-solute interactions in irradiated Al-based alloys ... See Entry 107744

Interaction between self-interstitial and solute atoms in gold ... See Entry 107745

Self interstitial atom interactions with point defects and impurities in Cu, Al, Ag matrices ... See Entry 107746

A method for studying the self-interstitial trapping at impurity atoms in an irradiated metal and the resulting defect distribution as a function of the temperature ... See Entry 107747

The interactions between gas impurities and defects in Mo studied by the positron annihilation technique ... See Entry 107749

Investigation of cascade-induced point-defect fluctuations ... See Entry 107750

Donor complexes with interstitial indium atoms following low-temperature gamma irradiation of indium antimonide ... See Entry 107761

Radiation-induced defect formation in InSb doped with Gd, Ge, Cu, Ag, Zn, and Cd ... See Entry 107766

Paraelasticity in electron-irradiated molybdenum ... See Entry 107771

The low temperature recovery in electron-irradiated BCC transition metals ... See Entry 107772

Stage III recovery in electron-irradiated BCC transition metals ... See Entry 107773

Ion channeling investigations of the interactions between irradiation-produced defects and solute atoms in metals ... See Entry 107793

Moduli of elasticity and stability of strongly anisotropic crystal with vacancies ... See Entry 107808

Steady state vacancy concentration around a plastic crack ... See Entry 107820

Internal friction and point defects in ordered β Cu-Zn and β Cu-Zn-Al ... See Entry 107826

Estimation of strain dipole tensor due to interstitials in hexagonal close packed metals ... See Entry 107828

Hydrogen induced lattice expansion in nickel ... See Entry 107950

The migration, precipitation and dissolution of solute atoms in quenched Al-Ge, Al-Sn, and Cu-Ge alloys ... See Entry 107962

X-ray diffraction study of nonstoichiometry with respect to oxygen in cobalt ferrospinel ... See Entry 107965

A kinetic model for self-interstitial trapping at solutes ... See Entry 108014

Migration energies of a vacancy and a divacancy in aluminum ... See Entry 108019

A method for investigating migration of point defects ... See Entry 108020

Anomalous temperature dependence of the self-diffusion coefficient in silicon ... See Entry 108024

Tellurium self-diffusion and point defects in lead telluride ... See Entry 108025

Defects and diffusion in MnO ... See Entry 108026

The relationship between measured activation enthalpy and pre-exponential factor: rate processes in ionic crystals in the intrinsic-extrinsic region ... See Entry 108035

Atomic defects and diffusion in metals ... See Entry 108038

The effect of hydrostatic pressure on self-diffusion in silver and gold ... See Entry 108039

An analysis of self-diffusion data in FCC metals ... See Entry 108040

Isotope effect for self-diffusion in silver at low temperatures ... See Entry 108042

Isotope effect and diffusion of cadmium in copper ... See Entry 108043

Diffusion in Ni-Sn dilute alloys ... See Entry 108044

Mechanisms of the anomalous diffusion in β-zirconium and β-hafnium ... See Entry 108046

Diffusion behavior in titanium-chromium hydrides ... See Entry 108052

Jump frequency analysis on impurity diffusion in Cu based on new data ... See Entry 108066

Application of a solvation shell analysis to the diffusivity of an interstitial species in binary substitutional solutions ... See Entry 108067

'Uphill' diffusion of vacancies and the instability of irradiated materials ... See Entry 108068

X-ray diffraction study of thermal vacancies in solid helium-3 ... See Entry 108110

Properties of real surfaces of thin films of cadmium selenide ... See Entry 108166

X-ray determination of the surface compression force in the ion-doped layer in silicon ... See Entry 108245

Oxygen-related defects in irradiated germanium ... See Entry 108332

Energy levels of interstitial manganese in silicon ... See Entry 108343

The electronic structure and formation energy of a vacancy in aluminum ... See Entry 108349

Comment on the determination of ρ_F from damage-rate measurements ... See Entry 108375

Residual resistance of metals due to vacancies ... See Entry 108384

Galvanomagnetic effects in quenched aluminium ... See Entry 108391

Mossbauer studies of defect-impurity interaction and impurity diffusion in metals ... See Entry 108850

^{57}Fe Mossbauer study on point defects in pure iron ... See Entry 108851

Theory of Mossbauer line broadening due to diffusion ... See Entry 108852

Heterodyne correlation of scattered light from a Sr^{++}-doped NaCl crystal. A feasibility study ... See Entry 108965

Oxygen vacancies in lithium niobate ... See Entry 108981

Photoluminescence associated with thermally induced microdefects in Czochralski-grown silicon crystals ... See Entry 108987

Photothermal creation of $Cu^0v_a^+$ centres and mobility of anion vacancies in X-irradiated KCl:Cu crystals ... See Entry 109008

Precise positron lifetime measurements in indium ... See Entry 109038

Positron studies of Ti-based alloys irradiated by neutrons ... See Entry 109042

Positron annihilation in thermal equilibrium on pure and carbon doped α-iron ... See Entry 109044

Extended X-ray absorption fine structure of electron-irradiated dilute aluminium alloys ... See Entry 109053

Phase diagrams under irradiation ... See Entry 109236

Inhibition mechanism of the anatase-rutile phase transformation by rare earth oxides ... See Entry 109279

On precipitation in rapidly solidified aluminium-silicon alloys ... See Entry 109303

Hardening by thermal vacancies and quenching strains in singly-oriented Pb single crystals ... See Entry 109318

On the recovery and annealing kinetics of cold-worked Ni-4.5 at% Cu alloy ... See Entry 109327

The formation of vacancies during primary recrystallisation ... See Entry 109335

Nature of new X-ray diffuse scattering effects in ageing Al-Zn alloys ... See Entry 109348

Structural changes and strengthening in strain aging of austenitic steel ... See Entry 109367

New quenching experiments with high purity and carbon doped iron ... See Entry 109374

Quenching and annealing experiments on high-purity iron with and without carbon ... See Entry 109375

Mechanical relaxation effects of self-interstitial-atoms in molybdenum ... See Entry 109381

Elastic modulus change in Mo due to Frenkel defects ... See Entry 109382

Interstitial interaction in W observed by relaxation measurements ... See Entry 109383

Influence of dislocation density on microchemical inhomogeneity of the thermal influence zone of welded Nb alloys ... See Entry 109391

61.70D Colour centres

107693 Two types of F centres in alkaline earth fluoro-halides. I. Superhyperfine interactions and electronic structure. R.U.Bauer, J.R.Niklas, J.-M.Spaeth (Fachbereich Phys., Univ.-GH Paderborn, Paderborn, Germany).
Phys. Status Solidi b (Germany), vol.118, no.2, p.557-66 (1 Aug. 1983).
In the alkaline earth fluoro-halides BaFCl, SrFCl, and SrGBr, two types of F centres with different symmetry are produced, were the electron occupies either an F^- vacancy ($F(F^-)$ centres) or a Cl^- or Br^- vacancy ($F(Cl^-$, $Br^-)$ centres), respectively. Using electron nuclear double resonance the superhyperfine and quadrupole interactions with up to nine shells of neighbour nuclei are determined. The spin density distribution is rather anisotropic. For $F(Cl^-)$ centres it can be explained with an 1s-type centre wave function if the mutual overlap of the lattice ions is taken into account. For the $F(F^-)$ centres as small admixture of a 2p- or a 3d-type orbital to the 1 s function is required. (17 refs.)

A trapped-hole center causing rose coloration of natural quartz ....See Entry 108785

On the real refractive-index change in some *F*-coloured alkali-halide crystals ....See Entry 108905

Energy and phase relaxation of phosphorescent *F* centers in CaO ....See Entry 108995

Phototherma1 creation of $Cu^0v_a{}^+$ centres and mobility of anion vacancies in X-irradiated KCl:Cu crystals ....See Entry 109008

Thermoluminescence studies in KBr_xI_{1-x} mixed crystals ....See Entry 109024

Optical absorption and thermoluminescence of KCl single crystals coloured under DC fields ....See Entry 109027

Thermoluminescence of Z_3 centres in X-irradiated Ca-doped KCl crystals ....See Entry 109028

Positron angular correlation in uncoloured and neutron irradiated LiF and LiF:OH ....See Entry 109039

61.70E Other point defects

Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V ....See Entry 105037

Formation of point defect clusters in electron-irradiated dilute FCC alloys ....See Entry 107708

Elastic interaction in dislocations with orthorhombic and [001]-monoclinic point defects in HCP crystals ....See Entry 107738

Optical absorption in InP crystals with point radiation defects ....See Entry 108900

61.70G Dislocations: theory

107694 Periodic networks of disclination lines: application to metal structures. J.F.Sadoc (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France).
J. Phys. Lett. (France), vol.44, no.17, p.L707-15 (1 Sept. 1983).
Complex structures for some metals (Mn, W, U etc...) are described. It is shown how it is possible to define these structures as polytetrahedral structures reticulated by a periodic network of disclination lines. (18 refs.)

Nature of point defects and their interactions revealed by electron-microscope observation of their clusters ....See Entry 107682

Energy of special grain boundaries deviating from the coherent positions ....See Entry 107714

Elastic interaction in dislocations with orthorhombic and [001]-monoclinic point defects in HCP crystals ....See Entry 107738

Theory for saturation stress difference in torsion versus other types of deformation at low temperatures ....See Entry 107810

The surface dislocation and its relationship to the boundary-integral equation ....See Entry 107812

Creep in transforming polycrystalline materials ....See Entry 107813

A proposed criterion for fatigue threshold dislocation substructure approach ....See Entry 107818

Thermal conductivity of LiF containing dislocations at low temperatures ....See Entry 107973

Thermal transport in heavily deformed and γ-irradiated LiF at temperatures near 1K ....See Entry 108082

Magneto-resistance of a semiconductor with the dislocation wall in the quantum limit ....See Entry 108456

The nature of photoluminescence from plastically deformed silicon ....See Entry 109010

On the theory of acoustic softening of low-carbon steel .... See Entry 109314

Precipitation hardening caused by a difference in shear modulus between particle and matrix ....See Entry 109317

61.70J Etch pits, decoration, transmission electron-microscopy and other direct observations of dislocations

107695 The defect structure of crystals grown in large scale industrial crystallizers: Case of ammonium sulphate. W.J.P.van Enckevort, H.J.Boeshaar (Catholic Univ., Nijmegen, Netherlands).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.K79-83 (1983).
Despite the fact that in industry enormous amounts of crystalline materials are produced, only little work has been done on the investigation of the defect structure of crystals grown in industrial mass crystallisers. Ammonium sulphate crystals collected from a production line of a commercial plant are investigated by the Lang method. The defect configuration of these crystals observed by this X-ray topographic technique is compared with the dislocation structure of high quality, laboratory grown $(NH_4)_2SO_4$ crystals. (10 refs.)

107696 On the theory of X-ray and thermal neutron scattering in strongly distorted crystals containing dislocation loops. R.I.Barabash, M.A.Krivoglaz (Polytech. Inst. & Inst. of Phys. of Metals, Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.417-28 (1982). [received: Aug. 1983]
Discusses X-ray and neutron scattering in crystals with a high density of dislocation loops. The width and shift of regular reflection maxima have been investigated. Numerical calculations have been made for prismatic dislocation loops and for glide loops in elastically isotropic crystals. A single system of loops of a given orientation and arbitrarily oriented loops as well as the dependence of quasi-line broadening on the diffraction vector orientation have been studied. (8 refs.)

107697 Dislocations in $Pb_{1-y}Sn_ySe$. A.P.Petukhov.
Inorg. Mater. (USA), vol.18, no.11, p.1543-5 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1798-801 (Nov. 1982).
It has been shown that the overall magnitudes of the damaged layer, and of the region with elevated dislocation density due to electrospark cutting and polishing with ASM-1.0 diamond paste on $Pb_{1-y}Sn_ySe$ single crystals, may be taken as correspondingly 100-300 and 100-200 μm. Annealing of a mechanically polished wafer reduces the dislocation density in the region of elevated density. It has been found that $Pb_{1-y}Sn_ySe$ films grown by liquid phase epitaxy on PbSe substrates usually have a surface dislocation density of 10^4-10^5 cm^{-2}. (3 refs.)

107698 Effect of growth conditions on formation of microdefects in dislocation-free silicon crystals. V.P.Grishin, L.P.Katerushina, L.V.Lainer, O.A.Remizov (State Sci. Res. & Design Inst. of the Rare-Earth-Metal Industry, USSR).
Inorg. Mater. (USA), vol.18, no.9, p.1222-4 (Sept. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.9, p.1437-9 (Sept. 1982). [received: Sept. 1983]
The authors have investigated the nature of the microdefect distribution in dislocation-free single crystals of silicon grown by the Czochralski method and by crucible-free zone melting. It has been shown that in crystals obtained by the Czochralski method, a large variety of microdefect distribution patterns is observed. The effect of the atmosphere and the rate of growth on the density and distribution of the microdefects has been determined. A mechanism by which microdefects are formed during the growth of dislocation-free single crystals of silicon has been proposed. (7 refs.)

107699 Cross-slip on the first order pyramidal plane ($10\bar{1}1$) of a-type dislocations ($1\bar{2}10$) in the plastic deformation of α-titanium single crystals. S.Naka, A.Lasalmonie (Office Nat. d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux, France).
J. Mater. Sci. (GB), vol.18, no.9, p.2613-17 (Sept. 1983).
The nature of the cross-slip plane was determined by electron microscopy observations of α-titanium single crystal specimens, oriented for single prismatic slip ($10\bar{1}0$) [$1\bar{2}10$]. The occurrence of cross slip on the first order pyramidal plane ($10\bar{1}1$) was proved for a-type dislocations [$1\bar{2}10$]. Furthermore, two types of dislocation configuration due to the double cross-slip were observed: edge dislocation dipoles and loops elongated along the Burger's vector. (8 refs.)

107700 A transmission electron microscopy study of hexagonal ice. A.H.Falls, S.T.Wellinghoff (Dept. of Chem. Engng. & Materials Sci., Univ. of Minnesota, Minneapolis, MN, USA), Y.Talmon, E.L.Thomas.
J. Mater. Sci. (GB), vol.18, no.9, p.2752-64 (Sept. 1983).
The morphologies of fast-frozen, thin-film samples of pure and dilute solutions of salts and surfactants in hexagonal ice are investigated with transmission electron microscopy. The cold-stage microscopy technique is described briefly and limitations imposed by the equipment and the sample itself are discussed. Ice grains, grain boundaries, dislocations, and stacking faults are imaged before radiolysis from the electron beam can alter their structures. The technique shows that screw dislocations in the ice basal plane are common, in accord with observations from X-ray topography and etch-replication microscopy. It also makes visible nonbasal dislocations in hexagonal ice, including dislocation in first prismatic planes, nonprismatic dislocation loops, and stacking faults on first pyramidal planes; heretofore, these defects have not been confirmed experimentally. Implications of the work for cold-stage microscopy of microstructured fluids are mentioned. (47 refs.)

107701 Dislocation configurations induced by cyclic deformation in silicon crystals. Y.Nishino (Dept. of Crystalline Materials Sci., Nagoya Univ., Nagoya, Japan), T.Imura.
Phys. Status Solidi a (Germany), vol.78, no.2, p.655-63 (16 Aug. 1983).
Silicon crystals are stressed cyclically in tension and in compression at the stress level of about one-seventh of the upper yield stress at 1073K. Electron microscope observations indicate that edge dislocation bundles and dipoles are common to both cyclic and tensile deformation in the early stages. In cyclic deformation, the majority of dislocations assume the dipole configuration even in the initiation of cycling, and very few primary screw dislocations are found. In the manner as in f.c.c. metals, the dislocation bundles contribute to rapid hardening by providing effective barriers to continued dislocation motion. The present results suggest that the fatigue hardening is possible to take place during cyclic deformation in the elastic region. (18 refs.)

107702 Nucleation and growth process of dislocation loops in electron-irradiated β-Nb-3.1 wt.% Zr alloy. K.Nakai, C.Kinoshita, Y.Muroo, S.Kitajima (Dept. of Nuclear Engng., Kyushu Univ., Fukuoka, Japan).
Philos. Mag. A (GB), vol.48, no.2, p.215-30 (Aug. 1983).
In order to understand the kinetic behaviour of point defects in β-Nb-3.1 wt.% Zr containing small amounts of impurities, the nucleation and growth process of dislocation loops has been examined during electron irradiation in a high-voltage electron microscope. Small dislocation loops of interstitial character are formed during irradiation at temperatures from 300 to 675K. The density of loops saturates at the beginning of irradiation, and loops grow in proportion to the cube root of irradiation time. The temperature dependence of the saturated loop density under a fixed electron flux consists of five stages. These results, together with the dependence of loop density on electron flux, are analysed in terms of the effect of impurities on the nucleation process of loops and the mobility of point defects. Two kinds of impurity, probably oxygen and nitrogen, act as nucleation sites of loops. The binding energies between a Nb interstitial and each of these impurities are estimated to be $(1.1\pm0.1)\times10^{-19}$ J and $(7.2\pm0.8)\times10^{-20}$ J, respectively, and the migration energy of free Nb interstitials is estimated to be $(3.4\pm0.5)\times10^{-20}$ J. (22 refs.)

107703 The isolated partial and dissociated total dislocations in deformed ZnS crystals. A.V.Zaretskii, Yu.A.Osipyan, V.F.Petrenko, G.K.Strukova, I.I.Khodos (Inst. of Solid State Phys., Acad. of Sci., Moscow, USSR).
Philos. Mag. A (GB), vol.48, no.2, p.279-85 (Aug. 1983).
The dislocation structure of plastically deformed ZnS crystals has been studied using transmission electron microscopy. It is shown that both total and partial dislocations are simultaneously available in the crystal. The total dislocations are dissociated into Shockley partials. (12 refs.)

107704 Disordering and enhanced damping in Cu_3Au. K.Miura, T.Yokoyama (Dept. of Mech. Engng., Yokohama Nat. Univ., Yokohama, Japan).
Philos. Mag. A (GB), vol.48, no.2, p.L1-4 (Aug. 1983).
Amplitude-independent dislocation damping in Cu_3Au is measured during disordering. When disordering takes place homogeneously at higher temperatures an enhanced damping is observed. When it occurs at lower temperatures, however, no enhancement is observed. Based on a mechanism of enhanced damping by dissociation of a superdislocation, it is suggested that the disordering in Cu_3Au immediately above the order-disorder transformation temperature may be characterized, to a certain extent, by an inhomogeneous process. (7 refs.)

107705 Direct observations of the effect of hydrogen on the behavior of dislocations in iron. T.Tabata, H.K.Birnbaum (Dept. of Metall. & Mining Engng., Univ. of Illinois, Urbana, IL, USA).
Scr. Metall. (USA), vol.17, no.7, p.947-50 (July 1983).
Investigates the effects of hydrogen on the behavior of dislocations in iron of various purities by using an in situ deformation technique in the environmental cell of a high voltage electron microscope. This method allows the study of the dynamic behavior of dislocations under stress as hydrogen is added or removed from the specimen. This is the first of a series of papers which will describe the effect of hydrogen on the behavior of dislocations in iron. (10 refs.)

107706 Transverse banding in single crystals of $FeGe_2$ and $Fe_{0.99}Co_{0.01}Ge_2$. A.Yu.Bunkin, A.A.Frolov, S.V.Ustelemov (Ural Polytech. Inst., Sverdlovsk, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.119-21 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.203-5 (Jan.-Feb. 1983). [received: Sept. 1983]
Regular dislocation structures can occur in crystals of $Fe_{1-x}Co_xGe_2$. The authors detect these structures and examine their causes. After mechanical polishing, sections of the crystals were treated with SR-4 etching agent and studied under the optical microscope. (6 refs.)

107707 Dislocation etching of $KClO_4$ single crystals. V.P.Bhatt, R.M.Patel, C.F.Desai (Phys. Dept., Maharaja Sayajirao Univ., Baroda, India).
Surf. Technol. (Switzerland), vol.19, no.4, p.315-19 (Aug. 1983).
Chemical reagents for revealing dislocations which intersect the cleavage surface of $KClO_4$ single crystals were developed using various dispersing media with H_2SO_4. The etching characteristics of the etchants are discussed. In addition, the apparent activation energies involved in the etching process were determined, and the results are reported. (10 refs.)

107708 Formation of point defect clusters in electron-irradiated dilute FCC alloys. T.Ezawa, Y.Kawamata, M.Suehiro, M.Kiritani (Dept. of Materials Phys., Osaka Univ., Osaka, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.380-2
In situ electron irradiation experiments in a high voltage electron microscope have been carried out to study the influence of about 500 at. ppm of solutes on the formation of interstitial type dislocation loops. The addition of Sn, Sb and Ge to Au increases the number density and decreases its temperature dependence. The addition of Cu, Ag, Si, Zn and Mg to Al suppresses the formation of loops in each to a different degree. All the observed results are clearly understood from the strength of interaction of interstitial atoms with solutes which is definitely in the series of the volume size factor of solute atoms in the solvent. A possibility of the fast migration of strongly bound vacancy-solute pairs in gold-based alloys is inferred from the observed smaller temperature dependence of the growth speed of the loops. (7 refs.)

Characterization of extended defects in α-HgI_2 single crystals .... See Entry 106224

Influence of temperature upon dislocation mobility and elastic limit of single crystal HgI_2 .... See Entry 106226

On the theory of X-ray and electron dynamical scattering in crystals with defects .... See Entry 107478

Violations of Friedel's law in real elastically bent crystals .... See Entry 107481

Crystallization of bismuth telluride from a melt containing excess tellurium .... See Entry 107576

Crystallography of dislocations inherited in martensitic transformations and twinning .... See Entry 107586

Cross-slip of twinning dislocations on crossing domain boundaries in ordered Ni_3V .... See Entry 107718

Creep of aluminium single crystals under high pressure .... See Entry 107815

Formation of disperse liquid zones at coherent boundaries in superheated FCC crystals .... See Entry 107881

Weak-beam electron microscopy of radiation-induced segregation .... See Entry 107957

Direct observation of lattice arrangement in MBE grown GaAs-AlGaAs superlattices .... See Entry 108197

Crystalline perfection of heteroepitaxial structures of $Al_{0.3}Ga_{0.7}P_yAs_{1-y}$-GaAs grown from the liquid phase .... See Entry 108203

Mismatch and electron mobility in MBE $Ga_xIn_{1-x}As$ epitaxial layers on InP substrates .... See Entry 108213

$CuGaS_{2x}Se_{2(1-x)}$ solid solutions .... See Entry 109249

Transformation behaviour of laser processed Fe-5%Cr, Fe-5%Ni and Fe-6%Cr-2%Ni alloys .... See Entry 109282

Microindentation kinetics at premelting temperature .... See Entry 109311

Influence of dislocation density on microchemical inhomogeneity of the thermal influence zone of welded Nb alloys .... See Entry 109391

Effects of V-addition and welding method on the change of microstructure during creep process for 308 type stainless weld metals .... See Entry 109402

Examination of the temper brittleness of quenched and tempered low-alloy steels .... See Entry 109494

Fatigue damage to pseudo-α-titanium alloy in the 10-33-Hz frequency range .... See Entry 109504

61.70L Slip, creep, internal friction and other indirect evidence of dislocations

(see also 62.20H Creep, 62.40 Internal friction)

107709 Energy absorption during deformation of yttrium and zirconium. A.L.Samsonik, G.A.Sirenko (Kharkov Univ., Kharkov, Ukrainian SSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.597-600 (1982). [received: Aug. 1983]
Stored strain energy Q_{sto}, i.e. energy accumulated by lattice defects generated by straining, is an important characteristic of plastically deformed crystals. The stored strain energy of hexagonal yttrium and zirconium obtained by the differential pulsed method demonstrates that: (a) the more brittle material (yttrium) stores a greater amount of energy at early deformation states than the more ductile material (zirconium); (b) the dislocation density estimated by stored strain energy is in good agreement with X-ray data. (8 refs.)

107710 $a\langle 100\rangle$ dislocation loops in MgO unusual configurations. G.Kameswara Rao (Advanced Centre for Materials Sci., Indian Inst. of Technol., Kanpur, India).
Phys. Status Solidi a (Germany), vol.78, no.2, p.697-703 (16 Aug. 1983).
A study is made of the formation of dislocation configurations generated at high temperatures as a result of diffused aliovalent impurity in single crystals of magnesium oxide by the gold decoration technique. A number of unusual dislocation loops are observed whose crystallography indicates that new slip sytems, which hitherto are not observed, are activated. The loops are long, narrow, and elongated with spikes developing at right angles to the elongation ([100]-direction). The plane of the loop itself is (100). A mechanism is suggested involving (i) the formation of a long narrow loop elongated along [100]-direction; (ii) spike formation along [010]-direction by the climb of a small portion of the edge dislocation segment constituting the narrow loop. (25 refs.)

107711 Effect of ageing on martensitic transformation during the deformation of metastable austenitic steels. L.S.Malinov, V.I.Konop-Lyashko.
Russ. Metall. (GB), no.3, p.112-15 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.3, p.130-3 (1982).
In the given steels, ageing may cause an ambiguous variation of stacking fault energy (SFE). Pinning the dislocations by the solute atoms during ageing or the precipitation of highly disperse particles causes a marked depletion of austenite in carbon and the alloying elements reduces SFE and destabilises austenite. Ageing should be used to control SFE and, consequently, austenite stability. This makes it possible to optimise the development of martensitic transformation in hardening austenite during loading and as a result obtain a high level of strength and ductility characteristics. (6 refs.)

107712 Use of the extinction effect to analyze the dislocation structures of crystals. A.N.Ivanov, P.I.Klimanek, Yu.A.Skakov (Inst. of Steel & Alloys, Moscow, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.58-61 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.109-14 (Jan.-Feb. 1983). [received: Sept. 1983]
For the traditional model of a mosaic crystal, the authors propose a method of separating the effects of primary and secondary extinction and simultaneously determining the mean block dimension and the angle of misorientation between blocks. The intensity of a reflection from a real crystal is regarded as the sum of the reflections from regions near a dislocation (calculated from the kinematic theory) and from the rest of the crystal (calculated from the dynamic theory). On the basis of this approach, for the case of a chaotic distribution of dislocations, expressions are obtained which enable the authors to find the dislocation density (provided that it does not exceed 10^7-10^8 cm^{-2}) from the value of the extinction parameter $Y=I_e/I_k$. The proposed approach can be used in structural crystallography to make corrections for extinction in analyzing the reflected intensities from polycrystalline aggregates and small single crystals. (12 refs.)

107713 Effect of ultrasound on the dislocation structure of alkali halide crystals in various orientations. E.P.Belozerova, A.A.Svetashov, N.A.Tyapunina (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.202-4 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.346-50 (March-April 1983). [received: Sept. 1983]
The dislocation structure in alkali halide crystals in various orientations is investigated by means of a composite piezoelectric oscillator at a frequency of 73 kHz with relative deformation amplitudes of 10^{-7}-10^{-3}. The authors elucidate the motion and multiplication of dislocations in specimens with nonzero orientation, due to differences in the Schmidt factor for planes of type (110) and to the presence of shear stresses in the transverse glide plane. (11 refs.)

Influence of temperature upon dislocation mobility and elastic limit of single crystal HgI_2 .... See Entry 106226

Cross-slip on the first order pyramidal plane $(10\bar{1}1)$ of a-type dislocations $(\bar{1}210)$ in the plastic deformation of α-titanium single crystals .... See Entry 107699

Investigation of cascade-induced point-defect fluctuations .... See Entry 107750

Mesoscopic and microscopic aspects of the PSB formation mechanism in fatigued FCC monocrystals .... See Entry 107809

Theory for saturation stress difference in torsion versus other types of deformation at low temperatures .... See Entry 107810

Creep in transforming polycrystalline materials .... See Entry 107813

Creep of aluminium single crystals under high pressure .... See Entry 107815

Inverse primary creep .... See Entry 107816

A proposed criterion for fatigue threshold dislocation substructure approach .... See Entry 107818

Influence of substrate deformations on interface structures. I. Theory .... See Entry 108205

Coherence of the phase boundary and deformation in the epitaxial system Ge/GaAs .... See Entry 108206

Influence of plastic deformation on magnetic interaction in $FePt_3$ alloy .... See Entry 108754

Positron studies of Ti-based alloys irradiated by neutrons .... See Entry 109042

Hardening by thermal vacancies and quenching strains in singly-oriented Pb single crystals .... See Entry 109318

Recovery in deformed copper and nickel single crystals .... See Entry 109325

On the recovery and annealing kinetics of cold-worked Ni-4.5 at% Cu alloy .... See Entry 109327

Dynamic recovery and dynamic recrystallization .... See Entry 109333

The formation of vacancies during primary recrystallisation . See Entry 109335

Relationships governing structure formation in the hot working of austenite in alloy steels .... See Entry 109365

Interrelationship between twinning and slip in single crystals of heterophase alloys with a low energy of stacking faults .... See Entry 109392

Effect of swaging on the 1000°C compressive slow plastic flow characteristics of the directionally solidified eutectic alloy γ/γ'-α .... See Entry 109396

Transient creep in iron at low stresses and homologous temperatures 0.40-0.54 .... See Entry 109403

Variations in density of movable dislocations in the zone of microplastic strain .... See Entry 109405

Theoretical and experimental study of the plastic deformation of aluminium single crystals. II: Partially imposed plane compression .... See Entry 109412

Estimation of the yield point of textured polycrystals (with computer calculation of the yield point of titanium) .... See Entry 109418

Orientation dependence of creep behavior of single crystal γ' (Ni_3Al) .... See Entry 109424

Effect of stacking-fault energy on the parameters of high-temperature creep of nickel-cobalt alloys .... See Entry 109426

Influence of creep on the precipitate structure under conditions of long-term creep—investigation of a Fe-Cu model alloy .... See Entry 109431

Strain distribution and load transfer characteristics of a Cu-9.6 wt.% Al dual-phase structure .... See Entry 109432

Regularities in the formation of the shape of scratches on tungsten monocrystals .... See Entry 109496

Strain-induced anodic dissolution of Cu single crystals—effects of specimen geometry and slip morphology .... See Entry 109566

61.70N Grain and twin boundaries

107714 Energy of special grain boundaries deviating from the coherent positions. L.K.Fionova (Inst. of Steel & Alloys, Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.41-6 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A calculation is reported of the additional energy of special boundaries with $\Sigma \leq 17$, associated with the presence of grain-boundary dislocations compensating the deviation of the plane of the boundary from a coherent position. The orientational dependence of this additional energy is obtained for a twin boundary with a symmetric initial orientation of the {111}, {112}, or {110} kind, and also for asymmetric positions. A study is made of the influence of the dislocation component of the grain-boundary energy on the driving force of boundary migration. (9 refs.) *A.T.*

107715 Effects at boundaries of recrystallized twins in overheated FCC crystals. E.S.Kucherenko (Metall. Inst., Dnepropetrovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.155-9 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Formation of disperse liquid zones along coherent boundaries in overheated copper-base alloys with the FCC lattice was observed. This effect was due to decoration, by liquid phase centers, of structure defects in near-twin zones of crystals and it was evidence of a high density of defects near coherent boundaries. Melting around noncoherent twin boundaries confirmed the low value of the energies of the various regions of these boundaries. (9 refs.) *A.T.*

107716 Distribution of the atoms on grain boundaries and in the Bravais cell of the coincidence site lattice. N.An, R.Herrmann (Sektion Phys., Humboldt-Univ. zu Berlin, Berlin, Germany).
Phys. Status Solidi b (Germany), vol.118, no.2, p.691-702 (1 Aug. 1983).
The distribution of the atoms on symmetrical and asymmetrical coincidence grain boundaries in s.c., f.c.c., b.c.c., diamond, and zinc blende lattices is calculated. A general method is developed which allows one to detemine the number of atoms and the structure of the two-dimensional lattice of any grain boundary plane and of the planes next to grain boundary. (8 refs.)

107717 The nature of grain boundary sliding and the superplastic flow. R.Z.Valiev, O.A.Kaibyshev, V.V.Astanin, A.K.Emaletdinov (Ufa Aviation Inst., Ufa, USSR).
Phys. Status Solidi a (Germany), vol.78, no.2, p.439-48 (16 Aug. 1983).
Two types of grain boundary sliding are established and investigated during Zn bicrystal deformation: 'pure' grain boundary sliding (GBS) which is not associated with intragranular sliding (IS) and GBS which develops simultaneously with IS. Both types of GBS exhibit greatly similar structural peculiarities but under identical deformation conditions the second type GBS has a much higher rate with a m_{GBS} parameter decreasing from 1 to 0.4. The comparative analysis of GBS regularities in Zn bicrystals and the superplastic Zn-0.4% Al alloy attests to the fact that 'pure' GBS determines the strain hardening at superplastic deformation while GBS of the second type determines the development of the recovery processes. It is shown that these concepts may serve as a basis for the elucidation of many experimentally observed peculiarities of the superplastic flow—the existence of the initial unsteady and steady state stages, decrease of flow stress after short-term deformation at elevated rates, and others. (28 refs.)

107718 Cross-slip of twinning dislocations on crossing domain boundaries in ordered Ni_3V. G.Vanderschaeve, B.Escaig (Univ. des Sci. et Tech. de Lille, Villeneuve d'Ascq, France).
Philos. Mag. A (GB), vol.48, no.2, p.265-77 (Aug. 1983).
Zigzag propagation of deformation microtwins across the domain structure, as observed by electron microscopy in ordered Ni_3V alloy, is shown to be due to cross-slip of partial dislocations via the stair-rod mode (Fleischer 1959). Twin bands change direction to preserve the long-range order inside domains. The peculiarities of the interaction of twinning dislocations with domain boundaries are studied, and an activation energy for such a cross-slip mechanism is evaluated. It is shown that local stress concentration at the microtwin tip makes cross-slip easier. (21 refs.)

Crystallography of dislocations inherited in martensitic transformations and twinning .... See Entry 107586

A transmission electron microscopy study of hexagonal ice .. See Entry 107700

Surface damage of Cu/Ni alloys by low energy noble gas ion bombardment .... See Entry 107784

The role of grain boundaries in deformation and fracture at high temperatures .... See Entry 107814

Formation of disperse liquid zones at coherent boundaries in superheated FCC crystals .... See Entry 107881

Second phase development in Sr-doped TiO_2 .... See Entry 107947

Size effect, internal stress and diffusion driven boundary motion .... See Entry 108008

Effect of copper on the electrical conductivity of the solid electrolyte $RbAg_4I_5$ .... See Entry 108030

Diffusion induced grain boundary migration in Ni-C alloys ...See Entry 108057

Dependence of the thermal electromotive force of aluminum alloys on the grain size .... See Entry 108393

Spin dependent trapping in a polycrystalline silicon integrated circuit resistor .... See Entry 108435

Electron-beam-induced current measurements in silicon-on-insulator films prepared by zone-melting recrystallization .... See Entry 108578

Experimental studies of laterally seeded recrystallized, polysilicon on silicon dioxide .... See Entry 109176

The occurence, effect, and control of twinned columnar growth in aluminum alloys .... See Entry 109265

The isothermal δ-γ transformation of ferritic-austenitic iron-chromium-nickel alloys .... See Entry 109277

Influence of the texture, grain shape, and substructure of austenite after warm rolling on the martensite structure .... See Entry 109292

Effect of titanium on the grain boundary segregation of phosphorus in Fe-Ti-P and Fe-Ti-C-P alloys and on the embrittlement of steels .... See Entry 109297

A study of antimony segregation in Fe-Ni alloys .... See Entry 109299

Grain-boundary segregation in low-alloy titanium-vanadium alloys .... See Entry 109301

A preliminary study of precipitation in Ti^{4+}-doped polycrystalline alumina .... See Entry 109304

Twinning in heating of cast oxygen-free copper .... See Entry 109358

Extended ductility in Al-Zn-Mg alloys .... See Entry 109386

Interrelationship between twinning and slip in single crystals of heterophase alloys with a low energy of stacking faults .... See Entry 109392

Effect of strain wave shape on low-cycle fatigue crack propagation of type SUS 304 stainless steel at elevated temperatures .... See Entry 109465

Hydrogen pressure dependence of the fracture mode transition in nickel .... See Entry 109479

Regularities in the formation of the shape of scratches on tungsten monocrystals .... See Entry 109496

61.70P Stacking faults, stacking fault tetrahedra and other planar or extended defects

107719 Two kinds of stacking faults in InSb liquid phase epitaxial layers. Yu Zhenzhong, Ma Kejun, Jin Gang (Shanghai Inst. of Tech. Phys., Acad. Sinica, Beijing, China).
Chin. J. Semicond. (China), vol.4, no.4, p.407-9 (July 1983). In Chinese.
The experiments show that, in InSb liquid phase epitaxial layers, there exist two kinds of stacking faults, namely dumbbell- and pole-shaped faults. The feature and structure of the two faults and the interaction between them have been observed. Analysis indicates that the dumbbell-shaped faults belong to intrinsic faults, with Shockley partial dislocation around, while the pole-shaped ones probably belong to extrinsic faults. The mechanism forming the stacking faults is also discussed. (1 ref.)

107720 Multilayer stacking faults in b.c.c. metals. V.Paidar (Inst. of Phys., Czechoslovak Acad. of Sci., Praha, Czechoslovakia).
Philos. Mag. A (GB), vol.48, no.2, p.231-8 (Aug. 1983).
The symmetry of the unrelaxed energy of multilayer stacking faults on the {112} plane in the b.c.c. lattice is studied. The property that the single-layer fault energy does not depend on the sense of displacement in the ⟨111⟩ direction is generalized for multilayer faults. It is pointed out that the triple-layer fault deduced from the structure of the metastable ω phase may be stable, and furthermore that this fault is related to another fault which may be regarded as a distorted close-packed structure. (17 refs.)

Sensitivity of plane wave topography to microdefects .... See Entry 107484

A transmission electron microscopy study of hexagonal ice .. See Entry 107700

Effect of ageing on martensitic transformation during the deformation of metastable austenitic steels .... See Entry 107711

Interrelationship between twinning and slip in single crystals of heterophase alloys with a low energy of stacking faults .... See Entry 109392

Effect of stacking-fault energy on the parameters of high-temperature creep of nickel-cobalt alloys .... See Entry 109426

61.70R Crystal impurities: general

(see also 71.55 Impurity and defect levels; 81.10 Purification techniques)

107721 Computer simulation model of the structure of ion implanted impurities in semiconductors. E.Roman (Scuola Internazionale Superiore di Studi Avanzati, Trieste, Italy), N.Majlis.
Solid State Commun. (USA), vol.47, no.4, p.259-61 (July 1983).
A system of ion implanted impurities in a semiconductor is described by a Monte Carlo simulation of a non-equilibrium system of random distributed hard spheres. The radial distribution function of this system is found. The comparison is made with the fluid hard sphere case. The assumption that the absence either of annealing or diffusion of the impurities after the implantation process is also made. (9 refs.)

X-ray diffraction investigation of the structure of deformed samarium-cobalt alloys .... See Entry 107604

Interaction of an interstitial impurity with a divacancy .... See Entry 107670

Nuclear magnetic resonance study of point defects in aluminium and copper .... See Entry 107679

Influence of impurities on the growth of tin whiskers .... See Entry 108250

Oxygen-related defects in irradiated germanium .... See Entry 108332

Observation of dielectric collapse at excited acceptors in germanium .... See Entry 108857

Origins of impurity-perturbed fluorescent lines of MnF_2 .... See Entry 108998

61.70T Doping and implantation of impurities

107722 Temperature processing effects in proton-implanted *n*-type GaAs. M.A.Mentzer (Advanced Technol. Div., Westinghouse Electric Corp., Baltimore, MD, USA), R.G.Hunsperger, J.M.Zavada, H.A.Jenkinson, T.J.Gavanis.
Appl. Phys. A (Germany), vol.A32, no.1, p.19-25 (Sept. 1983).
Characterization of the effects of thermal processing on the optical and electronic properties of proton implanted *n*-type GaAs is reported in this paper. The thermal processing includes variations in the substrate temperature during implantation and post-implantation thermal annealing. Infrared reflectivity data indicate that the depths to which the optical changes extend in the as-implanted samples are greatest in the cryogenic implants. Carrier concentration profiles derived from capacitance-voltage measurements are shown to have significant differences depending upon processing history. Existence of *n*-type surface layers are noted in high fluence level implants. (20 refs.)

107723 Sn ion doping during GaAs MBE with field ion gun. Y.Bamba, E.Miyauchi, K.Kuramoto, A.Takamori, T.Furuya (Optoelectronics Joint Res. Lab., Kawasaki, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.6, p.L331-2 (June 1983).
Low energy Sn ion doping of growing MBE GaAs at 550°C was made using a liquid metal field ion gun. From Raman measurements, no disordered structures were detected in the grown films. However, the films showed high resistivity and the activation of Sn differed from that of Zn for p-type ion doping previously reported. A broad and weak emission at around 1.28 eV was observed in a photoluminescence spectrum taken at 4.2K. These suggest that radiation damage caused by Sn ion irradiation remains in the films. (11 refs.)

107724 Formation of p^+-layer in GaAs by dual implantation of Zn and As. J.Kasahara, K.Taira, Y.Kato, M.Arai, N.Watanabe (Sony Corp. Res. Center, Yokohama, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.6, p.L373-5 (June 1983).
Dual implantation of Zn and As in GaAs resulted in a p^+-layer superior to that formed by the implantation of Zn only. Dual implantation improved the electrical activity of Zn significantly. The double-peak often observed in the hole concentration profile of the sample by the implantation of Zn only was

eliminated by equal dose co-implantation of As, in which the hole concentration profile was Gaussian-like with a peak at the projected range (R_p) of Zn. The equal dose coimplantation of As also resulted in lower sheet resistance, suggesting that stoichiometry in the implanted layer is essential for activating implanted impurities in GaAs effectively. (9 refs.)

107725 Doping of germanium telluride with bismuth and copper. N.Kh.Abrikisov, O.G.Karpinskii, T.Sh.Makalatiya, L.E.Shelimova (A.A. Baikov Inst. of Metall., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.9, p.1286-504 (Sept. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.9, p.1504-9 (Sept. 1982). [received: Sept. 1983]
It has been shown that double doping of germanium telluride with bismuth an copper produces and increase in the degree of rhombohedral distortion of the lattice of the α phase and in the temperature of the $\alpha \rightarrow \beta$ phase transitions and also an increase in the volume change at the phase transition point for a constant GeTe content as the ratio between the number of bismuth and copper atoms shifts in favor of the latter. It has been shown that the performance of the double doping is determined by the concentration of the copper atoms and by the concentration of the electrically neutral cation vacancies produced in the solid solution matrix by the bismuth tellurides introduced into the GeTe. Differences have been established in the electrophysical properties of the alloys obtained by double doping in relation to the mode of introduction of the copper: as Cu_2Te or as elemental copper. (8 refs.)

107726 Photodoping of Ag into single crystal As_2S_3. T.Imura, K.Kubota, A.Hiraki, K.Tanaka (Dept. of Electrical Engng., Osaka Univ., Osaka, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2459-61 (July 1983).
Photodoping of silver into the cleaved surface of single crystal As_2S_3 (natural orpiment) was observed by electrical resistance measurements and Rutherford backscattering spectrometry. The initial stage of the phenomenon was concluded to be photo-oxidation of silver at the interface between silver and As_2S_3, and was proved to be independent of the amorphous nature like photodarkening observed in amorphous chalcogenides. (9 refs.)

107727 The influence of ion implantation on the thermal oxidation of copper. P.J.Ratcliffe, R.A.Collins (Dept. of Phys., Univ. of Lancaster, Lancaster, England).
Phys. Status Solidi a (Germany), vol.78, no.2, p.547-53 (16 Aug. 1983).
The effect of 31 species of ion implanted impurities on the thermal oxidation of polycrystalline copper, and nine implanted species on the oxidtion of single crystal (110) copper is studied. The majority of these increased the oxidation resistance of the copper, the greatest effect on oxidation being caused by chromium (88% decrease), platinum, and hafnium. An increase in the degree of oxidation is found with increasing ionic radius of the implanted species. A drastic (174%) increase in the oxidation induced by vanadium implantation is associated with changes in the morphology of the oxide. The results generally support a model based on the formation of a p-n junction in the implanted oxide. (35 refs.)

107728 On the effect of ambients on the formation of oxygen-related donors in Cz-Si. K.Schmalz, P.Gaworzewski (Inst. fur Phys. Werkstoffbearbeitung, Akad. der Wissenschaften, Berlin, Germany).
Phys. Status Solidi a (Germany), vol.78, no.2, p.K141-5 (16 Aug. 1983).
In oxygen-rich Si, oxygen-related donors (OD) are introduced due to heat treatment (HT) in the temperature range 600 to 900°C. The authors investigate the effect of ambients on OD formation in Cz-Si. The experimental results show that OD formation can be influenced by the ambient of HT. The OD formation due to HT in oxidizing ambients is retarded compared to HT in inert ambients. In dependence on the temperature of HT the OD formation can even be suppressed due to a preoxidation at high temperatures. (8 refs.)

Application of ion implantation and backscattering techniques to the analysis of nuclear waste glass corrosion .... See Entry 105959

The mechanism of implanted ion tapping in thick targets investigated by Mossbauer technique .... See Entry 106189

Interstitial type defects in ion implanted silicon .... See Entry 107673

Computer simulation model of the structure of ion implanted impurities in semiconductors .... See Entry 107721

Calculation of project ion-range distribution moments in compounds and alloys. I. Range distribution moments for heavy ions ($Z_1 > 10$) .... See Entry 107729

CW laser-annealing behavior of Se^+-implanted InP investigated by ellipsometry .... See Entry 107755

Transient annealing of ion implanted gallium arsenide .... See Entry 107757

Large area electron beam annealing .... See Entry 107764

Metastable Fe(Pd) alloys formed by pulsed electron beam melting .... See Entry 107769

Amorphous Al(Ni) alloy formation by pulsed electron beam quenching .... See Entry 107770

Influence of doping on the liquid-amorphous transition induced by picosecond laser irradiation of Si .... See Entry 107873

Effect of H^+ on the $\beta \rightarrow \alpha$ transition in β-$LiIO_3$ after high pressure treatment .... See Entry 107901

Diffusion of zinc into ion implanted iron doped indium phosphide .... See Entry 108058

Migration of implanted He in stainless steel as observed by trapping at ^{111}In atoms .... See Entry 108065

Absorption of carbon from residual gases during Ti implantation of alloys .... See Entry 108153

Adsorption and electrophysical properties of doped gallium arsenide .... See Entry 108165

High-resistivity ($>10^5$ Ω.cm) InP layers by liquid phase epitaxy .... See Entry 108210

X-ray determination of the surface compression force in the ion-doped layer in silicon .... See Entry 108245

Damaged-induced isolation in *n*-type InP by light-ion implantation .... See Entry 108426

Calculation of the ionization energy of a donor atom near a semiconductor surface .... See Entry 108488

The effect of doping on Fermi level position at a semiconductor-metal interface .... See Entry 108494

Silicon-nickel silicide Schottky barriers formed by ion mixing .... See Entry 108517

Properties and ion implantation of $Al_xGa_{1-x}N$ epitaxial single crystal films prepared by low pressure metalorganic chemical vapor deposition .... See Entry 108579

Epitaxial layers of iron-doped gallium arsenide .... See Entry 108580

Preliminary study of the recoil implanted perturbed angular distribution .... See Entry 108841

A new method for the fabrication of submicron thick gallium arsenide membranes .... See Entry 109145

Chemical conversion of surface and film formation techniques used together with vacuum deposition and ion implantation .... See Entry 109157

Rapid thermal annealing of Se and Be implanted InP using an ultrahigh power argon arc lamp .... See Entry 109339

Rapid thermal annealing of Be, Si, and Zn implanted GaAs using an ultrahigh power argon arc lamp .... See Entry 109340

The amorphous phase and surface mechanical properties of 304 stainless steel implanted with Ti and C .... See Entry 109517

Tribological characteristics of nitrogen (N^+) implanted iron . See Entry 109519

Effect of boron compensation on the photovoltaic properties of amorphous silicon solar cells .... See Entry 109883

61.70W Impurity concentration, distribution, and gradients

(see also 66.30J Diffusion, migration and displacement of impurities)

107729 Calculation of project ion-range distribution moments in compounds and alloys. I. Range distribution moments for heavy ions ($Z_1 > 10$). Xia Yue-yuan (Dept. of Phys., Shandong Univ., China), Yang Hong, Tan Chun-yu, Li Jin-hua.
Acta Phys. Sin. (China), vol.32, no.4, p.423-45 (April 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)* [received: Sept. 1983]
Project range and range distribution moments up to third order for twelve ion species implanted into five different substrates (such as amorphous Al_2O_3, SiO_2, UO_2, $LiNbO_3$ and 20/25/Nb stainless steel) are calculated using an improved nuclear scattering function developed recently. Some results are given for the ions considered with energy range from 5 keV to 1 MeV. The present theoretical results are compared with those published by Gibbons et al. (1975) and Winterbon (1975), and the authors' results are shown to agree with the recent experimental measurements more closely. The calculation method which deals with the range distribution moments in amorphous compounds and alloys is presented in some detail, and a brief discussion on the calculation accuracy is given. (25 refs.)

107730 RBS measurements of the nitrogen concentration in diamonds. A.Katern, E.A.Burgemeister, J.F.M.Westendorp, H.E.Roosendaal (Fakultat fur Phys., Univ. Bielefeld, Bielefeld, Germany).
Mater. Lett. (Netherlands), vol.2, no.1, p.71-3 (July 1983).
The nitrogen content in a depth up to 500 Å of three type IaA, two mixed type and two type IaB diamond plates has been determined by Rutherford backscattering spectroscopy (RBS). The natural concentration of carbon-13 served as an intrinsic reference for an absolute determination of the nitrogen content. The RBS results are compared with the nitrogen concentration, obtained from IR-absorption measurements. (17 refs.)

107731 Measurement of substrate impurity concentration by the use of alpha-particle radiation. C.M.Hsieh, R.R.O'Brien (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.2, p.632-3 (July 1983).
The impurity concentration of a substrate is determined accurately and conveniently in a nondestructive manner by the use of alpha particle radiation. (no refs.)

107732 Physicochemical investigation of melts and single crystals of lithium tantalate. V.F.Tkachenko, M.B.Kosmyna, T.S.Teplitskaya, L.A.Egorova, N.F.Efremova (All-Union Sci.-Res. Inst. of Single Crystals, Scintillation Materials & High-Purity Chem. Substances, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1152-5 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1359-62 (Aug. 1982).
The degree and nature of the contamination of melts and single crystals of lithium tantalate, grown from molybdenum and iridium crucibles, were investigated by X-ray diffractometric, chemical, and optical methods of analysis. It was established that the bulk of the molybdenum impurity is in a lithium tantalate melt in the form of mechanical inclusions, and part (<0.1% by weight) is incorporated into the crystal lattice of lithium tantalate. (2 refs.)

107733 Distribution of Cu between solid CdS and liquid $CdCl_2 + CdS$. M.E.Altosaar, P.L.Kukk (Tallin Polytech. Inst., Tallin, USSR).
Inorg. Mater. (USA), vol.18, no.9, p.1259-62 (Sept. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.9, p.1475-8 (Sept. 1982). [received: Sept. 1983]
Analysis of the electrical and luminescence experimental data on the distribution of copper between solid CdS and liquid $CdCl_2 + CdS$ leads to the conclusion that for $[Cl] > [Cu]$ the main defect caused by the copper in the cadmium sulfide is a single copper atom on the cadmium sublattice associated with one or two chlorine atoms on the sulfur sublattice. (18 refs.)

107734 Calculations on the laser-induced diffusion of surface-deposited dopants on silicon. H.S.Tan, C.K.Ong (Dept. of Phys., Nat. Univ. of Singapore, Singapore).
J. Phys. C (GB), vol.16, no.25, p.5063-72 (10 Sept. 1983).
A theoretical method for the calculations of dopant redistribution in pulsed laser annealing is introduced. A loss mechanism that allows an outflow of dopant atoms across the substrate surface is included in this method. The present work also suggests a triangular approximation to the full melt histories employed in the dopant redistribution calculations. The calculated dopant profiles obtained with the full melt histories and the triangular approximations are compared with the dopant profiles measured with Rutherford backscattering, spectroscopy. In the analysis of laser-induced diffusion of surface-deposited antimony on silicon, it is found that the loss mechanism is essential for the theoretical fitting of the measured dopant profile. The variation of the maximum melt depth with laser energy is also briefly discussed. (14 refs.)

107735 Impurity composition and surface-layer state of diphenyl crystals. E.D.Dukova, A.I.Ogloblina, R.M.Myasnikova (Inst. of Crystallography, Acad. of Sci., USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.86-2 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.146-56 (Jan.-Feb. 1983). [received: Sept. 1983]
On diphenyl crystals formed by recrystallization from powder in an evacuated ampoule, the authors found the distribution of organic impurities by the spectral fluorescence method in the (001) and (111) growth pyramids and in the initial boule. They took the NMR spectrum of the diphenyl powder. They examined the P-T and T-C diagrams for diphenyl and the found impurities (acenapthene and anthracene). On the basis of this investigation they con-

cluded that diphenyl crystals from the vapor phase grow with aid of an intermediate layer of solid and liquid solutions. (14 refs.)

107736 Impurity distribution in KCl crystals. A.B.Vasil'ev, L.D.Kislovskii, S.F.Chernov (Inst. of Crystallography, Acad. of Sci., USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.101-2 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.178-9 (Jan.-Feb. 1983). [received: Sept. 1983]
Investigates the distribution and form of oxygen-containing impurities in KCl crystals grown by the Bridgman and Kyropoulos methods from raw materials of various degrees of purity. The authors used the methods of vacuum decoration at the electron-microscopic level and spectrophotometry. (4 refs.)

High resolution measurement of ^{3}He depth profile ....See Entry 106157

Spark source mass spectrographic analyses of α-HgI$_2$: a comparison of samples from different laboratories ....See Entry 106223

Violations of Friedel's law in real elastically bent crystals ....See Entry 107481

Transverse banding in single crystals of FeGe$_2$ and Fe$_{0.99}$Co$_{0.01}$Ge$_2$ ....See Entry 107706

Temperature processing effects in proton-implanted *n*-type GaAs ....See Entry 107722

A method for studying the self-interstitial trapping at impurity atoms in an irradiated metal and the resulting defect distribution as a function of the temperature ....See Entry 107747

Extremely rapid out diffusion of sulfur in InP ....See Entry 108048

Diffusion and redistribution of carbon in iron and its alloys during deformation ....See Entry 108049

Electronic characteristics of Ge-GaAs interface having chemisorbed oxygen at the GaAs surface ....See Entry 108538

Superconductivity of gallium nitride ....See Entry 108590

Mossbauer effect of ^{57}Fe impurity atoms in TiAl ....See Entry 108842

Purification of mercuric iodide ....See Entry 109120

Rapid thermal annealing of Be, Si, and Zn implanted GaAs using an ultrahigh power argon arc lamp ....See Entry 109340

Structural irregularities in solid (Pb$_{1-x}$Sn$_x$)$_{1-y}$Te$_y$ solutions after annealing in a temperature gradient ....See Entry 109371

Hydrogen pressure dependence of the fracture mode transition in nickel ....See Entry 109479

Effect of palladium additions to AISI 4130 steel on its sulfide cracking susceptibility ....See Entry 109596

Estimation of depth profiles of boron in silicon on ion beam etched sloping cuts by means of neutron induced autoradiography ....See Entry 109831

Quantitative autoradiography of semiconductor materials with phosphorus diffusion standards ....See Entry 109832

61.70Y Interaction between different crystal structure defects

107737 Trapping of hydrogen by substitutional and interstitial impurities in α-iron. A.I.Shirley, C.K.Hall (Dept. of Chem. Engng., Princeton Univ., Princeton, NJ, USA).
Scr. Metall. (USA), vol.17, no.8, p.1003-8 (Aug. 1983).
The elastic and electronic interactions of hydrogen with substitutional and interstitial impurities in α-iron are calculated. The study of trapping of hydrogen in iron is of practical interest to the iron and steel industry since trapping can suppress hydrogen embrittlement. To understand better the relationship between trapping and embrittlement it is helpful to be able to predict which impurities will trap hydrogen and to quantify the magnitude of this interaction. The results of the calculation on substitutional impurities show that all of the impurities considered here have an elastic interaction with hydrogen in iron which is attractive. The electronic interaction, however, is found to be attractive for impurities which lie to the left of iron in the periodic table but is repulsive for impurities lying to the right. (34 refs.)

107738 Elastic interaction in dislocations with orthorhombic and [001]-monoclinic point defects in HCP crystals. M.M.Savin, V.M.Chernov (Physicoenergetic Inst., Obninsk, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.62-5 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.115-22 (Jan.-Feb. 1983). [received: Sept. 1983]
By methods of the anisotropic theory of elasticity the authors calculate the interaction energy of dislocations with all orientations of orthorhombic and [001]-monoclinic point defects (elastic dipoles) in crystals with hexagonal close-packed structure. The following slip systems are considered: basal, $(0001)1/3\langle 11\bar{2}0\rangle$, prismatic $\{10\bar{1}0\}$ $1/3\langle 11\bar{2}0\rangle$ and $\{10\bar{1}0\}$ $\langle 0001\rangle$, second-order pyramidal $\{11\bar{2}2\}$ $1/3\langle 11\bar{2}3\rangle$, and first-order pyramidal $\{10\bar{1}1\}$ $1/3\langle 11\bar{2}0\rangle$ and $\{10\bar{1}1\}$ $1/3\langle 11\bar{2}3\rangle$. Calculations are made for edge and screw dislocations in all these slip systems except for the first-order pyramidal $\{10\bar{1}1\}$ $1/3\langle 11\bar{2}3\rangle$ in which mixed and screw dislocations are considered. The resulting expressions include as a special case the well-known expressions for trigonal and hexagonal point defects. In contrast, orthorhombic defects (four of six orientations) and [001]-monoclinic defects (all 12 orientations) interact with screw dislocations with Burgers vectors $b=1/3\langle 11\bar{2}0\rangle$. Like trigonal and hexagonal point defects, orthorhombic and [001]-monoclinic defects do not interact with screw dislocations with $b=\langle 001\rangle$. (10 refs.)

107739 Calculation of interaction energy between atomic defects in BCC transition metals: vacancy-vacancy, vacancy-vacancy cluster, and vacancy impurity pairs. K.Masuda (Dept. of Materials Sci. & Engng., Tokyo Inst. of Technol., Yokohama, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.105-8
A tight-binding type electronic theory is used to calculate the atomic relaxations and binding energies E_{bin} of the vacancy-type lattice defects in BCC transition metals. The short-range repulsive energies between neighbouring atomic sites are simulated by a Born-Mayer potential. Binding energies of di-vacancies, small vacancy clusters (up to tetra-vacancies) and vacancy-interstitial impurity pairs are obtained using the direct energy minimization procedure. It is shown that E_{bin} and electronic density of states of d-electrons around the vacancy-type lattice defects (calculated using the recursion method) are very sensitive to the structure of atomic defects (configuration of vacancies). (12 refs.)

107740 Pseudopotential formulation of point defect interactions in metals. O.Takai, M.Doyama, Y.Hisamatsu (Dept. of Metall. & Materials Sci., Univ. of Tokyo, Tokyo, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.109-12
The electronic interactions between various point defects have been formulated using the pseudopotential theory. The distortions of the lattice around point defects were conventionally neglected because of their great complexity. The authors considered a vacancy, nonsplit interstitials, split interstitials, a substitutional impurity, nonsplit interstitial impurities, and split interstitial impurities as point defects. The formulation has been carried out for twenty-one types of the effective interaction potentials between two point defects denoted above. (9 refs.)

107741 Interactions between point defects in HCP metals. O.Takai, M.Doyama, Y.Hisamatsu (Dept. of Metall. & Materials Sci., Univ. of Tokyo, Tokyo, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.113-16
The vacancy-vacancy, vacancy-interstitial, interstitial-interstitial, vacancy-impurity (both substitutional and interstitial types), interstitial-impurity, and impurity-impurity interaction potential have been calculated in Mg, Zn, and Cd using the Ashcroft model potentials and the Hubbard-Sham exchange and correlation corrections in the dielectric function of the conduction electrons. The binding energies of a divacancy, sixteen kinds of vacancy-substitutional impurity pairs, and sixteen kinds of substitutional impurity pairs have also been calculated. The interaction potentials have been applied to the study of small point-defect clusters, for which the configurations and the binding energies have been discussed. (6 refs.)

107742 Dipolar point defect interactions with stress fields. Y.Kogure, W.K.B.Ho, A.V.Granato (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.153-5
Elastic dipole-stress interactions are discussed in the light of ultrasonic experiments. Especially examined is the characteristic behavior of quantum dipoles. Experiments on RbCl:OH systems are shown to prove a suitable example, and static bias stress experiments have been developed to obtain information about internal stresses in crystals. (4 refs.)

107743 Interstitial-impurity interactions in aluminum and copper alloys. A.V.Granato (Dept. of Phys. & Materials Res. Lab., Univ. of Illinois, Urbana, IL, USA), J.Holder, K.L.Hultman, D.L.Johnson, G.G.Setser, P.Wallace, H.Wong.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.360-3
Ultrasonic attenuation and velocity measurements have been made in Al-Mn, Al-Fe, Al-Zn, Al-Ag, Al-Zn-Fe, Al-Mg and Cu-Ag irradiated with 2.5 MeV electrons. Both dielastic and parelastic effects are obtained as well as an ultrasonic determination of the resistivity change for interstitial concentrations of the order of few ppm. Both the dielastic and parelastic effects show strong polarization effects. The frequency and annealing temperature dependence provide information on reorientation, binding and migration enthalpies and frequency factors. In general, several peaks appear which are specific to each impurity. Although Fe and Mn have similar mass and size differences with Al, the results for the two alloys are very different, contrary to expectations from existing theory. Evidence for the caged mixed dumbbell configuration is obtained for Al-Zn and Al-Ag. In Al-Zn, it is found additionally that the mixed dumbbell tunnels between equivalent configurations and disappears near 140K without dissociating. In contrast to Al alloys with undersized impurities, the peaks in Al-Mg and Cu-Ag are smaller and increase with annealing near 130K before disappearing in Stage III. The changes in peak heights correlate well with resistivity changes. (9 refs.)

107744 Molecular dynamics study of interstitial-solute interactions in irradiated Al-based alloys. N.V.Doan (Section de Recherches de Metall. Phys., CENS, Gif sur Yvette, France), N.Q.Lam, L.Dagens, Y.Adda.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.372-5
The stable configurations and binding energies of interstitial and di-interstitial-solute complexes in Al-Be, Al-Ca, Al-K, Al-Li, Al-Mg and Al-Zn alloys were calculated using the molecular dynamics technique in conjunction with interatomic potentials derived entirely from theoretical considerations and not fitted to any experimental data. All the results reported are thus of a first-principle nature. (11 refs.)

107745 Interaction between self-interstitial and solute atoms in gold. K.Nakata, J.Takamura, K.Furukawa (Dept. of Metal Sci. & Technol., Kyoto Univ., Kyoto, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.376-9
The interaction between self-interstitial (I) and solute (S) toms has been examined in electron-irradiated gold: (a) The radiation-induced resistivity rapidly increases for solutes that differ from the solvent in atomic size by more than 20%. (b) Undersized solutes such as Cu and Ni interact strongly with self-interstitial atoms, and show two distinct substages connected with a long plateau in stage II, which are responsible for the dissociation of $IS \rightarrow I+S$ and $I_2S \rightarrow I_2+S$, whose energies are about 0.3 and 0.5 eV, respectively. (c) Oversized solutes such as Sb and Sn increase markedly the amount of recovery in stage II, and in particular Pb with an extraordinarily large atomic size has specific trapping configurations different from other oversized solutes. (12 refs.)

107746 Self interstitial atom interactions with point defects and impurities in Cu, Al, Ag matrices. F.Maury, P.Lucasson (Univ. Paris-Sud, Orsay, France), A.Lucasson, P.Vajda, C.Dimitrov, O.Dimitrov, J.Le Hericy, G.Mathieu.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.383-8
The interaction radii of self interstitial atoms with vacancies and a number of impurities in the pure metals and dilute alloys of Cu, Ag, Al have been determined by electrical measurements and the stage I_d-I_e recovery analysis method. The discussion of the results leads to reassess the well known damage build up method used in the unsaturable trap approximation. It is concluded that this approximation may be inadequate in numerous cases. The methods complement each other and should be used in parallel. (24 refs.)

107747 A method for studying the self-interstitial trapping at impurity atoms in an irradiated metal and the resulting defect distribution as a function of the temperature. F.Maury, P.Lucasson (Univ. Paris XI, Orsay, France).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.389-91
Presents a rapid survey and analysis of the reasons of the discrepancies between the values given by either one of the two methods traditionally used for determining trapping radii, r_t, of self-interstitials by impurities: the recovery method and the damage rate method. The two main factors which are to be taken into account and can lead to wrong estimates if neglected, are the multiple trapping which governs the cluster formation, and the decrease in resistivity which can result from the trapping, especially in the case of mixed dumbbell formation. It is shown that only a combination of the two methods, both involving the same kind of analysis based on a simple chemical rate model, can provide a reliable value of $R_t=(r_t/r_v)$ when nothing is known of the various possible trapping configurations. (13 refs.)

107748 Interaction between vacancies and hydrogen atoms in aluminum. E.Hashimoto, K.Ono, Y.Murakami, T.Kino (Lab. of Crystal Phys., Hiroshima Univ., Hiroshima, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.496-9
Hydrogen permeation through aluminum was measured by using a quadrupole mass spectrometer, and the hydrogen diffusivity was determined. The diffusivity depends on the concentration of vacancies relative to that of dissolved hydrogen. At high temperatures where the vacancy concentration is much larger than that of hydrogen, the activation energy of hydrogen diffusion is near the migration energy of a vacancy in aluminum. The results suggest a strong interaction between a hydrogen atom and a vacancy. Furthermore, the binding energies between a hydrogen atom and solutes were discussed in a similar experiment on Al-Mg and Al-Si alloys. (11 refs.)

107749 The interactions between gas impurities and defects in Mo studied by the positron annihilation technique. B.Nielsen, A.van Veen, L.M.Caspers, W.Lourens (Lab. of Appl. Phys. II, Tech. Univ. of Denmark, Lyngby, Denmark), W.Wierzchowski, H.E.Hansen, G.Trumpy, K.Petersen.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.500-3
The interaction between gas impurities and defects in Mo has been studied by the positron annihilation technique. It was possible to observe interaction with vacancy loops, vacancies and voids. Hydrogen was shown to decorate vacancy loops, whereas no interaction with voids was detected. The observed interaction of a gas impurity with voids is most likely due to nitrogen. The presence of nitrogen in interstitial position leads to a strongly enhanced vacancy production by electron irradiation. Isochronal annealing of two nitrogen doped and electron irradiated samples showed nitrogen filling of vacancies at around 160°C, which the authors attribute to interstitial migration of nitrogen. The free migration of vacancies in stage III, i.e. around 240°C, was totally suppressed, i.e. no clustering of vacancies or loss to sinks was observed. (10 refs.)

Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V .... See Entry 105037

Interaction of an interstitial impurity with a divacancy .... See Entry 107670

Dynamics of absorption of host interstitial atoms by vacancy pores .... See Entry 107671

PAC study of point defects in metals .... See Entry 107678

Nature of point defects and their interactions revealed by electron-microscope observation of their clusters .... See Entry 107682

Ultrasonic studies of dipolar point defects .... See Entry 107683

Unsolved problems concerning point defects .... See Entry 107684

Study of self-interstitial-atom solute-atom-complexes by mechanical relaxation .... See Entry 107690

Ion channeling investigations of the interactions between irradiation-produced defects and solute atoms in metals .... See Entry 107793

Comments on 'Mechanical strengthening and impurity precipitation behaviour for divalent cation-doped alkali halides' .... See Entry 107811

Extremely rapid out diffusion of sulfur in InP .... See Entry 108048

Oxygen-related defects in irradiated germanium .... See Entry 108332

Mossbauer studies of defect-impurity interaction and impurity diffusion in metals .... See Entry 108850

Heterodyne correlation of scattered light from a Sr^{++}-doped NaCl crystal. A feasibility study .... See Entry 108965

Photothermal creation of $Cu^0v_a{}^+$ centres and mobility of anion vacancies in X-irradiated KCl:Cu crystals .... See Entry 109008

Interstitial interaction in W observed by relaxation measurements .... See Entry 109383

61.80 RADIATION DAMAGE AND OTHER IRRADIATION EFFECTS

(for techniques of structure determination, see 61.10 to 61.16; for electron and ion impact phenomena, see 79.20)

107750 Investigation of cascade-induced point-defect fluctuations. H.Gurol (Sci. Applications Inc., La Jolla, CA, USA), W.G.Wolfer.
J. Nucl. Mater. (Netherlands), vol.117, p.244-9 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
High energy irradiation produces collision cascades, which occur randomly in space and time. Any given point in the material will therefore be subject to intermittent arrival of interstitials and vacancies, even under steady irradiation. The conventional rate theory formulation of the point-defect concentrations, which contains spatial and time averaging and a uniform production rate, may not always adequately describe processes such as void nucleation and irradiation creep. The author develops a theoretical approach to describe the cascade-induced point-defect fluctuations by their moments. The first moment, giving the average point-defect concentration, is used in the traditional rate theory. However, the second moment provides the variance of the point defect concentration, and it becomes important for processes such as void nucleation, dislocation climb, and loop growth. An approximate analytical expression is given for the second moment. The obtained concentration variances compare well with numerical results. It is demonstrated with the example of climb-induced dislocation glide how the moments can be used to extend rate theory results. Large enhancement in the creep rate due to point defect fluctuations can be obtained if the barrier size and the average climb rate are small and if the cascade size is large. (10 refs.)

107751 The effect of neutron and He-irradiation on the crack modes of type 316 stainless steel. T.Hanamura, W.A.Jesser (Dept. of Materials Sci., Univ. of Virginia, Charlottesville, VA, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.308-19 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
An investigation was carried out in order to determine the crack opening mode (Mode I and Mode II) during in situ HVEM tensile testing and how it is influenced by neutron and helium irradiation, and test temperature. Mode II crack opening was observed as grain boundary sliding initiated by a predominantly Mode I crack steeply intersecting the grain boundary. Mode II crack opening was absent in neutron- or helium-irradiated specimens tested between 400°C and room temperature, but could be restored by a post-irradiation anneal. (8 refs.)

107752 Displacement cascades in polyatomic materials. D.M.Parkin, C.A.Coulter (Los Alamos Nat. Lab., Los Alamos, NM, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.340-4 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
Using a continuous slowing-down, random amorphous material model, the authors have studied displacement cascades in a number of diatomic materials. They review a number of previously obtained results that elucidate the effect of atomic mass, reocil enegy, displacement energy, capture energy and material stoichiometry on the numbers of displacements in a cascade. The displacement cascade reveals a complex structure that is dependent on the type of irradiation and the material properties. Conclusions related to damage analysis for fusion reactors are given. (13 refs.)

107753 Incoherent focused radiation for activation of implanted InP. J.P.Lorenzo, D.E.Davies, K.J.Soda, T.G.Ryan, P.J.McNally (Rome Air Dev. Center, Hanscom AFB, MA, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.683-8
InP layers implanted with Si^+ ions are successfully activated through the use of a focused incoherent energy source. High mobility values and excellent carrier concentrations, both directly comparable to values attained using conventional furnace annealing, are achieved with this technique. Under optimized anneal conditions, electrical evaluation also indicates no surface anomalies such as those encountered with pulsed laser or electron beam annealed InP. (8 refs.)

Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V .... See Entry 105037

Testing and evaluation of solidified high-level waste forms .... See Entry 105981

Molecular dynamics study of interstitial-solute interactions in irradiated Al-based alloys .... See Entry 107744

A method for studying the self-interstitial trapping at impurity atoms in an irradiated metal and the resulting defect distribution as a function of the temperature .... See Entry 107747

A kinetic model for self-interstitial trapping at solutes .... See Entry 108014

Interstitialcy transport in dilute alloys under irradiation .... See Entry 108021

'Uphill' diffusion of vacancies and the instability of irradiated materials .... See Entry 108068

Linear zone-melt recrystallized Si films using incoherent light .... See Entry 108241

Comment on the determination of ρ_F from damage-rate measurements .... See Entry 108375

Contact resistance of Al/Si ohmic electrodes formed by rapid lamp sintering .... See Entry 108549

Nature of radiation effects in laminated MOS structures. A review .... See Entry 108563

Review of the effect of external action (heat treatment, deformation, irradiation) on the luminescence of GaAs .... See Entry 108994

Irradiation-induced photodarkening in As-Se-Cu amorphous films .... See Entry 109032

Formation of nickel and palladium silicides by a short-pulse light-flash and its application in the metallization of solar cells .... See Entry 109897

61.80B Laser beams

107754 Test for nonthermal transient annealing in silicon. J.E.E.Baglin, R.T.Hodgson (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), J.M.Neri, R.Fastow.
Appl. Phys. Lett. (USA), vol.43, no.3, p.299-301 (1 Aug. 1983).
The proposition that nanosecond pulsed laser annealing of implanted silicon is accomplished by electron plasma interactions (below 1700K) has been tested by comparing the threshold energy densities required for epitaxial regrowth, using intense pulsed beams of B^+ and Ba^+ ions. Thresholds for 250-ns pulsed B^+ (210 keV) (90% electronic energy deposition in Si) and Ba^+ (285 keV) (44% electronic, 56% collisional) are identical, indicating that the mode of initial energy coupling to the solid is not important. The results agree with quantitative predictions for a normal thermal melting process. (8 refs.)

107755 CW laser-annealing behavior of Se^+-implanted InP investigated by ellipsometry. M.Mizuta, J.L.Merz (Dept. of Electrical & Computer Engng., Univ. of California, Santa Barbara, CA, USA).
Appl. Phys. Lett. (USA), vol.43, no.4, p.375-7 (15 Aug. 1983).
Damage removal of Se^+-implanted InP after CW Ar^+ laser annealing has been monitored by measurement of the optical extinction coefficient *k*. A gradual decrease in *k* as a function of laser power is observed for room-temperature ion-implanted InP samples, compared to a sharp decrease in *k* for ion-implanted Si. These data and electrical measurements indicate that the ion-implantation damage removal process for InP is more complex than for Si. (16 refs.)

107756 Temperature distribution in CW CO_2 laser annealed silicon samples. L.Nanu, E.Cojocaru, I.N.Mihailescu (Central Inst. of Phys., IPTRA, Magurele, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.5, p.425-9 (1983).
A numerical treatment of the thermal phenomena during cw CO_2 laser annealing of implanted semiconductors is presented. The nonlinear heat equation with source term was solved using a Crank-Nicholson implicit method. The temperature distribution in the silicon sample for two values of the incident laser power is comparatively given. (11 refs.)

107757 Transient annealing of ion implanted gallium arsenide. J.S.Williams (JMRC, Faculty of Engng., Royal Melbourne Inst. of Technol., Melbourne, Australia).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.621-32
Provides a brief overview of the application of transient annealing to the removal of ion implantation damage and dopant activation in GaAs. It is shown that both the liquid phase and solid phase annealing processes are more complex in GaAs than those observed in Si. Particular attention is given to observations of damage removal, surface dissociation, dopant redistribution, solubility and the electrical properties of GaAs. The various annealing mechanisms are discussed and areas in need of further investigation are identified. (62 refs.)

107758 Neutron activation measurements of As and Ga loss during transient annealing of GaAs. A.Rose, J.T.A.Pollock, M.D.Scott (Div. of Chem. Phys., CSIRO, Sydney, NSW, Australia), F.M.Adams, J.S.Williams, E.M.Lawson.
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.633-9
Significant dissociation is normally detected under non-optimised transient annealing of GaAs. The authors have utilised neutron activation to measure As and Ga loss from virgin and implanted material annealed under various transient conditions. Complementary RBS data are reported. In particular, surface dissocation has been measured as a function of pulsed ruby laser power and for several combinations of time and surface temperature using an incoherent light source and a vitreous carbon strip heater. The results indicate that neutron activation analysis offers a powerful tool to identify the conditions required to minimise GaAs dissociation during annealing. For example, ruby laser pulses of energy 0.29-1.38 J cm^{-2} caused As loss of 4-90$\times 10^{14}$ cm^{-2}. (13 refs.)

107759 Pulsed UV laser irradiation of ZnS films on Si and GaAs. H.S.Reehal, C.B.Thomas, J.M.Gallego, G.Hawkins (Dept. of Appl. Phys., Univ. of Bradford, Bradford, England), C.B.Edwards.
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.677-82
Pulsed XeCl (308 nm) and XeF (351 nm) laser annealing of undoped and Mn-implanted single crystal and polycrystalline ZnS films deposited upon either Si or GaAs substrates is described. Annealing energy densities in the range ~0.6-2.5 J cm^{-2} have been employed, with the specimens held under an Ar environment at ~100-200 psig pressure. Film thicknesses in the range ~0.2-1.0 μm have been investigated, with the substrates cleaned in various ways prior to deposition. In all the cases investigated, laser annealing results in polycrystalline regrowth of the films as shown by RHEED analysis. Furthermore the RHEED patterns obtained are consistent with the presence of both the cubic and the hexagonal phases of ZnS, except for thin (~0.2 μm thick) films annealed above ~2 J cm^{-2}. These show a purely cubic structure on both Si and GaAs, possibly due to regrowth from the underlying cubic substrates. (10 refs.)

107760 Pulsed laser melting of metallic glasses. A.K.Jain, D.K.Sood (Nuclear Phys. Div., Bhabha Atomic Res. Centre, Bombay, India), G.Battaglin, A.Carnera, G.Della Mea, V.N.Kulkarni, P.Mazzoldi, R.V.Nandedkar.
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.703-8
Studies pulsed ruby laser melting of metallic glasses—Fe40Ni40P14B6 and Fe40Ni40B20. Both amorphous and crystallised samples were used, and some of them were implanted with Ru to serve as a marker species. SEM measurements on surface topography and RBS depth profiling of Ru marker redistribution were used to establish melting above about 1 J/cm^2. Heat flow calculations and liquid phase diffusion analysis of the Ru marker species under a moving melt front have been performed. The flat Ru depth profiles at high energy densities arise from convection effects. Results on crystallised and amorphous samples are similar. TEM measurements of quenched regions on a crystallised sample show an unexpected absence of amorphous phase. (15 refs.)

Reconstruction of the intensity distribution of heating radiation from the thermal damage profile of a thin plate .... See Entry 106800

***Q*-switched frequency-doubled Nd:YAG laser surface finishing of metals** ....
....See Entry 106904

Laser-generated glassy phases ....See Entry 107559

Calculations on the laser-induced diffusion of surface-deposited dopants on silicon ....See Entry 107734

Influence of doping on the liquid-amorphous transition induced by picosecond laser irradiation of Si ....See Entry 107873

Impurity redistribution studies on laser-formed silicides .... See Entry 108063

Electron- and photon-stimulated desorption benefits and pitfalls ....
....See Entry 108192

Electrical defect analysis following pulsed laser irradiation of unimplanted GaAs ....See Entry 108348

A study of the Hall coefficient and electrical conductivity of thin CdHgTe films subjected to laser irradiation .... See Entry 108581

Liquid phase growth of epitaxial Ni and Co silicides :............ See Entry 109170

Oxidation of thin Cd, Cu and Te films under continuous laser irradiation ....
....See Entry 109557

61.80C X-rays

Paramagnetic centres in X-irradiated $LiNaSO_4$ single crystal: A comment ....
....See Entry 108781

Reply to comments on 'Paramagnetic centres in X-irradiated $LiNaSO_4$ single crystals' ....See Entry 108782

Photothermal creation of $Cu^0v_a{}^+$ centres and mobility of anion vacancies in X-irradiated KCl:Cu crystals ....See Entry 109008

Thermoluminescence studies in KBr_xI_{1-x} mixed crystals ....See Entry 109024

Optical absorption and thermoluminescence of KCl single crystals coloured under DC fields ....See Entry 109027

Thermoluminescence of Z_3 centres in X-irradiated Ca-doped KCl crystals ....
....See Entry 109028

61.80E Gamma rays

107761 Donor complexes with interstitial indium atoms following low-temperature gamma irradiation of indium antimonide. F.A.Zaitov, O.V.Gorshkova, A.Ya.Polyakov.
Inorg. Mater. (USA), vol.18, no.11, p.1528-30 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1781-3 (Nov. 1982).
From an analysis of data in the literature it is concluded that with low-temperature gamma irradiation of n-InSb, complexes of donor atoms with interstitial indium atoms are formed. These complexes correspond to an acceptor level $E_c = -0.03$ eV. The acceptors at $E_v = +0.04$ eV formed after n-p conversion in n-InSb with low-temperature gamma irradiation are most probably complexes of donor atoms with two interstitial indium atoms. (10 refs.)

107762 Debonding of epoxy from glass in irradiated laminates. C.E.Klabunde, R.R.Coltman,Jr. (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.345-50 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
Glass fabric filled epoxies irradiated at 4.7K and examined at room temperature by 20× stereomicroscopy showed an internal flaw structure which increasingly filled the sample as the γ dose was increased. These flaws were determined to be areas where the plastic had debonded from the glass fibers. The extent of this process correlated well with the dose-dependent loss of mechanical strength. Evidence is reported for a similar mechanism in polyimides although visible flaws have not yet been produced. Possible mechanisms for debonding are suggested. New experiments are also suggested to further clarify the failure mechanism. (5 refs.)

107763 The effect of gamma radiation on the mechanical properties of corundum. V.Brozek (Inst. of Chem. Technol., Prague, Czechoslovakia), M.Matusek, J.Zemlicka.
Silikaty (Czechoslovakia), vol.27, no.3, p.245-51 (1983). In Czech.
Radiation of the ^{60}Co brings about changes in the mechanical properties of corundum within the dose range 0.1-2.0 MGy. Above the statistical 5% significance level, the most pronounced effect is a decrease in microhardness of monocrystals prepared by the Verneuill method, a decrease in the individual strength of corundum polycrystalline grains, and a decrease in the elasticity modulus of the monocrystals. On the other hand, the brittleness of polycrystalline corundum increases together with the values of secondary mechanical characteristics, such as an increasing grinding ability of free and bound corundum abrasives. The respective changes can be explained by the creation of radiation defects which reduce the bond strength in the corundum crystal structure. (8 refs.)

Gamma photon backscattering in gauging ....See Entry 105436

Scattering of 1.1732- and 1.3325-MeV gamma rays through small angles by carbon, aluminum, copper, tin, and lead ....See Entry 106377

Critical behavior in the heat capacity of ferroelectric TGS, TGSe, and TGFB .
....See Entry 107972

Thermal transport in heavily deformed and γ-irradiated LiF at temperatures near 1K .... See Entry 108082

Effect of γ -irradiation on EPR spectra of Eu^{2+} doped KCl and NaCl crystals
....See Entry 108779

Pulsed polarization reversal in gamma-irradiated crystals of triglycine sulfate ..
....See Entry 108895

Nickel centers in strontium tartrate tetrahydrate single crystals ....
....See Entry 108984

Intense exoelectron emission from fine particles of Al_2O_3 and its dependence on the conductivity of the substrate material .... See Entry 109118

61.80F Electrons and positrons

107764 Large area electron beam annealing. C.A.Moore, J.J.Rocca, T.Johnson, G.J.Collins (Colorado State Univ., Fort Collins, CO, USA), P.E.Russell.
Appl. Phys. Lett. (USA), vol.43, no.3, p.290-2 (1 Aug. 1983).
The authors have achieved wide area (38 cm^2) electron beam annealing of ion implanted silicon wafers using a glow discharge electron beam with electron energies between 3 and 7 keV. A continuous beam 7 cm in diameter with a power density up to 90 W/cm^2 was used to anneal the 7-cm-diameter central portion of boron-implanted (30 keV, 5$\times 10^{15}$ atoms/cm^2) *n*-type ⟨100⟩ silicon wafers 10 cm in diameter. Annealing was obtained without redistribution of the original dopant profile using a 15-s electron beam exposure. Due to the high electron beam power density achieved over a large area, one can uniformly anneal an entire wafer in a single exposure without sample or beam scanning. (7 refs.)

107765 Investigation of localized annealing by electron beams. H.T.Sun, R.A.McMahon, H.Ahmed (Dept. of Engng., Cambridge Univ., Cambridge, England).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.827-31 (July-Sept. 1983).
An improved method of localized annealing with electron beams—selective repeat electron beam scanning (SREBS)—is described. The annealed region better delineated than with single scan localized annealing. Three characteristic types of cross sections, perpendicular to an annealed line have been investigated to determine the extent of e-beam induced damage in the ion implanted layer and the substrate. The resolution of the annealed region is limited by edge phenomena caused by the local temperature gradient. (6 refs.)

107766 Radiation-induced defect formation in InSb doped with Gd, Ge, Cu, Ag, Zn, and Cd. F.A.Zaitov, O.V.Gorshkova, A.Ya.Polyakov, A.I.Popkov, M.D.Khlystovskaya.
Inorg. Mater. (USA), vol.18, no.11, p.1525-8 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1777-80 (Nov. 1982).
The electrical properties of indium antimonide strongly doped with gadolinium are determined at low temperatures by acceptors with E_v=0.012-0.014 eV, as probably being complexes of indium vacancies with oxygen. The effect on these properties of 25 MeV electron irradiation is also studied. In p-InSb crystals weakly doped with Gd a major role is played by uncontrolled contaminant impurities (copper). The concentration of holes in p-InSb crystals doped with Gd changes significantly more slowly than in the case of the other impurities. (17 refs.)

107767 The kinetics of electron-beam dispersion of polymers when obtaining coatings. A.V.Rogachev, V.V.Kharitonov (Inst. of Railroad Transport Engrs., Gomel, USSR).
J. Eng. Phys. (USA), vol.44, no.1, p.88-90 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.105-8 (Jan. 1983). [received: Sept. 1983]
The kinetics of the variation in surface charge is considered, taking into account its destruction when acted upon by a beam of electrons. The experimentally established features of dispersion kinetics can be explained by the presence of a surface charge. (4 refs.)

107768 Electron beam processing of semiconductors. H.Ahmed, R.A.McMahon (Engng. Dept., Cambridge Univ., Cambridge, England).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.653-64
Electron beams can transfer energy very efficiently to semiconductors. Systems have been developed for rapid heating to temperature around 1000°C under a variety of conditions from adiabatic to isothermal. Pulsed, focused, line and synthesized shaped beams are used to obtain a wide range of thermal cycles. The following applications are described: the annealing of ion-implanted Si, particularly the activation of As implants and shallow implants ($R_p < 150$Å), the annealing of Si and Se in GaAs, the e-beam processing of implanted silicon devices and the improvement of SOS substrate quality. Localized annealing by a computer controlled e-beam and the recrystallization of deposited films on insulators are also considered. (33 refs.)

107769 Metastable Fe(Pd) alloys formed by pulsed electron beam melting. D.M.Follstaedt, J.A.Knapp (Ion Solid Interactions, Sandia Nat. Lab., Albuquerque, NM, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.745-50
Fe(Pd) surface alloys formed by either ion implanting Pd into Fe or by vapor depositing Pd on Fe have been examined after pulsed ($\sim$70 nsec) electron beam melting. TEM and ion backscattering/channeling showed that the implanted alloys with up to 9.6 at.% Pd were BCC and epitaxial with the substrate, in spite of predictions of initial solidification to the FCC phase by the Fe-Pd phase diagram. The resolidified Pd films, however, were FCC as predicted by the diagram. The defect structures observed in these alloys are discussed. (7 refs.)

107770 Amorphous Al(Ni) alloy formation by pulsed electron beam quenching. S.T.Picraux, D.M.Follstaedt (Sandia Nat. Lab., Albuquerque, NM, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.751-6
The microstructural transition from the epitaxial crystalline to amorphous state as a function of Ni concentration is examined in Al(Ni) alloys formed by ion implantation and e-beam melt quenching. The evolution from epitaxial crystalline Al at $\lesssim$3.5 at.% Ni to amorphous phase formation at 15-30 at.% Ni is characterized in detail for 8, 10 and 12% Ni uniform concentration samples by ion channeling and transmission electron microscopy. The transition occurs via complete loss of epitaxial regrowth at 9 at.% and the formation of a fine-grained polycrystalline Al, with grain size decreasing with increasing Ni from 20-100 Å at 10% Ni concentration to $\lesssim$ $\lesssim$0-50 Å at 12% Ni. (8 refs.)

107771 Paraelasticity in electron-irradiated molybdenum. B.Beuneu, Y.Quere (SESI, CEN, Fontenay-aux-Roses, France).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.156-8
The relaxation of a radiation-induced point defect—most probably the rotation of a $\langle 110 \rangle$ dumbbell—is observed during isothermal anneals of irradiated molybdenum, by resistivity measurements. The recovery of close pairs is not affected, in first analysis, by the presence of a uniaxial stress. (14 refs.)

107772 The low temperature recovery in electron-irradiated BCC transition metals. H.Kugler, I.A.Schwirtlich (Inst. fur Phys., Max-Planck-Inst. fur Metall., Stuttgart, Germany), S.Takaki, U.Ziebart, H.Schultz.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.191-4
New results are reported on the isochronal recovery of the electrical resistivity of ultra-high-purity Mo, Fe, Nb, and Ta following low temperature electron irradiation. (10 refs.)

107773 Stage III recovery in electron-irradiated BCC transition metals. H.Kugler, I.A.Schwirtlich (Inst. fur Theoretische und Angewandte Phys., Univ. Stuttgart, Stuttgart, Germany), S.Takaki, K.Yamakawa, U.Ziebart, J.Petzold, H.Schultz.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.520-2
New results are reported on ultra-high purity and impurity doped materials. Characteristic impurity influences on stage III are observed, due to metallic solute atoms, impurity interstitials as C, O, N, and by H solute atoms. (13 refs.)

Observation of monovacancies in iron by the μSR technique .See Entry 107677

Nuclear magnetic resonance study of point defects in aluminium and copper .... See Entry 107679

Self-interstitial-atoms and their agglomerates in HCP metals .... See Entry 107681

Nature of point defects and their interactions revealed by electron-microscope observation of their clusters .... See Entry 107682

X-ray diffraction studies on the interstitials in high-purity iron .... See Entry 107686

Atomic defects in BCC transition metals .... See Entry 107688

Vacancies in carbon-doped iron .... See Entry 107692

Nucleation and growth process of dislocation loops in electron-irradiated β-Nb-3.1 wt.% Zr alloy .... See Entry 107702

Interaction between self-interstitial and solute atoms in gold .... See Entry 107745

The interactions between gas impurities and defects in Mo studied by the positron annihilation technique .... See Entry 107749

Weak-beam electron microscopy of radiation-induced segregation .... See Entry 107957

A method for investigating migration of point defects .... See Entry 108020

The mobility of vacancies and interstitials in Ag-Cu studied by high-voltage electron microscopy .... See Entry 108022

Electron- and photon-stimulated desorption benefits and pitfalls .... See Entry 108192

Characteristics of recrystallised polysilicon on SiO$_2$ produced by dual electron beam processing .... See Entry 108240

Oxygen-related defects in irradiated germanium .... See Entry 108332

Low-temperature investigations of the system α-R(H, D)$_x$ with R=Er, Tm, Lu after quench and/or electron irradiation .... See Entry 108390

Enhancement of electrical conductivity of polyacetylene by electron beam irradiation in the presence of dopant .... See Entry 108396

The influence of annealing on the resistivity of irradiated n-GaP samples .... See Entry 108412

Radiation-induced conductivity in polyethylene .... See Entry 108420

DLTS investigations of Si-SiO$_2$ interface states of electron-beam irradiated MOS structures .... See Entry 108568

Electron-beam-induced current measurements in silicon-on-insulator films prepared by zone-melting recrystallization .... See Entry 108578

ESR studies of electron irradiated $K_3Ir(CN)_6$ in KCl single crystals. Mono and di-chlorinated species .... See Entry 108774

Mossbauer study of cage motion in Ag^{57}Co/^{57}Fe .... See Entry 108840

Optical absorption in InP crystals with point radiation defects .... See Entry 108900

Extended X-ray absorption fine structure of electron-irradiated dilute aluminium alloys .... See Entry 109053

Phase diagrams under irradiation .... See Entry 109236

Mechanical relaxation effects of self-interstitial-atoms in molybdenum .... See Entry 109381

61.80H Neutrons

107774 Effect of irradiation on the parameters of neutron-transmutation-doped silicon. L.S.Berman, I.N.Voronov, I.V.Grekhov, P.M.Grinshtein, M.A.Morokhovets, A.D.Remenyuk (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1052-6 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1249-52 (Aug. 1982).
Reduction of the fast neutron component in the neutron flux allows higher parameters to be obtained for neutron-transmutation-doped (NTD) silicon (smaller spread in ρ, higher values of τ, lack of deep centres with a complex energy spectrum, more perfect structure). Differences in the spectra are observed for samples of neutron-transmutation-doped silicon obtained under various irradiation conditions when the samples are subjected to heat treatment at 1170K. High-temperature heat treatment during preparation of diode structures ensures complete annealing of radiation defects, but causes the appearance of new deep centres. (13 refs.)

107775 Effects of 14 MeV neutron irradiation on creep of nickel and niobium. W.Barmore, A.Ruotola, E.Raymond (Materials Sci. Div., Lawrence Livermore Nat. Lab., Livermore, CA, USA), A.Mukherjee.
J. Nucl. Mater. (Netherlands), vol.117, p.258-63 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
Flux, stress and temperature effects on the creep strength of nickel and niobium were observed in situ at the RTNS-II 14 MeV neutron source at Lawrence Livermore National Laboratory. Creep tests were done on Ni and Nb near 0.3 T_m with stresses to 280 MPa in a high vacuum test unit using a digital computer for control and data acquisition. Cyclic flux tests produced dramatic changes in creep rate. This creep behaviour is attributed to the point defect fluctuations in the crystal structure. Analysis of creep and stress relaxation under steady state flux indicates that an intermediate temperature, thermally activated deformation mechanism is rate controlling. (16 refs.)

107776 Crack propagation characteristics in neutron irradiated type 316 stainless steel microspecimens. R.D.Gerke, W.A.Jesser (Dept. of Materials Sci., Univ. of Virginia, Charlottesville, VA, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.320-6 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
In order to better relate the macroscopic mechanical behaviour of irradiated alloys to their associated microstructural condition, unirradiated and neutron irradiated microspecimens were tensile tested at 25-600°C in a quantitative load elongation stage while under continuous observation in a high voltage electron microscope (HVEM). The microtensile specimens, 40 μm thick, of type 316 stainless steel were irradiated at ambient temperature to a fluence of 1×10^{22} n/m^2 with 14 MeV neutrons in the Lawrence Livermore Rotating Target Neutron Source II (RTNS) facility. Crack angles, directions and length plotted against total specimen elongation were used to describe the manner in which a crack progressed through each specimen. Rapid crack propagation is accompanied by rapidly changing crack angles and direction and conversely slow propagation corresponds to slowly changing variables. A graph of cumulative crack length plotted against total elongation exhibits a slope which increases as specimen ductility decreases. This graph reflects changes due to the effect of neutron irradiation. (11 refs.)

107777 Mechanical, thermal, and microstructural properties of neutron-irradiated SiC. J.C.Corelli, J.Hoole, J.Lazzaro, C.W.Lee (Dept. of Nuclear Engng., Rensselaer Polytech. Inst., Troy, NY, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.7, p.529-37 (July 1983).
The thermal and electrical conductivities, fracture strength, swelling, and microstructure of sintered alpha-phase SiC and siliconized reaction-bonded SiC materials were studied before and after irradiation with reactor neutrons. The effects of helium gas on the properties were studied using boron enriched in ^{10}B to produce helium from ^{10}B(n, α)^{7}Li. The decrease in thermal conductivity after irradiation is due to enhanced phonon scattering by radiation-induced defects. Electrical, mechanical, and thermal properties exhibit partia recovery after heat treatment to 1000 to 1500K. An overall consistency is observed in radiation-produced property changes and annealing and a mode is presented to explain the changes. (28 refs.)

107778 A two-function α-particle model for radiation damage caused by 14-MeV neutrons. I.Yu.Abdrashitov, S.P.Vagin, V.F.Reutov, A.V.Yushkov R.R.Yanke (Inst. of Nuclear Phys., Acad. of Sci., Alma-Ata, Kazakh SSR).
Sov. Phys.-Tech. Phys. (USA), vol.28, no.2, p.226-30 (Feb. 1983). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.53, no.2, p.369-76 (Feb. 1983). [received Sept. 1983]
It is shown by comparing radiation damage in terms of two critical correlation functions, the primary ejected atom (PEA) energy spectrum and th nuclear reaction product (NRP) mass spectrum, that damage to structura materials caused by 14-MeV neutrons can be stimulated using α particles o energy between 20 and 30 MeV. Alpha particles are much more efficient i

producing radiation-induced defects than the 17-MeV protons usually used to simulate neutron-induced damage. Findings from an experimental investigation of correlations in damage to molybdenum caused by 17-MeV protons and 28-MeV α particles are reported. (28 refs.)

107779 Recovery of lattice spacing in HCP metals after fast-neutron irradiation at 5K. H.Maeta (Div. of Phys., JAERI, Ibaraki, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.149-52
Recovery of the c-axis and a-axis spacing in Cd, Zn, and Mg after fast neutron irradiation at 5K was measured in the range from 5 to 300K by the X-ray diffraction method. The ratio of a fractional change of the c-axis spacing to that of the a-axis spacing by fast-neutron irradiation, $(\Delta c/c_0)/(\Delta a/a_0)$, was found to be 3.4 for Cd, 2.1 for Zn and -0.3 for Mg, respectively. Recovery mechanisms of defects in HCP metals are discussed. (10 refs.)

Vacancies in carbon-doped iron .... See Entry 107692

The effect of neutron and He-irradiation on the crack modes of type 316 stainless steel .... See Entry 107751

A method for investigating migration of point defects .... See Entry 108020

^{57}Fe Mossbauer study on point defects in pure iron .... See Entry 108851

Positron angular correlation in uncoloured and neutron irradiated LiF and LiF:OH .... See Entry 109039

Positron studies of Ti-based alloys irradiated by neutrons .... See Entry 109042

Phase diagrams under irradiation .... See Entry 109236

Effect of disorder on the martensitic phase transformation in Nb_3Sn .... See Entry 109289

Elastic modulus change in Mo due to Frenkel defects .... See Entry 109382

Interstitial interaction in W observed by relaxation measurements .... See Entry 109383

An apparatus for determining the deformability of a material in a complex strain state with neutron irradiation from the Neitron 9 unit .... See Entry 109669

61.80J Ions

(for ion implantation, see 61.70T)

107780 Effect of beam energy and anneal history on trivalently bonded silicon defect centers induced by ion beam etching. R.Singh, S.J.Fonash (Engng. Sci. Program, Pennsylvania State Univ., University Park, PA, USA), P.J.Caplan, E.H.Poindexter.
Appl. Phys. Lett. (USA), vol.43, no.5, p.502-4 (1 Sept. 1983).
Ion beam etching produces a modified layer at the surface of silicon which subsequently affects the electrical characteristics of devices fabricated on these surfaces. In this investigation it is shown that the modified layer resulting from low-energy ion beam processing contains a fundamental defect which has the signature of a trivalently bonded, silicon defect center. The evolution of the signature of this defect with ion beam energy and anneal history correlates with the evolution of the current-voltage characteristics of metal contacts made to the modified layer. (11 refs.)

107781 Depth profiling of helium irradiation damage in niobium. I.Nashiyama, T.Nishijima.
Bull. Electrotech. Lab. (Japan), vol.47, no.6, p.433-40 (1983). In Japanese.
A depth damage profile is measured by ⟨111⟩ and ⟨110⟩ axial proton channeling backscattering with incident energy of 0.8, 1.0 and 1.3 MeV at room temperature. Irradiation damages are introduced by 0.8 MeV helium ion bombardment with a fluence of 4.42×10^{17} ions/cm^2. An almost flat damage profile with a slight peak at its edge is observed to extend within the whole penetration area of helium implants. This profile differs remarkably from a theoretical damage-introduction profile given by Brice (1975), suggesting strong migration of primary defects towards the specimen surface. An anisotropy of the damage is found: damage concentrations measured by ⟨111⟩ axial channeling are almost twice as high as those measured by ⟨110⟩ channeling. (18 refs.)

107782 First stage of agglomeration or irradiated helium in refractory metals. N.Kobayashi.
Bull. Electrotech. Lab. (Japan), vol.47, no.6, p.469-78 (1983). In Japanese.
Thermal desorption spectrometry has been applied to the study of the agglomeration of irradiated helium in refractory metals—vanadium, niobium, molybdenum and tungsten. After single crystals are irradiated with 100 keV helium ions with fluences of 2×10^{13} to 2×10^{15} ions/cm^2 at room temperature, thermal desorption spectra and absolute partial pressure of reemitted helium are measured with a calibrated quadrupole mass filter. Values of helium dissociation energy are calculated by a computer-simulation method in the case of vanadium. Using the values of dissociation energy, desorption peaks are assigned to the trapped modes of irradiated helium. (29 refs.)

107783 Surface damage and crystallization in amorphous alloys by helium ion bombardment. N.Hayashi, T.Takahashi, I.Sakamoto, H.Sekiguchi.
Bull. Electrotech. Lab. (Japan), vol.47, no.6, p.479-88 (1983). In Japanese.
The effects of 40 keV helium ion irradiation on amorphous alloys and stainless steel have been studied by topographical examination of their surface with a scanning electron microscope and measurement of the surface magnetism by conversion electron Mossbauer spectroscopy. In amorphous alloy $Fe_{40}Ni_{40}P_{14}B_6$ surface blistering is observed after irradiation at ~400°C with a total dose of 1×10^{18} ions/cm^2. The surface damages are found to be associated with a crystallization in the alloy. Mossbauer spectra taken from the damaged region reveal the existence of paramagnetic phases and ferromagnetic phases with small internal fields. The surface damage is not observed for amorphous alloy $Fe_{80}B_{20}$ irradiated with 40 keV helium ions to a dose of 3×10^{18} ions/cm^2. The Mossbauer spectra, on the other hand, show that α-iron phases appear in the near surface region without formation of crystalline iron borides. The critical dose for the crystallization is 5×10^{17} ions/cm^2. Results of investigation into ferromagnetic layer formation on the surface of type 304 stainless steel irradiated with helium ions are also given. Magnetically split peaks are detected in the Mossbauer spectrum of the bombarded surface. (35 refs.)

107784 Surface damage of Cu/Ni alloys by low energy noble gas ion bombardment. H.Shimizu, M.Ono, K.Nakayama.
Bull. Electrotech. Lab. (Japan), vol.47, no.6, p.505-24 (1983). In Japanese.
Compositional changes of the surface and near-surface layers in Cu/Ni alloys during noble gas ion bombardment from room temperature to 873K have been studied by means of microprobe Auger spectroscopy (μ-AES), X-ray microanalysis (XMA) and scanning electron microscopy (SEM). After sputtering at room temperature, the surface is enriched with nickel by the selective sputtering of copper. With the increase in the specimen temperature sputtering at a high dose rate results in further nickel enrichment. On the other hand copper segregation is observed at a low dose rate. A long range depletion of copper in the order of 100 nm in thickness is observed depending on the sputtering time, specimen temperature and ion beam density. From the depth profile of the copper depleted region, the enhanced diffusion coefficients of copper in the ion-damaged layer are measured. The apparent activation energy calculated, assuming an Arrhenius type equation, is 5 to 6 kcal/mol. It is suggested that an interstitial type diffusion mechanism is predominant in the damage layer. The depletion of copper is of the order of a few μm along the grain boundary for the sputtering at 873K. (64 refs.)

107785 The development of surface morphological features on crystalline materials by 30 keV Ar$^+$ ion bombardment. D.Ghose, D.Basu, S.B.Karmohapatro (Saha Inst. of Nuclear Phys., Calcutta, India).
Indian J. Phys. Part B, vol.57B, no.2, p.133-48 (April 1983). [received: Sept. 1983]
The development of conical protrusions, a frequently appearing phenomenon in sputtering experiments, is studied on Cu, Ni and Ag metals as a function of ion dose and crystal orientation. The results are discussed in the light of different physical mechanisms proposed for their formation. (28 refs.)

107786 Void formation and solute segregation in ion-irradiated niobium-base alloys. B.A.Loomis, S.B.Gerber (Materials Sci. & Technol. Div., Argonne Nat. Lab., Argonne, IL, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.224-33 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
The void-volume fraction is in unalloyed Nb and Nb-base binary alloys containing either ~2.4 a/o Mo,Ti,Zr,Hf,Ni,Fe,V or Ta has been determined from observations of specimens by transmission electron microscopy following 3.0-MeV $^{58}Ni^+$ ion irradiation at 1225K to ~50 d.p.a. Also, the thermal- and irradiation-induced segregation of these substitutional-atom solutes to the specimen surface and within the irradiation-damaged layer have been determined by us of the Auger Electron Spectroscopy technique. In addition, the segregation of the intrinsic, interstitial-O impurity (~0.06 a/o) in these irradiated or annealed materials has been determined. The void-volume fraction and the segregation of solutes have been shown to be correlated by the solute diffusivity and the relative chemical affinity of the substitutional solutes for O. The correlated diffusion of vacancy defects and O atoms is postulated to explain the experimental results. (30 refs.)

107787 Effect of microstructure on light ion irradiation creep in nickel. C.H.Henager,Jr., E.P.Simonen, E.R.Bradley (Pacific Northwest Lab., Richland, WA, USA), R.G.Stang.
J. Nucl. Mater. (Netherlands), vol.117, p.250-7 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
The concept of inhomogeneous slip or localized deformation is introduced to account for a weak dependence of irradiation creep on initial microstructure. Specimens of pure nickel (Ni) with three different microstructures were irradiated at 473K with 15-17 MeV deuterons in the Pacific Northwest Laboratory (PNL) light ion irradiation creep apparatus. A dispersed barrier model for climb-glide (CG) creep was unable to account for the observed creep rates and creep strains. The weak dependence on microstructure was consistent with the stress induced preferential absorption (SIPA) creep mechanism but a high stress enhanced bias had to be assumed to account for the creep rates. Also, SIPA was unable to account for the observed creep strains. The CG and SIPA modeling utilized rate theory calculations of point defect fluxes and transmission electron microscopy for sink sizes and densities. (23 refs.)

107788 Pulsed proton beam annealing of Co-Si thin film systems. L.J.Chen (Dept. of Materials Sci. & Engng., Nat. Tsing Univ., Hsinchu, Taiwan), L.S.Hung, J.W.Mayer, J.E.E.Baglin.
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.709-14
Cobalt (~300 Å) and $CoSi_2$ (~1000 Å) thin films on Si have been annealed by intense proton beams. RBS and TEM are performed to study ion beam annealing effects. For ion beam energy densities above about 1 J/cm^2, epitaxial $CoSi_2$ layers were formed for both Co and polycrystalline $CoSi_2$ on Si. At low energy densities, Co_2Si was found to coexist with Co. The results are discussed in terms of eutectic melting processes. (7 refs.)

107789 Pulsed ion beam interface melting of PtCr and CrTa alloys on Si structures. C.J.Palmstrom, R.Fastow (Dept. of Materials Sci. & Engng., Cornell Univ., Ithaca, NY, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.715-20
Composition profiles of thermal and pulsed ion beam annealed PtCr/Si and CrTa/Si have been determined using Rutherford backscattering analysis. Thermal annealing resulted in layered phase separation with Pt-silicide in the PtCr/Si case, and $CrSi_2$ in the CrTa/Si case, forming at the Si surface. Pulsed ion beam annealing, 300-380 keV protons at energy densities ~0.75-1.6 J/cm^2, produced interface melting with no layered phase separation. (16 refs.)

Temperature processing effects in proton-implanted *n*-type GaAs .... See Entry 107722

The effect of neutron and He-irradiation on the crack modes of type 316 stainless steel .... See Entry 107751

A two-function α-particle model for radiation damage caused by 14-MeV neutrons .... See Entry 107778

Position-dependent stopping power for channeled ions .... See Entry 107792

Ion channeling investigations of the interactions between irradiation-produced defects and solute atoms in metals .... See Entry 107793

Pulsed ion beam technique for measuring diffusion coefficient of a slow diffusant in polymers .... See Entry 108047

Whisker growth and cone formation on metal surfaces under ion bombardment .... See Entry 108249

Damaged-induced isolation in *n*-type InP by light-ion implantation .... See Entry 108426

Preliminary study of the recoil implanted perturbed angular distribution .... See Entry 108841

Absolute measurements of thermal reemission of incident helium ions .... See Entry 109078

Phase diagrams under irradiation .... See Entry 109236

Tribological characteristics of nitrogen (N$^+$) implanted iron .... See Entry 109519

61.80L Atoms and molecules

The dependence of the high temperature mechanical properties of austenitic stainless steels on implanted helium .... See Entry 106164

The resistance of 9 Cr-1 MoVNb and 12 Cr-1 MoVW steels to helium embrittlement .... See Entry 106165

61.80M Channelling, blocking and energy loss of particles

(see also 29.70 Energy loss and range relations)

107790 Dechanneling anomalies of high-energy ions at the charge-density-wave transition in 1*T*-TaS$_2$. T.Haga, Y.Abe (Dept. of Nuclear Engng., Hokkaido Univ., Sapporo, Japan), Y.Okwamoto.
Phys. Rev. Lett. (USA), vol.51, no.8, p.678-81 (22 Aug. 1983).
Backscattering yields of 1.00-MeV He$^+$ ions on 1*T*-TaS$_2$ are reported from room temperature to 120K. The temperature dependence of the backscattering yield exhibits the softening of an acoustic mode and an optical mode. An anomalously large peak in the backscattering yield with large hysteresis was observed around the nearly commensurate to commensurate transition temperature, indicating existence of a disordered state. A small peak around 280K was observed on heating, indicating existence of a new transition in this material. (12 refs.)

107791 Radiation at planar channeling of relativistic electrons in thick crystals. V.N.Baier, V.M.Katkov, V.M.Strakhovenko (Inst. of Nuclear Phys., Novosibirsk, USSR).
Phys. Status Solidi b (Germany), vol.118, no.2, p.499-509 (1 Aug. 1983).
The distribution kinetics with respect to the transverse energy at electron channeling is discussed. The asymptotic expressions for the radiation intensity into a given collimator at electron channeling in thick crystals are derived. An optimal thickness at which the radiation output is maximal is found. The spectral distribution of the radiation intensity is analysed for the case of a single diamond crystal. (10 refs.)

107792 Position-dependent stopping power for channeled ions. O.H.Crawford, C.W.Nestor,Jr. (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1260-6 (Sept. 1983).
A method is developed for predicting the stopping power of crystals toward swift channeled ions, based on a semiempirical treatment of the dielectric response of the medium. Random stopping power is also obtained. Theoretical results are compared with the experimental channeled stopping power of gold as a function of ion velocity and position within channels. It is shown that the theory is accurate when the velocity of the ion equals at least twice the root-mean-square velocity (estimated from binding energies) of most of the electrons near its path. (30 refs.)

107793 Ion channeling investigations of the interactions between irradiation-produced defects and solute atoms in metals. L.M.Howe (Chalk River Nuclear Labs., AECL Res. Co., Chalk River, Ontario, Canada).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.53-8
Ion channelling investigations in various metals have shown that small solute atoms trap self-interstitial atoms to form the mixed dumbbell configuration, in which a solute atom and a host atom straddle a lattice site. Recent data are presented concerning the production of mixed dumbbells and the nature of the trapping configurations resulting from irradiation of dilute Al alloys with He and Kr ions. The channeling technique is also now providing information on the trapping of vacancies by solute atoms. The growth of trivacancy-solute atom, tetravacancy-solute atom and hexavacancy-solute atom complexes caused by vacancy trapping at large solute atoms in the FCC metals Al and Cu during annealing in stage III following low temperature irradiations is discussed and evidence is presented for trapping of vacancies at large solute atoms in BCC Fe. (20 refs.)

On the measurement of surface step heights by low-loss imaging in STEM .... See Entry 107502

Channeling studies of defect trapping configurations in aluminum .... See Entry 107691

Calculation of project ion-range distribution moments in compounds and alloys. I. Range distribution moments for heavy ions (*Z*$_1$>10) .... See Entry 107729

Depth profiling of helium irradiation damage in niobium .... See Entry 107781

Structural studies of InGaAs/GaAs and GaAsP/GaP strained-layer superlattices by ion channeling .... See Entry 108201

Elementary surface excitations and electron energy loss spectroscopy .... See Entry 109074

62.00 MECHANICAL AND ACOUSTIC PROPERTIES OF CONDENSED MATTER

(see also 46.30 Mechanics of solids and rheology, 61.70 Defects in crystals, 68.25 Surfaces and interfaces, 81. Materials science; for thermomechanical effects, see 65.70; for magnetomechanical effects, see 75.80; for piezoelectric effects, see 77.60; for elasto-optical effects, see 78.20H)

62.10 MECHANICAL PROPERTIES OF LIQUIDS

(for viscosity of liquids, see 66.20)

107794 Viscoelastic properties of liquid pentachlorobiphenyl under pressure using depolarized light scattering. P.Bezot, C.Hesse-Bezot (Lab. de Phys. de la Matiere Condensee, Univ. de Nice, Nice, France), P.Pruzan.
Can. J. Phys. (Canada), vol.61, no.9, p.1291-6 (Sept. 1983).
A study of the depolarized light scattering spectra of high pressure supercooled pentachlorobiphenyl is presented. From the analysis of the propagative shear doublet, the infinite shear modulus G_∞ is measured over a large pressure range, at various temperatures, up to a pressure where the liquid is in a glassy state. $G_\infty(P)$ is found to vary linearly at each temperature. From values of G_∞ (P=0.1 MPa) together with those obtained in a previous paper at P=0.1 MPa as a function of T, it is concluded that $G_\infty(T)$ is linear over 70°C, contrary to what is generally obtained in most of the supercooled molecular liquids. (15 refs.)

107795 Density and viscosity of melts in the system Pb-Sn-Te and critical rates of growing Pb$_{1-x}$Sn$_x$Te single crystals by the Czochralski method. V.F.Mikhailov, A.M.Sokolov, E.B.Sokolov, O.V.Pelevin (Moscow Inst. of Electronic Engng., Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1078-80 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1278-80 (Aug. 1982).
The viscosity and density of liquid solutions have been determined in the system Pb-PbTe-SnTe-Sn with solidus isoconcentrates for Pb$_{1-x}$Sn$_x$Te (x=0.20) single crystals. Diffusion coefficients and the thickness of the diffusion layer have been calculated for the melt compositions investigated. The critical growth rates of Pb$_{1-x}$Sn$_x$Te single crystals have been calculated for the whole range in which solid solutions exist, as well as of Pb$_{0.8}$Sn$_{0.2}$Te single crystals grown from solution and melts in the Pb-PbTe-SnTe-Sn system for certain temperature gradients. (8 refs.)

107796 Experimental determination of propanol-1 P, ρ, T data. Z.R.Zakar'yaev (Phys. Inst., Acad. of Sci., Makhachkala, USSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1261-2 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.796-8 (Nov. 1982). [received: Sept. 1983]
The constant volume piezometer method is used to obtain P, ρ, T data for propanol-1 at temperatures of 150-370K and pressures of 0.1-80 MPa. (5 refs.)

107797 Model of elastic deformation in describing the stretching of polymer solutions. A.N.Prokunin (Inst. of Problems of Mech., Acad. of Sci., Moscow, USSR).
J. Eng. Phys. (USA), vol.44, no.1, p.35-41 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.44-51 (Jan. 1983). [received: Sept. 1983]
The tension of solutions in the case of large elastic strains can be described by means of rheological equations for cross-linked rubber. (9 refs.)

107798 Determination of the first and second normal stress differences in the truncated-cone-and-plate apparatus. I. Measurements on a polyisobutylene/decalin solution. G.A.Alvarez, A.S.Lodge, H.-J.Cantow (Inst. fur Makromolekulare Chem., Univ. Freiburg, Freiburg, Germany).
Polym. Bull. (Germany), vol.10, no.5-6, p.256-63 (Aug. 1983).
The steady state radial pressure distribution in the truncated cone-and-plate (TCP) apparatus has been measured for a highly elastic polyisobutylene solution in cis-trans decalin (M_W=4300 kgmol^{-1} M_W/M_n=2) at eight shear rates from 1 to 270 s^{-1} and temperatures of 3.0, 20.0, 30.0 and 46.0°C. The slope of pressure, corrected for inertia by the classical formula, versus the logarithm of radius provides a combination of normal stress differences N_1+2N_2 with a typical experimental scatter of 1% at all measured temperatures and shear rates. The plots of N_1+2N_2 versus shear rate can be shifted, without loss of accuracy, by means of the time-temperature superposition principle, the shift factors strictly adhering to a WLF equation. Extrapolated rim pressures, when corrected for elastic hole pressure with a theoretical equation, give values to the second normal stress difference with typically less than 10% of experimental scatter. Contrary to previous analyses of the TCP apparatus, the center-hole pressure is found to give a useful estimate of the second normal stress difference, although there are insufficient data at present to perform the differentiation of a nonlinear function required in the analysis of the data. (9 refs.)

107799 Elastic deformation of nematic liquid-crystal media. A.N.Bulygin, L.G.Shaltyko.
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.240-2 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.405-8 (March-April 1983). [received: Sept. 1983]
In a magnetic field H, elastic deformations of nematic liquid crystals (NLC) are realized: 'twist', and longitudinal and transverse 'bend'. The initial orientations of a uniformly oriented NLC are planar and homeotropic; a measure of the deformation is the angle of rotation of the axes of anisotropy ϕ. The dependence of ϕ on z and H is found from the equations of the continuum theory. The authors' aim was to find and investigate the exact solutions of these equations. (2 refs.)

Discontinuous Freedericksz transition in the smectic C phase .... See Entry 107523

Breakdown of conventional hydrodynamics for smectic-*A*, hexatic-*B*, and cholesteric liquid crystals .... See Entry 107537

Behavior of sodium near melting point found by measurement of sound velocity .... See Entry 107832

Change of ultrasonic wave velocity in indium near the melting point .... See Entry 107833

Determination of the thermodynamic properties of water from measurements of the speed of sound in the temperature range 251.15-293.15K and the pressure range 0.1-350 MPa .... See Entry 107970

Partial molar volumes and partial molal adiabatic compressibilities of nitroamminecobalt(III) complexes in water at 25°C .... See Entry 107983

Dependence of interfacial tension of plane isotropic liquid-nematic liquid crystal boundary on elastic constants and phase transition parameters .... See Entry 108121

Partial molal volumes of some halobenzenes in carbon tetrachloride .... See Entry 109782

62.20 MECHANICAL PROPERTIES OF SOLIDS (RELATED TO MICROSCOPIC STRUCTURE)

(see also 81.40 Treatment of materials and its effects on microstructures and properties, 81.70 Materials testing)

107800 Statistical evaluation of the mechanical strength of insulators. V.Cerny, J.Chmelicek.
Energetika (Czechoslovakia), vol.33, no.6, p.247-9 (June 1983). In Czech.
The author presents statistical evaluation data of Spirelec insulators, gathered over a period from 1977 to 1982. The type L 100 BH 550 insulator is characterised by a spiral-shaped hood and internal cementing. During piece tests, these insulators are subjected to stressing by 100 kN for 1 minute, this being the nominal tensile strength of the insulator. The test led to the scrapping of a considerable number of insulators. After complete assessment by means of Weibulls' division, a new test value in the range below 100 kN was estimated on the basis of the earlier measurements. Suitability of employing the described statistical method for assessing acceptance of type L 100 BH 550 insulators was thus verified. (5 refs.)

107801 Restoration of components of diesel-electric locomotives. V.A.Babenko, V.A.Vetrennikova, A.P.Nefedov.
Elektr. & Teplovoznaya Tyaga (USSR), no.5, p.26-8 (May 1983). In Russian.
Restoration of worn components of diesel-electric locomotives by building up by the electrolytic deposition of iron is a process widely used in the USSR. The cathode is the workpiece, the anode is a rod or disc of low-carbon steel and a hot chloride electrolyte is used. Details of the process and the mechanical properties (micro-hardness, wear resistance, porosity, etc.) of the built-up layer are given. (no refs.) *H.E.G.*

Growth and physical properties of Ln_2GeSe_5, $Ln_2Ge_2Se_7$, $Ln_2Ge_3Se_9$ single crystals .... See Entry 107578

Study of thermal properties, electrical conductivity, and the crystallization process of the glassy alloy $SeGe_{20}$ .... See Entry 108085

Precipitation of helium and its effects on mechanical properties of metals .... See Entry 109310

Effect of heat treatment temperature (HTT) on density, weight and volume of glass-like carbon (GC) .... See Entry 109350

62.20D Elastic constants

(see also 03.40D Mathematical theory of elasticity, 81.40J Elasticity and anelasticity)

107802 Static and dynamical elastic behaviour of squaric acid around its phase transition. W.Rehwald, A.Vonlanthen (Labs. RCA Ltd., Zurich, Switzerland).
Z. Phys. B (Germany), vol.52, no.2, p.139-44 (1983).
Ultrasonic velocity measurements could be performed on a good quality single crystal of squaric acid close to its transition temperature around 373K. The behaviour of the stiffness components c_{33} and c_{44} clearly demonstrates a first-order transition. The temperature variation of c_{11} and c_{66} can be fitted to a formula obtained from the Landau theory and assuming a strictive-type coupling between order parameter and strain. From attenuation measurements characteristic times for the order-parameter dynamics can be estimated, ranging from 10^{-11} to several 10^{-10} s in a temperature range of about 12K on either side of the transition. (21 refs.)

107803 A simple method for determining of the elastic coefficient A_{11}-$2A_{21}>0$ of smectic C liquid crystals. H.P.Hinov (Inst. of Solid State Phys., Bulgarian Acad. of Sci., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.5, p.611-14 (1983).
Although some have dealt with a possible Freedericksz transition in a Sm*C*LC the experiments, performed in this direction, are very rare and up to now they give only the value of the characteristic tilt and its temperature dependence. No information has been given about the possible values of the elastic Sm*C* coefficients entering in the elastic energy expression. The measurement of the elastic coefficients A_{11}, A_{12} and A_{21}, related to the curvature of the Sm*C* layers, is more complicated since the utilization of electric or magnetic fields cannot ensure the eventual determination of these coefficients due to the very weak non-observable deformation of the Sm*C* planes. Another useful way for determining of these coefficients is connected with a measurement of the periodicity of Sm*C* layer undulations, investigated for the first time by Johnson and Saupe (1977) and by other authors. However, these measurements cannot give the difference between the elastic coefficients A_{11} and A_{21}. The aim of the communication is to propose a simple method for possible measurements of the difference between the elastic coefficients A_{11} and $2A_{21}$ when $A_{12}-A_{21}>0$. (10 refs.)

107804 Elastic constants of GaS and GaSe layered crystals determined by Brillouin scattering. Y.Honma, M.Yamada, K.Yamamoto, K.Abe (Dept. of Electronics, Kobe Univ., Kobe, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2777-83 (Aug. 1983).
The five independent elastic constants of GaS and GaSe have been precisely determined at room temperature from high-resolution Brillouin spectra in various scattering geometries. The results are: $c_{11}=12.16$, $c_{12}=3.52$, $c_{13}=1.14$, $c_{33}=3.79$, $c_{44}=0.95$, $c_{66}={}^1/_2(c_{11}-c_{12})=4.30$ for GaS, and $c_{11}=10.50$, $c_{12}=2.97$, $c_{13}=1.22$, $c_{33}=3.51$, $c_{44}=1.00$, $c_{66}={}^1/_2(c_{11}-c_{12})$ for GaSe, in units of 10^{10} Nm^{-2}. The authors found a relatively low elastic anisotropy, associating with the layered structure of GaS and GaSe crystals. (16 refs.)

107805 The elastic properties of some phosphate/vanadate glasses. C.F.Drake (Standard Telecommunications Labs. Ltd., Harlow, England), B.W.James, H.Kheyrandish, B.Yates.
J. Non-Cryst. Solids (Netherlands), vol.57, no.2, p.305-25 (1 Sept. 1983).
The elastic constants of 7 phosphate/vanadate glasses, containing TiO_2, Na_2O and a range of concentrations of CuO, have been measured from 4.2 to 300K. The pressure variation of the elastic constants has also been measured and has been used to calculate the low temperature value of the Gruneisen parameter γ_0 for these glasses. Analysis of the results and other data has been used to show how TiO_2, Na_2O and CuO may be incorporated in the structure of these P_2O_5/V_2O_5 glasses. (42 refs.)

107806 Compression effect on the bulk modulus of Al. T.Soma, Y.Konno, H.-M.Kagaya (Dept. of Appl. Phys. & Maths., Mining Coll., Akita Univ., Akita, Japan).
Phys. Status Solidi b (Germany), vol.118, no.2, p.K155-7 (1 Aug. 1983).
The local Heine-Abarenkov model potential of Al with volume-dependent parameters is applied to the calculation of bulk modulus and the compression effect on the bulk modulus of Al. The bulk modulus B is obtained from the second derivative of the crystal energy E with respect to the crystal volume Ω as $B=\Omega d^2E/d\Omega^2$. (3 refs.)

107807 Dependence of the elastic constants of zinc sulfide on the wurtzite/sphalerite phase composition. S.Yu.Davydov, I.B.Kobyakov (A.V. Shubnikov Inst. of Crystallography, Acad. of Sci., Moscow, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.28, no.2, p.231-2 (Feb. 1983). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.53, no.2, p.377-9 (Feb. 1983). [received: Sept. 1983]
Many compounds crystallize with two or more polymorphic crystal structures. In particular, zinc sulfide (ZnS) crystallizes to give sphalerite (T_d) and wurtzite (C_{6V}) crystal structures, with the wurtzite structure being metastable under ordinary conditions. Both crystal modifications consist of the same type of structural units (tetrahedra), so that their lattice sites have identical environments up to and including the second-nearest neighbors (the authors take wurtzite to have the ideal structure with $c/a=1.633$). However, in the sphalerite all the tetrahedra have the same orientation, whereas in wurtzite two orientations differing by a 60° rotation are possible. The tensors describing the various physical properties of these structures also depend on the rotation angle. (8 refs.)

107808 Moduli of elasticity and stability of strongly anisotropic crystal with vacancies. D.M.Bercha, M.I.Maryan.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1221-6 (Aug. 1983). In Russian.
The stability conditions of a strongly anisotropic crystal with vacancies at high temperatures in the pseudoharmonic approximation of self-consistent phonons are considered for a simple hexagonal lattice of layer structure with allowance for central and non-central interactions between the neighbouring atoms. It is shown that formation of vacancies leads to a decrease in the temperature instability of the layered crystal corresponding to rupture of the weak interlayer forces. (9 refs.)

Elastic media with microstructure I. One-dimensional models .... See Entry 105051

Interfacial matrix stresses in composites due to misfitting cylindrical constituents .... See Entry 107007

Isothermal changes of volume and Young's modulus of amorphous Co-P .... See Entry 107548

Structural instability of $Hf_xZr_{1-x}V_2$ Laves phases .... See Entry 107605

The effect of gamma radiation on the mechanical properties of corundum .... See Entry 107763

Effects of 14 MeV neutron irradiation on creep of nickel and niobium .... See Entry 107775

Behavior of sodium near melting point found by measurement of sound velocity .... See Entry 107832

Change of ultrasonic wave velocity in indium near the melting point .... See Entry 107833

Dynamics and thermodynamics of anharmonic crystals near the instability point .... See Entry 107838

Ferroelastic phase transition in $BiVO_4$: III. Thermodynamics .... See Entry 107916

Divergent elastic response in the commensurate charge-density-wave state of $2H$-$TaSe_2$ .... See Entry 107926

Raman scattering and fundamental absorption in red-HgI_2 under hydrostatic pressure .... See Entry 108942

Light scattering from vibrational modes in GaAs-$Ga_{1-x}Al_xAs$ superlattices and related alloys .... See Entry 108954

Light scattering studies of rubidium cyanide under hydrostatic pressure .... See Entry 108955

Effect of disorder on the martensitic phase transformation in Nb_3Sn .... See Entry 109289

Precipitation hardening caused by a difference in shear modulus between particle and matrix .... See Entry 109317

Heat treatment and diamond burnishing of gray cast iron .... See Entry 109356

Young's modulus of Fe-, Co-, Pd- and Pt-based amorphous wires produced by the in-rotating-water spinning method .... See Entry 109377

Dynamic mechanical properties of a polycarbonate/polystyrene copolymer: effects of casting solvent .... See Entry 109379

Examination of the structure, magnetic and elastic properties of single crystals of alloy Fe-25% Co-30% Cr-3.4% Mo .... See Entry 109380

Elastic modulus change in Mo due to Frenkel defects .... See Entry 109382

A structural study of the tensile drawing behavior of poly(ethylene terephthalate) .... See Entry 109413

Certain features of the change in physicomechanical properties of type SSTF material in aging under humid subtropical conditions .... See Entry 109430

Fracture of phosphate-bonded high-alumina refractories .... See Entry 109435

62.20F Deformation and plasticity

(inc. yield, ductility and superplasticity; see also 81.40L Deformation, plasticity and creep)

107809 Mesoscopic and microscopic aspects of the PSB formation mechanism in fatigued FCC monocrystals. C.Blochwitz, H.-J.Burmeister, U.Kremling (Sektion Phys., Padagogische Hochschule Dresden, Dresden, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.859-72 (1983).
Persistent zones of plastic strain localisation (PSBs) can be observed in fatigued FCC monocrystals above the 'nucleation cycle number' N_n and the 'nucleation stress' amplitude τ_n, respectively. They follow after temporary strain localisations existing at $N<N_n$ and being discernible by oscillations of the relative shape of the hysteresis loops (V_H) or by strain bursts. Using a simple rheological model the frequency of internal stresses of mesoscopic wave length ('mesoscopic stresses') was determined for Ni monocrystals fatigued at four different plastic strain amplitudes up to N_n. A 'mesoscopic threshold stress' τ^* has been found to be exceeded within the whole volume of the dislocation-dense regions (DRs) at $N \geq N_n$. By comparison of τ^* with the stress for the operation of Frank-Read sources of the segment lengths l_0 at the border of the DRs, it might be assumed that above N_n and τ_n respectively a mechanism of dislocation sources acts, compensating the high annihilation rate of moveable dislocations in the zones of strain localisation. In so doing the formation of persistent zones of strain localisation becomes possible, in which the 'ladder-like' dislocation structure of the final PSBs develops successively. (20 refs.)

107810 Theory for saturation stress difference in torsion versus other types of deformation at low temperatures. J.Weertman, S.S.Hecker (Center for Materials Sci., Los Alamos Nat. Lab., Los Alamos, NM, USA).
Mech. Mater. (Netherlands), vol.2, no.2, p.89-101 (Aug. 1983).
Torsion tests carried out to large plastic strains typically exhibit a leveling out (saturation) of the flow stress. On the other hand, saturation is usually not observed for other modes of deformation such as wire drawing or rolling. In iron and other body-centered cubic materials linear hardening persists to strains of ≈ 10. For face-centered cubic materials the behavior is mixed, with saturation not being achieved for most impure metals. The authors propose an explanation for the difference in flow stress at large strains between torsion and other modes of deformation. The explanation is based on Holt's dislocation cell wall formation theory and on the fact that apparently dislocations of only one Burgers vector are required to be active in torsion at large strains, whereas several are required for other deformation modes. Consequently, at the same dislocation density and applied stress level dislocations of opposite character but of the same kind are closer together in torsion. The dislocations have a stronger force of attraction between them and a faster rate of mutual annihilation through pipe diffusion controlled climb. The saturation stress is larger the larger is the number of different Burgers vectors of the dislocations involved in the deformation. Shear band instabilities are explained as a conse-

quence of material locally reducing the number of active slip systems. (35 refs.)

107811 Comments on 'Mechanical strengthening and impurity precipitation behaviour for divalent cation-doped alkali halides'. G.Berg, P.Grau, F.Frohlich.
J. Mater. Sci. (GB), vol.18, no.9, p.2844-5 (Sept. 1983).
Comments are made on a paper by Zaldo et al. (see ibid., vol.17, p.1465, 1982) reporting the influence of the clustering of divalent metal impurity-cation vacancy dipoles on the critical yield stress of alkali halide crystals. The present authors have examined measurements by other workers. These agree with the experimental results of Zaldo et al., but differences exist with respect to their interpretation, originating especially from the information of other simultaneously applied methods used in addition to the mechanical one. (no refs.)

107812 The surface dislocation and its relationship to the boundary-integral equation. M.J.Marcinkowski (Dept. of Mech. Engng., Univ. of Maryland, College Park, MD, USA).
Phys. Status Solidi a (Germany), vol.78, no.2, p.401-14 (16 Aug. 1983).
The classic Somigliana identity allows the deformation within a body to be uniquely determined if the surface tractions or displacements associated with that body are prescribed. The physics associated with this method are described in detail, and it is shown that the Somigliana approach is equivalent to the surface dislocation approach. The method of surface dislocations, however, allows for greater physical insight, as well as a more straightforward numerical solution to complex problems involving the deformation of solids. (43 refs.)

Preparation of thorium metal sponge from thorium oxalate .. See Entry 106069

Influence of temperature upon dislocation mobility and elastic limit of single crystal HgI_2 .... See Entry 106226

Plane strain extrusion studies by finite element method .... See Entry 107018

Phenomenological model of the description of deformation and failure and metals under complex nonisothermal loading .... See Entry 107020

Elastoplastic behavior of a laminar-fibrous material .... See Entry 107021

Evaluation of the crystal binding and compressibility of alkali hydrides .... See Entry 107589

Effect of twisting of the diffraction net planes on the integral intensities at Laue diffraction of X-rays in elastically bent silicon crystals .... See Entry 107597

Electronic structure and tetragonality of martensite .... See Entry 107600

X-ray diffraction investigation of the structure of deformed samarium-cobalt alloys .... See Entry 107604

Cross-slip on the first order pyramidal plane $(10\bar{1}1)$ of a-type dislocations $(1\bar{2}10)$ in the plastic deformation of α-titanium single crystals .... See Entry 107699

Dislocation configurations induced by cyclic deformation in silicon crystals .... See Entry 107701

The isolated partial and dissociated total dislocations in deformed ZnS crystals .... See Entry 107703

Direct observations of the effect of hydrogen on the behavior of dislocations in iron .... See Entry 107705

Energy absorption during deformation of yttrium and zirconium .... See Entry 107709

Effect of ageing on martensitic transformation during the deformation of metastable austenitic steels .... See Entry 107711

The nature of grain boundary sliding and the superplastic flow .... See Entry 107717

Dipolar point defect interactions with stress fields .... See Entry 107742

Crack propagation characteristics in neutron irradiated type 316 stainless steel microspecimens .... See Entry 107776

Creep in transforming polycrystalline materials .... See Entry 107813

The role of grain boundaries in deformation and fracture at high temperatures .... See Entry 107814

Creep of aluminium single crystals under high pressure .... See Entry 107815

On the theory of axial-symmetric ductile fracture .... See Entry 107819

Analysis of plane elastic-plastic shock-waves from the fourth-order anharmonic theory .... See Entry 107829

Plastic-deformation dependence of the Gruneisen parameter strain derivatives .... See Entry 107854

Ferroelastic phase transition in $BiVO_4$: III. Thermodynamics .... See Entry 107916

Ferroelastic phase transition in $BiVO_4$: IV. Relationships between spontaneous strain and acoustic properties .... See Entry 107917

Ferroelastic phase transition in $BiVO_4$: V. Temperature dependence of Bi^{3+} displacement and spontaneous strains .... See Entry 107918

Ferroelastic phase transition in $BiVO_4$: VI. Some comments on the relationship between spontaneous deformation and domain walls in ferroelastics .... See Entry 107919

The oxide β-Ga_2O_3: force field, thermal expansion, and rigidity anisotropy .... See Entry 107990

Diffusion in an inhomogeneously deformed medium .... See Entry 108010

Diffusion and redistribution of carbon in iron and its alloys during deformation .... See Entry 108049

Diffusion of copper in explosion-deformed metals .... See Entry 108051

Thermal transport in heavily deformed and γ-irradiated LiF at temperatures near 1K .... See Entry 108082

Influence of substrate deformations on interface structures. I. Theory .... See Entry 108205

Coherence of the phase boundary and deformation in the epitaxial system Ge/GaAs .... See Entry 108206

Internal stress in evaporated tellurium films .... See Entry 108214

Determination of stresses in Si-SiO_2 and mechanically affected Si by EPR .... See Entry 108244

Deformation of epitaxial structures on the basis of GaAs in the process of their production .... See Entry 108246

Features of longitudinal flow of cellulose acetate films in active media .... See Entry 108248

Review of the effect of external action (heat treatment, deformation, irradiation) on the luminescence of GaAs .... See Entry 108994

The nature of photoluminescence from plastically deformed silicon .... See Entry 109010

Thermally induced changes in the cathodoluminescence image of deformed MgO .... See Entry 109023

Production of high-strength nickel coatings by pulse electrolysis .... See Entry 109175

Application of critical state to uniaxial compaction .... See Entry 109183

The metallurgy and applications of beryllium .... See Entry 109185

Microcrystalline iron-base alloys made using a rapid solidification technology .... See Entry 109186

Structure and properties of rapidly solidified 7075 P/M aluminum alloy modified with nickel and zirconium .... See Entry 109187

Preparation and strength of forsterite-zirconia ceramic composites .... See Entry 109197

Cementite decomposition in steel under plastic deformation .. See Entry 109212

Effect of repeated plastic deformation on the state of the carbide phase in steels .... See Entry 109213

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Study of the strain characteristics of materials and evaluation of deformation conditions in concentration zones with nonisothermal cyclic loading .... See Entry 109665

62.20H Creep

(see also 81.40L Deformation, plasticity and creep)

107813 Creep in transforming polycrystalline materials. M.S.Paterson (UER des Sci. Phys. de la Terre, Univ. Paris VII, Paris, France).
Mech. Mater. (Netherlands), vol.2, no.2, p.103-9 (Aug. 1983).
An extension, taking recovery into account, has been made of Poirier's (1982) theory of transformation plasticity, that is, the acceleration of creep due to the introduction of accommodation dislocations in the plastic relaxation of the misfit of domains of new phase formed during phase transformation. This enables more realistic distinctions to be made between situations where transformation plasticity may be a significant effect in the Earth and where it may not. (5 refs.)

107814 The role of grain boundaries in deformation and fracture at high temperatures. V.Sklenicka, I.Saxl, J.Cadek (CSAV, Brno, Czechoslovakia).
Kovove Mater. (Czechoslovakia), vol.21, no.4, p.364-82 (1983). In Czech.
Some experimental results are summarized demonstrating the role of grain boundaries and expecially the role of grain boundary sliding in deformation and fracture at high temperatures (i.e. homologous temperatures above about 0.4). Only the simplest case of deformation under invariable external conditions (stress, temperature) is considered i.e. creep under uniaxial load. The first part of the paper concerns the active role of grain boundary sliding in plastic deformation of metallic polycrystals. The second part concerns the role of grain boundaries in intergranular fracture. All the three stages of intergranular fracture—cavity nucleation, cavity growth and macroscopic crack growth are briefly discussed in relation to grain boundary sliding. Also the propagation of an a priori crack (the crack developed in the body prior to creep) is briefly discussed. (45 refs.)

107815 Creep of aluminium single crystals under high pressure. O.V.Presnyakova, V.I.Zaitsev, V.A.Fomchenko (Phys.-Tech. Inst., Acad. of Sci., Donetsk, Ukrainian SSR).
Phys. Status Solidi a (Germany), vol.78, no.2, p.377-83 (16 Aug. 1983).
A study of a high hydrostatic pressure effect on creep regularity and evolution of the dislocation structure in Al single crystals, oriented for single slip is carried out. It is found that the high pressure effect leads to an essential creep deceleration and to a quality change of a curve form to the sigmoidal one at $P \geq 750$ MPa. At $P=750$ MPa an essential decrease in density of slip lines and dislocations during the initial stage of a deformation process is observed. The results obtained are discussed using the Webster (1966) creep theory and explained by the higher pressure effect on the multiplication of mobile dislocations than on their environment. (12 refs.)

107816 Inverse primary creep. B.Burton (Berkeley Nuclear Labs., CEGB, Berkeley, England).
Philos. Mag. A (GB), vol.48, no.2, p.299-310 (Aug. 1983).
The transient behaviour which arises when the initial dislocation density is less than that which is to be achieved during subsequent steady-state creep is described in terms of the relative rates of creation and annihilation of dislocations. It is shown that the inverse primary creep of certain alloys in which the creep rate increases towards the steady value can be explained. The total inverse primary strain is shown to be proportional to the difference in the initial dislocation spacing and the equilibrium spacing at steady state, and also to the square of the stress. Predictions of the model are compared with reported results on the alloy Zircaloy 4. (4 refs.)

The dependence of the high temperature mechanical properties of austenitic stainless steels on implanted helium .... See Entry 106164

The development of small specimen mechanical test techniques .... See Entry 106166

Effects of 14 MeV neutron irradiation on creep of nickel and niobium .... See Entry 107775

Effect of microstructure on light ion irradiation creep in nickel .... See Entry 107787

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Transient creep in iron at low stresses and homologous temperatures 0.40-0.54 .... See Entry 109403

High temperature creep in a Cu-2% Fe alloy .... See Entry 109404

Effect of chromium content and heat treatment on creep of chromium bronze .... See Entry 109411

Influence of current-pulse duration on the rate of creep of zinc crystals .... See Entry 109415

Dependence of the long-term ductility of a Cr-MoV steel on changes in the structure .... See Entry 109416

Deformation-mechanism maps for silicon carbide .... See Entry 109423

Orientation dependence of creep behavior of single crystal γ' (Ni_3Al) .... See Entry 109424

Effect of stacking-fault energy on the parameters of high-temperature creep of nickel-cobalt alloys .... See Entry 109426

Influence of pulsed current peak on the creep rate of zinc crystals .... See Entry 109427

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Creep and stress rupture strength of 5VMTs alloy clad with VN7 alloy .... See Entry 109597

62.20M Fatigue, brittleness, fracture, and cracks

(inc. hardness; see also 81.40N Fatigue, embrittlement and fracture)

107817 Elastomer friction. M.Barquins (LCPC, CNRS, Paris, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.20, p.1567-70 (6 June 1983). In French.
It is shown that the energy dissipated by friction with Schallamach's waves is closely related to the propagation speed of these waves, and it can be interpreted in terms of peeling. (9 refs.)

107818 A proposed criterion for fatigue threshold dislocation substructure approach. J.P.Lucas (Sandia Nat. Lab., Albuquerque, NM, USA), W.W.Gerberich.
Fatigue Eng. Mater. & Struct. (GB), vol.6, no.3, p.271-80 (1983).
A model for fatigue threshold has been proposed based on the dislocation subgrain cell structure that evolves at the crack tip in steels during the fatigue deformation process. The stabilized subgrain cells that develop in the material act as impenetrable barriers to dislocations in slip band pile-ups that emanate from the fatigue crack tip. The blocking of these dislocations tends to limit crack growth that occurs by crack tip emission of dislocations, thereby leading ultimately to the fatigue threshold conditions. The grain size effect on threshold is deduced to be an indirect effect as it is proposed that the subgrain cell size is the controlling substructural parameter at the threshold stress intensity level. The subgrain cell size is shown to be proportional to the one-third power of the initial grain size. (26 refs.)

107819 On the theory of axial-symmetric ductile fracture. P.Stanek, J.Pokluda.
Kovove Mater. (Czechoslovakia), vol.21, no.4, p.383-96 (1983). In Czech.
The authors' previously introduced theory of plastic deformation kinetics in the instability region of the tensile test has shown the connection between macroscopic and microscopic parameters of the ductile fracture process. On this basis, undirect measurements of the mean microvoid growth characteristics of steels 12010, 14109 and 14331 containing carbide particles as the main void nucleators have been performed. The results of these measurements together with measurements of carbide size distribution have been applied to prove the fracture strain prediction possibilities of some void coalescence models. The best theoretical estimations of fracture strain were obtained using the Brown-Emburry model (1973). Satisfactory, slightly conservative results provide the percolation model submitted by the authors, while the application of McClintock's concept (1968) gives too high values of predicted fracture strain. (30 refs.)

107820 Steady state vacancy concentration around a plastic crack. K.Jagannadham (Dept. of Engng. Sci. & Mech., Tennessee Technol. Univ., Cookeville, TN, USA).
Metall. Trans. A (USA), vol.14A, no.8, p.1615-24 (Aug. 1983).
The vacancy chemical potential associated with the crack region and with the lattice dislocations representing the plastic zone are identified in terms of the energy of the dislocation configuration. In order to determine the steady state vacancy concentration, the configuration is considered as made up of several internal sources of stress. The diffusion equation under steady state is solved for a crystal containing each source of stress. Further, superposition of the concentration of vacancies around each source is used to determine the total concentration of vacancies for small scale deformation at the crack tip. On the other hand, for large scale deformation at the tip, matching boundary conditions are applied to determine the concentration in each region containing an internal source. Both the discrete dislocation and the single lattice dislocation representations of the crack are employed to determine the crack growth rate. The results are used to emphasize the influence of the plastic zone on the crack growth rate by vacancy diffusion mechanism. (20 refs.)

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Analysis of cleavage fracture potential of martensitic stainless steel fusion structures. II. Fracture analysis procedures for flawed fusion structures .... See Entry 106163

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The resistance of 9 Cr-1 MoVNb and 12 Cr-1 MoVW steels to helium embrittlement .... See Entry 106165

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62.20P Tribology

(see also 81.40P Friction, lubrication and wear)

107821 On prediction of wear coefficients in sliding wear. N.P.Suh, H.-C.Sin (MIT, Cambridge, MA, USA).
ASLE Trans. (USA), vol.26, no.3, p.360-6 (July 1983).
The wear rates and wear coefficients of metals are analytically predicted based on the delamination theory of wear when the wear rates are controlled by the subsurface crack propagation rate. The wear rate and the wear coefficient are predicted to be directly proportional to the depth of crack location and the crack growth rate. The numerical values of wear coefficients are obtained through finite element analysis of crack propagation in elastoplastic solids. The agreement between typical experimental results and theoretical prediction is excellent. (21 refs.)

107822 Water on ice; influence on friction. D.Slotfeldt-Ellingsen, L.Torgersen (Central Inst. for Industrial Res., Oslo, Norway).
J. Phys. D (GB), vol.16, no.9, p.1715-19 (14 Sept. 1983).
The dynamic friction between polyethylene and a mixture of crushed ice and small amounts of a very dilute solution of H_2SO_4 in water was measured at temperature from 0°C to -20°C. The liquid has only a moderate 'lubricating' effect which indicates that the generally low friction between polyethylene and ice and snow cannot be explained simply by a liquid or liquid-like layer on the ice. Larger amounts of liquid ($\geq 1\%$) lead to an increase in friction, due probably to viscous drag. Contrary to what is commonly stated, the increase in friction, which is observed as the temperature approaches 0°C, is not caused by viscous drag. (11 refs.)

Thermal desorption with the Smoluchowski equation ....See Entry 108170

Effect of lubricants on frictional polymerization of palladium electrical contacts ....See Entry 108525

On the mechanism of self-lubrication in metal-polymer electrical contacts ....See Entry 108548

Heat treatment and diamond burnishing of gray cast iron ....See Entry 109356

The amorphous phase and surface mechanical properties of 304 stainless steel implanted with Ti and C ....See Entry 109517

Plastic deformation and wear process at a surface during unlubricated sliding ....See Entry 109518

Tribological characteristics of nitrogen (N^+) implanted iron .See Entry 109519

Fabrication and wear test of a continuous fiber/particulate composite total surface hip replacement ....See Entry 109520

Tribochemical processes and wear resistance of polymeric materials ....See Entry 109521

The role of copper-base alloys in tribological experiments and applications ....See Entry 109522

Abrasive wear in uni-directional friction and reciprocating friction ....See Entry 109523

Structure and wear properties of Al-Sn alloy produced by electroslag remelting ....See Entry 109524

Metastable austenitic Cr-Mn steels ....See Entry 109525

Modification of Kh12M steel ....See Entry 109526

Lubrication of high temperature ceramic materials ....See Entry 109527

The effect of particle shape and size on erosion of aluminum alloy 1100 at 90° impact angles ....See Entry 109528

Effect of aqueous cations on friction between rubber and glass ....See Entry 109529

Study of rolling friction—behaviour of the small displacement of starting rolling friction .... See Entry 109530

A critical study of the erosion of an aluminium alloy by solid spherical particles at normal impingement .... See Entry 109531

Deformation by scratches and frictional properties of MgO crystals .... See Entry 109532

Antiwear property of lubricant additives for high silicon aluminium alloy under boundary lubricating conditions .... See Entry 109533

Observation of wear damage of a hot isostatically pressed alumina cutting tool by cathodoluminescence .... See Entry 109534

A proposed diamond polishing process .... See Entry 109550

Friction oxidation characteristics .... See Entry 109553

Cavitation erosion of cast iron in 3% salt water .... See Entry 109599

62.30 MECHANICAL AND ELASTIC WAVES

(see also 03.40K Mathematical aspects)

107823 Thermoelastic wave generation by resistive heating in silicon. S.E.Deggendorf, R.M.White (Dept. of Electrical Engng. & Computer Sci., Univ. of California, Berkeley, CA, USA).
Appl. Phys. Lett. (USA), vol.43, no.4, p.350-1 (15 Aug. 1983).
Reports the piezoelectric detection and thermoelastic signals resulting from resistive heating within a diffused resistor and commercial packaged transistor. CW and pulse experiments at 5 V and 300 kHz, as well as 5-V 10-MHz mixing experiments, result in transducer outputs in the 25 μV-1 mV range. Theoretical values are in good agreement with experimental findings. (16 refs.)

Generalized thermoelastic wave propagation in an infinite piezoelectric solid .... See Entry 108879

62.40 ANELASTICITY, INTERNAL FRICTION, AND DAMPING

(see also 81.40J Elasticity and anelasticity)

107824 Anomalous amplitude-dependence effect observed in Al-0.5 wt.% Cu alloy when the internal friction is extremely low. Zhang Jin-xiu (Dept. of Phys., Zhongshan Univ., China), Pan Zheng-liang, Ge Ting-sui.
Acta Phys. Sin. (China), vol.32, no.4, p.530-3 (April 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)* [received: Sept. 1983]
Free decay curves of slightly cold-worked Al-0.5 wt.% Cu specimen aged at room temperature (20°C) for 24 hrs were determined by an automatic inverted torsion pendulum with computer control. A series of amplitude internal friction peaks were observed as the low excitation amplitude was increased successively even when the internal friction was very low. (7 refs.)

107825 Internal friction of alkaline-earth-iron-metaphosphate glasses. W.Chomka, D.Samatowicz (Inst. of Phys., Tech. Univ. of Gdansk, Gdansk, Poland).
J. Non-Cryst. Solids (Netherlands), vol.57, no.2, p.327-37 (1 Sept. 1983).
The internal frictions of Mg, Ca, Ba iron-metaphosphate glasses were studied from 120 to 700K using the low-frequency torsion pendulum technique. The internal friction as a function of temperature revealed two distinct peaks. The low-temperature peak was absent in glass without iron oxide. Its activation energy compared favourably with that for dielectric loss and DC conductivity in similar glasses. This suggests the same mechanism for all three processes, probably connected with electron transfer between iron ions of different valence. (14 refs.)

107826 Internal friction and point defects in ordered β Cu-Zn and β Cu-Zn-Al. A.Ghilarducci, M.Ahlers (Centro Atomico Bariloche, Bariloche, Argentina).
J. Phys. F (GB), vol.13, no.9, p.1757-71 (Sept. 1983).
The internal friction and the torsion modulus have been measured in an inverted torsion pendulum using quenched β Cu-Zn and β Cu-Zn-Al alloys. Peaks observed at −50°C for the B2 ordered alloys and at −15°C for the DO_3 ordered alloys have been associated with ⟨111⟩ nearest neighbour vacancy-Cu atom pairs. Peaks found at 100°C and 200°C have been interpreted as being due to next nearest neighbour Cu pairs on the Zn rich sublattice. From the results a vacancy formation energy of 52 kJ mol^{-1} is deduced. Comparisons with existing diffusion data are presented. (24 refs.)

107827 Internal friction peaks and structural relaxation on some electroless deposited amorphous alloys. E.Bonetti, E.Evangelista, A.Cavallini, C.Patuelli (Istituto di Fisica, Univ. di Bologna, Bologna, Italy).
Phys. Status Solidi a (Germany), vol.78, no.2, p.615-21 (16 Aug. 1983).
Internal friction and dynamic modulus measurements are carried out on amorphous electroless deposited Ni-B and Ni-P alloys with different metalloid concentration from room temperature up to the starting temperature of the crystallization processes. In this temperature range, characterized by 'structural relaxation', one or two anelastic peaks depending on the alloy composition are observed. The influence of annealing and quenching on these peaks is studied together with the evaluation of the activation energies and of the relaxation times. Some possible elementary mechanisms at the origin of these peaks are discussed, also in connection with models recently proposed to explain the nature of the anelastic and magnetic relaxation peaks observed by other authors, in the same temperature range, on different amorphous alloys obtained with other techniques. The correlation of the peaks observed with the structural relaxation processes is also examined. (19 refs.)

107828 Estimation of strain dipole tensor due to interstitials in hexagonal close packed metals. B.Purniah, S.Srinivasan, K.Krishan (Reactor Res. Centre, Kalpakkam, India).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.322-4
The strain dipole tensor is an important quantity for the study of anelastic relaxation due to point defects. The authors estimate this tensor, using the computer simulation technique, for small interstitials carbon, nitrogen and oxygen in HCP metals Zr and Hf. The polynomial host-host and host-impurity interatomic potentials have been evaluated using various experimentally measured physical quantities. Results for the octahedral position of the interstitial are presented. The formation energy and volume are also obtained along with the dipole tensor. (8 refs.)

Study of self-interstitial-atom solute-atom-complexes by mechanical relaxation .... See Entry 107690

Paraelasticity in electron-irradiated molybdenum .... See Entry 107771

Nucleation and strain relaxation at the InAs/GaAs (100) heterojunction .... See Entry 108202

Method of studying viscoelastic properties of porous polymer films .... See Entry 108243

Entangled linear polymer chains in melts: n.m.r. and Rouse or reptation models; stress relaxation .... See Entry 108822

Effect of disorder on the martensitic phase transformation in Nb_3Sn .... See Entry 109289

Internal friction in Cu-Al-Zn alloy in the region of a reversible martensitic transformation .... See Entry 109291

Determining distortion of steel structural materials .... See Entry 109360

Size effects and micromechanics of a porous solid .... See Entry 109376

Internal friction in 3NiCrMoV steel .... See Entry 109378

Mechanical relaxation effects of self-interstitial-atoms in molybdenum .... See Entry 109381

Interstitial interaction in W observed by relaxation measurements .... See Entry 109383

Reloading stress relaxation behavior and rupture for 19Cr-9Ni-1.4Mo-1.4W-Nb bolting steel .... See Entry 109462

62.50 HIGH-PRESSURE AND SHOCK-WAVE EFFECTS IN SOLIDS

107829 Analysis of plane elastic-plastic shock-waves from the fourth-order anharmonic theory. G.Perrin (Dept. de Math. et Informatique, Univ. de Rennes I, Rennes, France), M.Delannoy-Coutris.
Mech. Mater. (Netherlands), vol.2, no.2, p.139-53 (Aug. 1983).
A finite strain elastic-plastic formalism developed in the literature and a generalization of the Mie-Gruneisen equation for nonhydrostatic stresses are used to calculate Hugoniot states for macroscopically isotropic materials. The general form of the free energy function resulting from the fourth-order anharmonic theory can be combined with the Hugoniot law of conservation of energy to obtain temperature-stress-strain relations for the uniaxial shock loading. In the third-order approximation the parameters entering these relations may be found from ultrasonic data by means of a suitable averaging procedure. With the work-hardening model proposed, it is shown that the determination of the Hugoniot curve does not require a description of the shock structure. The theoretical Hugoniot stress-strain curve for copper and aluminium is calculated in the special case of ideal plasticity for stresses up to 150 kbar. A comparative study of the results with those derived from the hydrodynamic approximation is also made. (27 refs.)

107830 Phase transformation under intense shock pressure loading. D.E.Grady (Sandia Nat. Labs., Albuquerque, NM, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.377-81
Solids subjected to high velocity impact or explosive loading may undergo polymorphic phase transformation or melting within time periods appreciably less than 10^{-8} s due to the intense shock-pressure evironment. Although criteria for equilibrium phase transformation on the Hugoniot are satisfied, other nonequilibrium features unique to the shock-wave environment have been identified in the shock transformation process. These features include shear and heterogeneous deformation effects which control the transformation kinetics and microstructure of the transformed material. Transformation under shock loading leads to unusual microstructure in the recovered materials and can result in interesting and useful changes in physical and mechanical properties. (23 refs.)

Creep of aluminium single crystals under high pressure .... See Entry 107815

Effect of H^+ on the $\beta \rightarrow \alpha$ transition in β-$LiIO_3$ after high pressure treatment .... See Entry 107901

Polymorphous transformations of graphitic boron nitride of various degrees of crystalline perfection at high pressures .... See Entry 107909

Conditions for a phase transition in solids under nonhydrostatic compression .... See Entry 107922

Effect of pressure on the phase transition of the $[(C_6H_5)_3PCH_3]^+(TCNQ)_2^-$ anion radical salt as studied by differential thermal analysis under pressure .... See Entry 107924

Effect of high pressure on interdiffusion in an Al-Mg alloy .... See Entry 108074

The deformation potential of the lowest impurity state of As in Si .... See Entry 108347

Raman scattering and fundamental absorption in red-HgI_2 under hydrostatic pressure .... See Entry 108942

The high pressure disproportionation of Spinel $MgAl_2O_4$ .... See Entry 109214

Universal dependence of the metal hardening parameters on the intensity of shock action .... See Entry 109323

Study of the behavior of closed steel spherical shells with single-stage internal explosive loading .... See Entry 109429

Behavior of shells of various types in internal explosive loading .... See Entry 109508

62.60 ACOUSTIC PROPERTIES OF LIQUIDS

(see also 62.80 Ultrasonic relaxation; for sound propagation, see 43.; for second sound in quantum fluids, see 67.40, 67.50 and 67.60)

Behavior of sodium near melting point found by measurement of sound velocity .... See Entry 107832

Change of ultrasonic wave velocity in indium near the melting point .... See Entry 107833

Pressure dependence of sound absorption in an aqueous solution of $CaSO_4$ .... See Entry 107834

Determination of the thermodynamic properties of water from measurements of the speed of sound in the temperature range 251.15-293.15K and the pressure range 0.1-350 MPa .... See Entry 107970

Partial molar volumes and partial molal adiabatic compressibilities of nitroamminecobalt(III) complexes in water at 25°C .... See Entry 107983

62.65 ACOUSTIC PROPERTIES OF SOLIDS

(see also 62.80 Ultrasonic relaxation; for sound propagation, see 43.; for lattice dynamics and phonons, see 63.; for magnetoacoustic effects, see 72.55; for acoustoelectric effects, see 72.50; for acousto-optical effects, see 78.20H)

107831 Acoustic emission transformation ratio during irreversible crystal deformation. V.V.Bovenko.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.8, p.42-5 (1983). In Ukrainian.
The acoustic emission transformation ratio is theoretically calculated and compared with experimental data. The conclusion reached is that it may be used to determine dimensions of moving sources and the ratio of particle velocity in a wave to sound velocity. The research is of great significance for identification of acoustic emission signals and for creation of the predestruction state theory. (12 refs.)

107832 Behavior of sodium near melting point found by measurement of sound velocity. H.Kamioka (Dept. of Phys., Gifu Univ., Gifu, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2433-9 (July 1983).
The sound velocity of sodium was measured in the solid phase and the liquid phase near the melting point by ultrasonic pulse transmission method. The temperature range of the experiment was from 19°C to 160°C, and the frequency of sound used was 1 MHz. The sound velocity and its temperature coefficient in the solid phase just below the melting point (97.8°C) were 3180 m/s and −1.23 m/s.deg, respectively; and those in the liquid phase just above the melting point were 2512 m/s and −0.52 m/s.deg, respectively. By combining the present results with the existing data of thermal expansivity and specific heat, the elastic properties of sodium at and around the melting temperature were presented and discussed. (29 refs.)

107833 Change of ultrasonic wave velocity in indium near the melting point. H.Kamioka (Dept. of Phys., Gifu Univ., Gifu, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2784-9 (Aug. 1983).
The ultrasonic wave velocity of indium was precisely measured in the temperature range from 120 to 183°C including the melting point. An ultrasonic pulse transmission method was used and the adopted sound frequency was 1 MHz. The melting point of the specimen was 156.4°C. The sound velocities were 2504 m/s in the solid phase just below the melting point and 2297 m/s in the liquid phase just above the melting point. The temperature coefficients of the sound velocity were 0.191 m/s.deg in the solid phase and 0.254 m/s.deg in the liquid phase. By combining the present results with existing data of thermal expansivity and specific heat, the elastic properties of indium at and around the melting temperature were reduced, and discussion was made on the obtained results. (19 refs.)

Apparatus for measuring the velocity of acoustic waves in solids .... See Entry 106941

Ultrasonic studies of dipolar point defects .... See Entry 107683

Effect of ultrasound on the dislocation structure of alkali halide crystals in various orientations .... See Entry 107713

Dipolar point defect interactions with stress fields .... See Entry 107742

Interstitial-impurity interactions in aluminum and copper alloys .... See Entry 107743

Static and dynamical elastic behaviour of squaric acid around its phase transition .... See Entry 107802

On the translation mode of the kink lattice of a quasi-one-dimensional Peierls-Frohlich system with a nearly half-filled band .... See Entry 107843

Ferroelastic phase transition in $BiVO_4$: IV. Relationships between spontaneous strain and acoustic properties .... See Entry 107917

Optoacoustic effect and the thermal diffusivity of solids .... See Entry 108083

Acoustic body waves and electromechanical coupling coefficients in crystals of berlinite .... See Entry 108881

Rayleigh and Brillouin scattering in $RbH_3(SeO_3)_2$ near the phase transition temperature .... See Entry 108963

Process occurring in supercooled austenite before pearlitic transformation .... See Entry 109287

On the theory of acoustic softening of low-carbon steel .... See Entry 109314

Measurement of the acoustical properties of plastics .... See Entry 109677

Acoustical characteristics of some polymers used as test specimens .... See Entry 109678

Effect of heat treatment conditions on the form of the scattered pulse and the mean level of structural noise for steels with a homogeneous structure .... See Entry 109679

62.80 ULTRASONIC RELAXATION

(see also 74.30G Ultrasonic attenuation in superconductors, 43.35 Ultrasonics)

107834 Pressure dependence of sound absorption in an aqueous solution of $CaSO_4$. C.C.Hsu, F.H.Fisher (Marine Phys. Lab., Univ. of California, San Diego, CA, UA).
J. Phys. Chem. (USA), vol.87, no.14, p.2581-4 (7 July 1983).
Sound adsorption has been measured in a 0.001 M aqueous solution of $CaSO_4$ at 25°C. The values of maximum absorption per wavelength 10^6 $(a\lambda)_{max}$, are 10.3 ± 0.1 at 1 atm and 7.7 ± 0.1 at 307 atm. The relaxation frequency is 177 ± 9 kHz at 1 atm and, within experimental error, is independent of pressure. This corresponds to an inner coordination sphere substitution rate of about 10^6, 2 orders below that of 2×10^8 quoted by M. Eigen and K.Z. Tamm (1962). At 1 atm, the $CaSO_4$ absorption is about 30% that of the same concentration of $MgSO_4$. (15 refs.)

Disorder phenomena in β-alumina .... See Entry 108034

63.00 LATTICE DYNAMICS AND CRYSTAL STATISTICS

(see also 05.50 Lattice theory, 65. Thermal properties, 66.70 Thermal conduction, 68.30 Dynamics of surface and interface vibrations, 78.30 Infrared and Raman spectra)

Yamada Conference VI on Neutron Scattering in Condensed Matter .... See Entry 105020

63.10 GENERAL THEORY

107835 Classfication of the vibrational spectrum of a crystal for irreducible co-representation. A method of secular equation train. O.V.Kovalev.
Ukr. Fiz. Zh. (USSR), vol.28, no.7, p.1103-5 (July 1983). In Russian.
The author expresses the energy as a sum of invariant coordinate combinations realising irreducible co-representation taking into account symmetry. A method is proposed to calculate frequencies in the complex case of some similar irreducible co-representations of the second type that cannot be analysed using usual methods. (1 ref.) *V.G.P.*

63.20 PHONONS AND VIBRATIONS IN CRYSTAL LATTICES

107836 Topological singularities and phonon focusing. D.Armbruster, G.Dangelmayr (Inst. fur Informationsverarbeitung, Univ. of Tubingen, Tubingen, Germany).
Z. Phys. B (Germany), vol.52, no.2, p.87-94 (1983).
The focusing directions of phonon images generated by the anisotropic propagation of ballistic phonons are interpreted as singularities of the Gauss map of the energy surface. While a linear dispersion produces only folds and cusps, a nonlinear dispersion relation generically induces singular events for critical values of the frequency. These events are classified by means of catastrophe theory and the local topology on the energy surfaces is elucidated. On reflection planes or symmetry axes new types of singularities occur. The consequences of Morse singularities in the dispersion relation for the focusing directions are discussed. (17 refs.)

107837 Systematic experimental and theoretical studies of the lattice vibrations of host atoms and substitutional Sn impurities in III-V semiconductors. O.H.Nielsen (Inst. of Phys., Univ. of Aarhus, Aarhus, Denmark), F.K.Larsen, S.Damgaard.
Z. Phys. B (Germany), vol.52, no.2, p.99-109 (1983).
The lattice vibrations of the two constituent atoms in the III-V semiconductors GaP, GaAs, GaSb, InP, InAs, and InSb have been studied experimentally by neutron diffraction and theoretically by calculations within the framework of various phonon models proposed in the literature for these compounds. The mean-square amplitudes (measured at 295K) show a general increase with increasing lattice constant and seem furthermore to reflect the partial ionicity of the compounds. The different phonon models for the lattice dynamics are compared with each other and tested critically against the experimental data. Several models are found to be insufficient. The most satisfactory ones are some shell models. ^{119}Sn Mossbauer impurity atoms have been implanted site-selectively on the two different substitutional lattice sites and their Debye temperatures have been determined. A rigorous result relating Debye temperatures of host and impurity atoms permits a simplified interpretation of the experimental results in terms of 'Einstein-Debye force constants'. (73 refs.)

107838 Dynamics and thermodynamics of anharmonic crystals near the instability point. C.Malinowska-Adamska (Inst. of Phys., Tech. Univ. of Lodz, Lodz, Poland).
Phys. Status Solidi b (Germany), vol.118, no.2, p.535-9 (1 Aug. 1983).
Using the self-consistent phonon theory based on the thermodynamic double-time Green's function method, the dynamics of the crystal lattice and the thermodynamics of anharmonic cubic crystals in the vicinity of the instability point are investigated. The results of calculations for the instability temperature T_s, relative displacements of atoms, anharmonic contributions to the free energy, and free Gibbs energy as well as the isothermal elastic constants are given and compared with experimental and other theoretical data for potassium, sodium, and rubidium. (17 refs.)

Condensed matter research at the Los Alamos pulsed neutron source (WNR) .... See Entry 106196

Vibrational spectra of hydrogen in silicon and germanium .... See Entry 107853

Plastic-deformation dependence of the Gruneisen parameter strain derivatives .... See Entry 107854

X-ray scattering in the normal and incommensurate phases of Rb_2ZnCl_4 .... See Entry 107915

Recent progress in commensurate-incommensurate phase transformations .... See Entry 107928

The oxide β-Ga_2O_3: force field, thermal expansion, and rigidity anisotropy .... See Entry 107990

Thermal transport in heavily deformed and γ-irradiated LiF at temperatures near 1K .... See Entry 108082

Thermal boundary resistance at the interface between a crystal and a disordered solid .... See Entry 108151

Role of phonon-induced hybridization in the spinless Anderson model .... See Entry 108291

Exciton solitons in one-dimensional molecular crystals .... See Entry 108298

Crystal field splittings and rapid direct relaxation of Fe^{2+} spin states from inelastic neutron scattering .... See Entry 108362

Phonon dynamics in superconductors .... See Entry 108601

High-pressure Raman study of liquid and molecular crystal at room temperature. Carbon disulphide .... See Entry 108936

Quantum beating of vibrational factor group components in molecular solids .... See Entry 108938

Spectroscopic studies of molecular interactions of oxygen-16 and oxygen-18 in the high-density ϵ-phase .... See Entry 108939

Raman scattering and fundamental absorption in red-HgI_2 under hydrostatic pressure .... See Entry 108942

Spectroscopic characteristics of the ν_{OH} vibration of polychlorophenols in the solid state .... See Entry 108957

Raman spectra of low-lying longitudinal model of KH_2PO_4 and KD_2PO_4 in ferroelectric phase .... See Entry 108959

Observation of disappearance of cooperative Jahn-Teller distortion in the two-dimensional magnetic system $K_2Cu_xZn_{1-x}F_4$ by Raman scattering experiments .... See Entry 108960

Optical absorption and magnetic circular dichroism of MnI_2 .... See Entry 108974

Effect of the application of uniaxial stress on precipitation in an Al(Cu) alloy .... See Entry 109307

63.20D Phonon states and bands, normal modes, and phonon dispersion

107839 X-ray diffraction determination of the mean-square static and dynamic displacements of atoms from the equilibrium position in solid solutions of the Fe-Ni system. A.G.Mikolaichuk, D.I.Vadets, V.D.Martynyuk, Ya.I.Fedyshin (Iv. Franko L'vov State Univ., L'vov, Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.8, p.1108-12 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1312-15 (Aug. 1982).
With an increase in temperature, the mean-square static displacements of atoms decrease for alloys of the Fe-Ni system containing 35, 44, 73, 80, and 90 at.% Ni. For the alloy with 50 at.% Ni, the mean-square static displacements of atoms do not vary in the temperature range from room temperature to 473K. The mean-square static displacements of atoms in Invar alloys decrease with an increase in temperature from room temperature to 973K. (8 refs.)

107840 Mode instability in NaCl structure under pressure. B.Okai (Nat. Inst. for Res. in Inorganic Materials, Ibaraki, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2289-92 (July 1983).
Mode instability is shown to occur in two models of NaCl structure as the applied pressure increases. One is Kellermann's model which neglects the field polarizability of the ions. In the other, this factor is taken into account along with distortion polarizability. In both of them, the transverse acoustic mode in the symmetric [100] direction becomes unstable; in the former, at the Γ point and in the latter, at the X point. With further increase of pressure, the longitudinal acoustic [100] mode becomes unstable at the X point in both cases.

107841 Infrared investigation of lattice vibration in black phosphorus. S.Terada, T.Hattori, M.Kobayashi, Y.Akahama, S.Endo (Dept. of Material Phys., Osaka Univ., Osaka, Japan), S.Narita.
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2630-3 (Aug. 1983).
The lattice vibrations in black phosphorus single crystals prepared under high pressure have been studied. The transmission spectra at various temperatures in a frequency range of 100-1000 cm^{-1} have been measured. The authors have found in the spectra at 1.5K sharp absorption peaks at 110, 132 and 474 cm^{-1}. By measuring the temperature, magnetic field and light-polarization dependences of the spectra and also by examining the correspondence of the observed several peaks in the spectra with the combinations of the single phonon modes, one can determine the energies of the two single infrared active phonon modes: B_{1u} and B_{2u}. (6 refs.)

107842 Phonon spectrum of boron nitride with wurtzite structure. T.D.Sokolovskii (Inst. of Phys. of Solids & Semiconductors, Acad. of Sci., Minsk, Belorussian SSR).
Phys. Status Solidi b (Germany), vol.118, no.2, p.493-8 (1 Aug. 1983).
Using quantum mechanics methods the interatomic force constants for the rigid-ion model of boron nitride with wurtzite structure are calculated. An analysis of the asymmetry of the fundamental vibrations of the lattice is performed by construction of the projection operators. Calculations of the phonon dispersion relations along seven directions of high symmetry of this lattice are carried out in the harmonic approximation. In terms of this model the phonon state density and the specific heat temperature dependence are determined for boron nitride with the wurtzite structure, the results being in good agreement with the experimental data on the specific heat. (18 refs.)

107843 On the translation mode of the kink lattice of a quasi-one-dimensional Peierls-Frohlich system with a nearly half-filled band. H.J.Fischbeck (Zentralinst. fur Elektronenphys., Akad. der Wissenschaften, Berlin, Germany).
Phys. Status Solidi b (Germany), vol.118, no.2, p.595-603 (1 Aug. 1983).
The translation mode of the kink lattice of a quasi-one-dimensional Peierls-Frohlich system in the continuum limit is investigated by means of the Landau expansion of the thermodynamic potential. An expression for the sound velocity is given and numerically evaluated. (9 refs.)

107844 Determination of the phonon density of states from the thermodynamic functions of a crystal (scandium and yttrium). V.A.Korshunov.
Russ. Metall. (GB), no.2, p.113-16 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.128-30 (1982).
For the group IIIA transition metals scandium and yttrium Tikhonov's regularisation method (see Dokl. AN SSSR, vol.151, no.3, p.501, 1963) provides a solution to the incorrectly formulated problem of determining the densities of states from the temperature dependence of the heat capacity of the phonons. The structures of the phonon densities of states found for Sc and Y are in good agreement with neutron-diffraction results. (23 refs.)

107845 Longwave optical phonons in $ZnTe_{1-x}S_x/_2Se_x/_2$ solid solutions. A.P.Litvinchuk, M.Ya.Valakh, G.G.Tarasov.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1194-8 (Aug. 1983). In Russian.
Phonon spectra of ternary $ZnTe_{1-x}S_{x/2}Se_{x/2}$ solid solutions are studied by Raman light scattering. The experimentally observed dependences of the long-wave optical phonon frequencies are compared with theoretical ones obtained on the basis of the isodisplacement model. The theoretical and experimental data are in good agreement. (9 refs.)

Nonlinear optical properties of semiconductors due to phonon flows .... See Entry 106823

Strain dependence of the amplitude of lattice vibration in a cubic crystal .... See Entry 107855

Phonon polaritons in the presence of a magnetic field .... See Entry 108308

Dielectric function of SmS. II. Infrared response: LO(Γ) phonon softening .... See Entry 108915

Complete first-order Raman spectra of the pyrite structure compounds FeS_2, MnS_2 and SiP_2 .... See Entry 108944

A Raman study of compositional disorder in defect chalcopyrites .... See Entry 108949

Directional dependence of extraordinary infrared oscillator parameters of $TlGaS_2$-type layer crystals .... See Entry 108950

B_{1g} mode softening in FeF_2 .... See Entry 108952

Light scattering from vibrational modes in GaAs-$Ga_{1-x}Al_xAs$ superlattices and related alloys .... See Entry 108954

Infrared transmission spectra of $CuInSe_2$ thin films .... See Entry 109029

63.20H Phonon-phonon interactions

Low temperature metallic resistivity of the charge-transfer organic conductor $(TMTSF)_2PF_6$ .... See Entry 108400

Anharmonic effects in light scattering due to optical phonons in silicon .... See Entry 108951

63.20K Phonon-electron interactions

107846 Electron-phonon interaction in periodic two-layer structures. E.P.Pokatilov, S.I.Beril (V.I. Lenin State Univ., Kishinev, USSR).
Phys. Status Solidi b (Germany), vol.118, no.2, p.567-73 (1 Aug. 1983).
The Hamiltonian of the interaction of electrons and spatially extended optical interface modes in two-layer periodic structures is developed. The developed interaction Hamiltonian could be used to study optical and kinetic processes in multilayer periodic structures including the structures of superlattice type, as the continuity criteria are fulfilled. (7 refs.)

Nonlinear optical properties of semiconductors due to phonon flows .... See Entry 106823

Theoretical study of lattice instability and lattice dynamics of 2H-$TaSe_2$ and 2H-$NbSe_2$. I. Electron Interaction and generalized electronic susceptibility .... See Entry 108284

The nature of temperature dependence of energy gaps in layer semiconductors .... See Entry 108289

Electrons and excitons in nonlinear molecular chains .... See Entry 108303

Charge orderings and lattice distortions in complex TCNQ salts .... See Entry 108316

Heavy doping effects on donor-acceptor spectra of polar semiconductors at low temperatures .... See Entry 108346

Influence of electron-phonon coupling on transport near a mobility edge .... See Entry 108378

Thermoelectric power of $TiSe_{2-x}S_x$ mixed crystals at low temperatures .... See Entry 108462

Effects of the electron-hole interaction on the giant quantum attenuation and velocity change of sound waves in pyrolytic graphite .... See Entry 108480

Theory of cyclotron resonance halfwidth for electrons scattered by impurities and phonons .... See Entry 108790

63.20M Phonon-defect interactions

107847 Solitons in a linear lattice with defects. V.Narisimha Iyer (Dept. of Phys., Mahatma Gandhi Coll., Trivandrum, India), K.S.Viswanathan.
Pramana (India), vol.20, no.5, p.415-27 (May 1983).
Solitons are generated in an anharmonic linear lattice in which neighbouring atoms interact through a Morse potential by giving either a strong initial impulse or a large displacement to an end atom. Studies on the variation of the characteristic properties of the soliton with the strength of the initial pulse show that the velocity and the amplitude of the soliton increase with the strength of the initial impulse, but below a certain critical value for the initial impulse, only an oscillatory tail is generated. It is shown that when a defect is present in the lattice, a localised mode appears at the site of the defect and additional solitons travelling forward or even backwards, are generated. When two solitons collide at a defect region, they reemerge but leave a localised mode at the site of the defect. If an initial velocity is imparted to a particular particle, synchronously with the crossing of the particle by the soliton, a localised mode emerges at the site of the particle and additional solitons are also generated. When a soliton moves from a denser to a rarer medium, a strong localised pulse is created near the region of the density discontinuity and additional solitons appear; and further a weak oscillatory tail is left behind in the denser medium. On the other hand, if a soliton moves from a rarer to a denser medium, it is reflected back and a small localised mode is generated at the site of the density discontinuity. The variation of amplitude of the soliton with the velocity of propagation is also studied. (9 refs.)

Mechanical, thermal, and microstructural properties of neutron-irradiated SiC .... See Entry 107777

Thermal conductivity of LiF containing dislocations at low temperatures .... See Entry 107973

Energy and phase relaxation of phosphorescent *F* centers in CaO .... See Entry 108995

63.20P Localized modes

107848 Lattice vibrations around a vacancy and vacancy clusters in metals. R.Yamamoto (Dept. of Metall. & Materials Sci., Univ. of Tokyo, Tokyo, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.120-5
The local vibrational densities of states of the neighbor atoms of a vacancy and vacancy-clusters in Cu, Fe and Ti were calculated by the recursion method. Broad resonant mode was found in the local frequency spectra of the first nearest neighbors. The influence of vacancy-type defects on the vibrations of the neighboring atoms is rather short range. (12 refs.)

107849 Computer simulations on the atomic vibration around a vacancy in refractory metals, V, Mo, Ta, and W. A.Suzuki, R.Yamamoto, M.Doyama (Dept. of Metall. & Materials Sci., Univ. of Tokyo, Tokyo, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.126-9
The local vibrational densities of states (LDS) around a vacancy in V, Mo, Ta and W were computed using the recursion method. The stage III temperatures (T_{III}) in radiation damage were estimated from these LDSs. (10 refs.)

107850 Lattice vibrations around point defects in cubic transition metals. K.Masuda (Dept. of Materials Sci. & Engng., Tokyo, Inst. of Technol., Yokohama, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.130-2
A (self-consistent) tight-binding type electronic theory and Born-Mayer repulsive potential are used to calculate the local vibrational spectra $g_i(\omega)$ and Debye parameters for the atoms near the vacancy-type lattice defects in cubic transition metals: $g_i(\omega)$ is determined by employing the recursion method. The so-called stage III temperature is also estimated using the calculated vibrational spectra. It is shown that inclusion of electronic effects (d-band narrowing and atomic relaxations) is important for the atomic vibrations near the defects. (12 refs.)

107851 Theory of the lattice vibration behaviour near point defects. I.Kanazawa, H.Murakami (Dept. of Phys., Tokyo Gakugei Univ., Tokyo, Japan), M.Doyama.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.133-5
A new theory about the vibration behaviour near point defects is introduced by the application of the Matsubara Green's function. This theory have a wide range of application rather than the formality by Dederichs and Zeller. The effect on interaction between the resonance mode and electrons was also discussed. (3 refs.)

Crystal analyser TOF spectrometer (CAT) .... See Entry 106213

Computer studies on self-interstitials in magnesium .... See Entry 107685

Solitons in a linear lattice with defects .... See Entry 107847

Theoretical description of photochemical hole burning in soft glasses .... See Entry 107852

Vibrational absorption bands for implanted nitrogen in crystalline silicon .... See Entry 108980

63.50 VIBRATIONAL STATES IN DISORDERED SYSTEMS

107852 Theoretical description of photochemical hole burning in soft glasses. B.Jackson, R.Silbey (Dept. of Chem., MIT, Cambridge, MA, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.4, p.331-4 (12 Aug. 1983).
The temperature dependence of the photochemical hole widths of molecules in soft glasses (T^α, $\alpha \approx 1.3$-1.5) is explained by a combination of two dephasing mechanisms. The narrow distribution of two-level systems in such glasses gives rise to one contribution, and the dephasing of localized librational modes by long-wavelength phonons provides a second contribution. The authors show that in the range $T \leq 25$K, the theoretical temperature dependence agrees with the experiment. (18 refs.)

107853 Vibrational spectra of hydrogen in silicon and germanium. M.Cardona (Xerox Palo Alto Res. Center, Palo Alto, CA, USA).
Phys. Status Solidi b (Germany), vol.118, no.2, p.463-81 (1 Aug. 1983).
Aims to give a comprehensive discussion of the vibrational spectra of hydrogen (or deuterium) in a-Si, c-Si, and c-Si surfaces and in a-Ge. A simple valence force field model for the vibrational frequencies of Si-H bonds is presented. The observed vibrational spectra are discussed in the light of the results of the model, and by comparison with the spectra of polysilanes and cyclopolysilanes. The author also discusses the strength of IR absorption lines. This makes it possible to determine the concentration of Si-H bonds in the various coexisting species. Finally, a similar, though less complete discussion is presented for a-Ge. (55 refs.)

Vibrational relaxation in liquids: quantum states in a classical bath .... See Entry 107503

The elastic properties of some phosphate/vanadate glasses ... See Entry 107805

Effect of empty spaces on the lattice thermal conductivity of noncrystalline material at low temperatures: Application to borosilicate glass .... See Entry 108086

Theory of the interaction between electrons and the two-level system in amorphous metals. I. Noncommutative model Hamiltonian and scaling of first order .... See Entry 108266

Theory of the interaction between electrons and the two-level system in amorphous metals. II. Second-order scaling equations .... See Entry 108267

Theory of the interaction between electrons and the two-level system in amorphous metals. III. Experimentally observable quantities .... See Entry 108268

Two-centre defects and low-energy excitations in vitreous silica .... See Entry 108334

Theoretical study of the infrared absorption in trans-$(CH)_x$ and trans-$(CD)_x$ .... See Entry 108953

63.70 STATISTICAL MECHANICS OF LATTICE VIBRATIONS

(see also 65. Thermal properties of condensed matter, 66.70 Thermal conduction)

107854 Plastic-deformation dependence of the Gruneisen parameter strain derivatives. P.M.Ossi (Istituto di Ingegneria Nucleare, CESNEF, Politecnico di Milano, Milano, Italy).
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.953-64 (July-Aug. 1983).
The strain derivatives of the Gruneisen parameter γ at room temperature are experimentally found to strongly depend on the plastic deformation ϵ_p imposed to the solid. γ is very sensitive to the alterations of the microstructure, which in turn remarkably influences the lattice dynamics of the crystal. To test such a complex interaction, measurements were performed on α-titanium at values of ϵ_p up to 10^{-1}. The obtained exponential relations between the strain derivatives of γ at the origin and ϵ_p are discussed for the first- and the second-order derivatives, $\partial\gamma/\partial\epsilon|_0$ and $\partial^2\gamma/\partial\epsilon^2|_0$, respectively. The results allow not only for a deeper knowledge of the γ behaviour, but also for outlining the work-hardening evolution in metallic materials. (11 refs.)

107855 Strain dependence of the amplitude of lattice vibration in a cubic crystal. M.Sugiyama (Dept. of Engng. Sci., Nagoya Inst. of Technol., Nagoya, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2428-32 (July 1983).
The coefficients of the linearized basic equations for thermo-elasticity and lattice vibration derived from the continuum approximation of the self-consistent Einstein model are estimated for FCC (Cu, Ag, Al, Pb, Ni) and BCC (Cr, Mo, W, Fe) crystals by assuming the Morse type pair-potentials. Two typical deformations, i.e. a uniaxial extension and a simple shear, are studied by using the linearized equations to show explicitly the effect of strain on the amplitude of the lattice vibration in a cubic crystal.

Systematic experimental and theoretical studies of the lattice vibrations of host atoms and substitutional Sn impurities in III-V semiconductors .... See Entry 107837

Thermal properties of a Bi_2O_3:Y_2O_3 oxygen conductor at low temperature .... See Entry 107975

The oxide β-Ga_2O_3: force field, thermal expansion, and rigidity anisotropy .... See Entry 107990

X-ray studies of solid n-H_2 .... See Entry 108107

Filling of the 3d band of the manganese in $GdAl_{2-x}Mn_x$ for $x<0.2$ .... See Entry 108276

Dielectric properties of alkali halides using Mott-Littleton polarization theory .... See Entry 108858

The generalization of the Debye equation and its application to the electrets study .... See Entry 108864

Anharmonic effects in light scattering due to optical phonons in silicon .... See Entry 108951

63.90 OTHER TOPICS IN LATTICE DYNAMICS AND CRYSTAL STATISTICS

Dechanneling anomalies of high-energy ions at the charge-density-wave transition in 1T-TaS_2 .... See Entry 107790

X-ray scattering in the normal and incommensurate phases of Rb_2ZnCl_4 .... See Entry 107915

Dielectric function of SmS. II. Infrared response: LO(Γ) phonon softening .... See Entry 108915

B_{1g} mode softening in FeF_2 .... See Entry 108952

64.00 EQUATIONS OF STATE, PHASE EQUILIBRIA, AND PHASE TRANSITIONS

(see also 82.60 Chemical thermodynamics)

64.10 GENERAL THEORY OF EQUATIONS OF STATE AND PHASE EQUILIBRIA

107856 Vapor-liquid equilibria calculations by means of an equation of state. A.Vetere (Primary Chem. Lab., ASSORENI, Milanese, Italy).
Chem. Eng. Sci. (GB), vol.38, no.8, p.1281-91 (1983).
An eight parameter equation of state has been applied to correlate vapor-liquid equilibria of binary and ternary mixtures, both polar and apolar, representative of various classes of compounds including high molecular weight compounds and quantal gases. The experimental field investigated ranges from subatmospheric to high pressure (up to 400 ata) and from cryogenic to high temperatures. It is shown that three binary interaction parameters are sufficient to correlate each binary system. Rules are given for calculating the eight pure component parameters when volumetric data for some compounds are lacking or inaccurate. (29 refs.)

107857 Modified Redlich-Kwong equation of state for saturated vapour-liquid equilibrium. J.Lielmezs, S.K.Howell, H.D.Campbell (Chem. Engng. Dept., Univ. of British Columbia, Vancouver, BC, Canada).
Chem. Eng. Sci. (GB), vol.38, no.8, p.1293-301 (1983).
Defining the dimensionless temperature T^* as: $T^* = [(T_c/T)-1]/[(T_c/T_{NB})-1]$ a new temperature dependence of the attractive force part of the Redlich-Kwong equation of state is presented. The new modified Redlich-Kwong equation predicts the saturated liquid-vapour equilibrium states accurately over the entire liquid range from the triple point up to the critical point. A comparison is made with experimental data for a series of selected organic, inorganic and quantal fluids (34 compounds, 740 data points pairs) and results obtained by the use of two modifications by Soave of the Redlich-Kwong equation of state. (90 refs.)

107858 Pore motion and change of shape in a temperature field because of evaporation and condensation processes. R.Ya.Kucherov, L.N.Shulepov.
J. Eng. Phys. (USA), vol.44, no.1, p.69-72 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.83-7 (Jan. 1983). [received: Sept. 1983]
Mass transfer in a vacuum spherical and cylindrical pore due to evaporation and condensation of the wall material in a temperature gradient field is examined on the basis of a molecular-kinetic analysis. (5 refs.)

107859 The equation of state for the hard sphere fluid at high density. The glass transition. R.J.Speedy (Chem. Dept., Victoria Univ. of Wellington, Wellington, New Zealand).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.153-61 (1983).
A new equation of state for the hard sphere and hard disc fluids is derived from the assumption that the correlation function $g(r,\phi)$, for the density of particles at a point ϕ on the surface of a pair of cavities separated by r, has the same density dependence as an arbitrary linear combination of $g(\sigma)$ and $(g(\sigma))^2$. This assumption provides a closure on the YBG hierarchy at the level of $g^{(3)}$. The equation is accurate over the entire fluid range and becomes unphysical a little beyond the freezing density. It predicts that the isothermal compressibility goes to zero, at a finite pressure, at a density $z_s = 0.75$ (relative to close packing). This observation accounts for the computer simulation results which indicate that the fluid becomes kinetically unstable with respect to freezing at $z = 0.76$ and that a diffuse fluid-amorphous solid transition occurs near z_s in the finite time experiments. (21 refs.)

An equation of state of Lennard-Jones fluids and evaluation of some thermodynamic properties .... See Entry 105296

Constructing a single equation of state for gas and liquid by the method of minimizing the sum of squares of the relative deviations .... See Entry 107310

Analysis of plane elastic-plastic shock-waves from the fourth-order anharmonic theory .... See Entry 107829

Thermodynamics of hard dumbell mixtures .... See Entry 107987

64.30 EQUATIONS OF STATE OF SPECIFIC SUBSTANCES

(see also 65.70 Thermal expansion)

Thermodynamic properties of liquid mixtures of krypton+methane ....See Entry 107986

64.60 GENERAL STUDIES OF PHASE TRANSITIONS

(for critical phenomena in quantum fluids, superconductors, magnetic materials and ferroelectrics, see 67., 74.40, 75.40 and 77.80 respectively)

107860 Algebraic investigations in Landau model of structural phase transitions. III. Extended integrity bases and thermodynamic potential. V.Kopsky (Inst. of Phys., Czechosl. Acad. Sci., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.8, p.845-69 (1983).
A review is given of the recently developed theory of the extended integrity bases, which gives a mathematical background for construction of all kinds of interactions within symmetric systems and hence also for the construction of the thermodynamic potential. It is shown for the first time that the invariants of second order for representations irreducible on the real arc of two types for those representations which are composed of two absolutely irreducible representations. Apart from the usual invariant of the form r^2 there exist also three antisymmetric invariants in the case of ireps of second kind and one antisymmetric invariant in the case of ireps of third kind. Different terms in thermodynamic potential are discussed. A special attention is given to the so-called faint variables and faint interactions in connection with application and interpretation of the Neuman's principle. It is shown, how the theory of integrity bases for covariants can be used to determine the faint interactions and interactions with external fields. The concept of exomorphism is finally discussed in connection with phase transition theory and its treatment in the language of colour groups. (29 refs.)

107861 Broadening of electronic spectra at the critical point of a binary polar mixture. L.D.Zusman (Inst. of Inorganic Chem., Acad. of Sci., Novosibirsk, USSR).
Chem. Phys. Lett. (Netherlands), vol.99, no.4, p.287-90 (12 Aug. 1983).
It is shown that in the vicinity of the critical point of a binary polar mixture the electronic spectral linewidth increases when approaching the critical point. The linewidth obeys the law $A_0[(T-T_c)/T_c]^{-\gamma}$, where γ is the universal critical index of dispersion of concentration fluctuations. (7 refs.)

107862 Computer study of the BCCj⇌FCC structure change by homogeneous deformations. P.Beauchamp, J.P.Villain (Lab. de Metall. Phys., Univ. de Poitiers, Poitiers, France).
J. Phys. (France), vol.44, no.9, p.1117-30 (Sept. 1983).
The Bain transformation BCC⇌FCC can be achieved by the two homogeneous 'shears' E and E′ proposed by Bogers and Burgers (1964). The authors first discuss the conditions for pair potentials to ensure the mechanical stability of both BCC and FCC structures; then, three phenomenological potentials for metals are used to calculate the crystal free energy density W for the deformation states $\gamma E+\gamma' E'$ (γ and γ' range from -0.5 to 1.5). The path $\gamma=\gamma'$, which keeps the crystal in a BCT structure, breaks the smallest number of symmetries and is found to be the minimum energy path. To generalize this result they have considered the elastic coefficients B (bulk modulus), $1/2(C_{11}-C_{12})$, C_{44}, C_{66} of the intermediate BCT structures: if they are positive the path $\gamma=\gamma'$ remains a minimum energy path with respect to any type of deformation. The potentials the authors have tried satisfy these conditions which, in general, are expected to be fulfilled for most potentials ensuring the mechanical stability at both ends of the path. The BCT intermediate structures are characterized by $\eta_1=(\text{Log } c/a)/\text{Log}\sqrt{2}$. The energy density $W(\eta_1)$ presents two minima at $\eta_1=0$ (BCC) and $\eta_1=1$ (FCC) separated by a maximum. The first derivative $dW/d\eta_1$ is proportional to the applied stress. The inflexion points, where the second derivative $d^2W/d\eta_1{}^2$ vanishes, define critical strains and stresses for the triggering of the transformation; these strains are of the order of 1/4 of the full Bain distortion and these stresses are lower than the theoretical shear strength. Besides, critical lines have been determined in the five planes (η_1, η_i) where η_i is either one of the shears $\{110\}\langle 1\bar{1}0\rangle$, ϵ_{23}, ϵ_{13}, ϵ_{12}, or an isotropic deformation. (18 refs.)

107863 The role of an isotropic term in governing the temperature range of the incommensurate phase. Y.Ishibashi (Synthetic Crystal Res. Lab., Nagoya Univ., Nagoya, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2634-6 (Aug. 1983).
An isotropic term of the form $QQ^* (\partial Q/\partial x)(\partial Q^*/\partial x)$ is taken into account in the Landau-type thermodynamic potential functional for normal-incommensurate-commensurate phase transitions, and is shown to play quantitatively an important role in governing the temperature range of the incommensurate phase.

107864 Monte Carlo investigation of the Mitsui model. V.I.Zinenko, N.G.Tomshina (Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
J. Phys. C (GB), vol.16, no.25, p.4997-5007 (10 Sept. 1983).
Two- and three-dimensional Mitsui models (1958) are investigated by Monte Carlo simulation. The temperature dependence of the order parameter, the susceptibility, the energy and the specific heat are computed. It is shown that in the region where $a+1>2\gamma$ all two- and three-dimensional lattices have one second-order phase transition in the 'ferroelectric' phase. In the region where $a+1<2\gamma$ just one type of three-dimensional lattice ($Z_1=2$, $Z_2=4$) has two second-order phase transitions. In this case the order parameter between two critical points has a dome-shaped temperature dependence. (17 refs.)

107865 Kinetics of domain growth in two dimensions. A.Sadiq, K.Binder (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
Phys. Rev. Lett. (USA), vol.51, no.8, p.674-7 (22 Aug. 1983).
The growth of ordered domains following a quench of a system from a temperature T in the disordered phase to a state below the critical temperature T_c is simulated by Monte Carlo computations. For a square-lattice gas with (fourfold-degenerate) 2×1 order the domain size $L(t)$ grows with time t as $L(t)\propto t^x$, $x\simeq0.35$ (density conserved) and $x={}^1/_2$ (density not conserved), respectively. Quenches to T_c and to $T=0$ are also discussed. (28 refs.)

107866 Eight-vertex model of two-dimensional domain walls. F.S.Rys (Fachbereich Phys., Freie Univ. Berlin, Berlin, Germany).
Phys. Rev. Lett. (USA), vol.51, no.10, p.849-52 (5 Sept. 1983).
A statistical model of interacting linear domain walls (occurring, e.g. in monolayer adsorbates) is solved on the square lattice with use of exact and numerical results of an equivalent eight-vertex model. For attractive walls a commensurate and an incommensurate phase are separated by a first-order line for stiff walls and by a fluid phase for flexible walls. The phase boundaries with the fluid phase are Ising-like. For repulsive stiff walls an intermediate striped phase with a nonuniversal boundary occurs which vanishes for higher flexibilities. Moreover, disorder lines are located. (21 refs.)

107867 Contribution to the solution of Heisenberg's model for phase transitions: the A2→B2 disorder-order transition in binary alloys of AB stoichiometry. F.Reynaud (Lab. d'Optique Electronique, CNRS, Toulouse, France).
Physica B & C (Netherlands), vol.121B+C, no.3, p.389-404 (Aug. 1983).
A fictitious spin operator is introduced in the state space of a lattice site i of a binary alloy. The spin operators of an isolated pair of nearest-neighbour sites i and j are coupled by the Heisenberg exchange Hamiltonian. Introduction of the Gibbs grand canonical ensemble enables one to show that the interaction Hamiltonian between the pair ij and the rest of the crystal may be written simply as $\hat{H}_{\text{int}}=-\mu\hat{N}$ (where $\hat{N}$ is the particle number operator corresponding to the long-range-order parameter and μ is its intensive conjugate variable). The state vector and the density matrix of the pair ij are then obtained by diagonalizing the operator corresponding to the grand canonical potential. Among others, the grand partition function is obtained as a function of the intensive variables of the problem. Neither the symmetry of the state vector nor the long-range-order parameter is a constant of the motion; they fluctuate with time in the vicinity of the transition. (20 refs.)

107868 Shift of phase equilibrium in highly dispersed systems. S.P.Chizhik, N.S.Lidorenko, N.T.Gladkikh, L.K.Grigor'yeva, R.N.Kuklin.
Russ. Metall. (GB), no.1, p.68-70 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.80-2 (1982).
It was established on the basis of a microscopic approach that a decrease in melting temperature results from a decrease in the energy of formation of vacancies in a dispersed particle due to the dimensional vacancy effect. The existence of more than one phase in a highly dispersed particle is impossible due to the instability of the thermodynamic state with the order parameter which is equal to the dimension of an ultradispersed particle. (12 refs.)

107869 Dimensional vacancy effect in the theory of homogeneous nucleation. N.S.Lidorenko, S.P.Chizhik, N.T.Gladkikh, L.K.Grigor'yeva, R.N.Kuklin.
Russ. Metall. (GB), no.1, p.70-3 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.82-6 (1982).
The size of a critical nucleus, taking into account the dimensional vacancy effect, is lower than the corresponding value predicted from the defect-free model. It follows from the dimensional vacancy effect that the energy barrier of formation of a nucleus of the new phase in a metastable thermodynamic system will decrease. The dimensional vacancy effect explains the experimentally observed rapid phase transitions of the first kind. (11 refs.)

107870 Kinetics of the chemo-epitaxial formation of a new phase during diffusional reaction. P.I.Ignatenko.
Russ. Metall. (GB), no.2, p.150-4 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.167-71 (1982).
In diffusional reaction in a given binary system, under isothermal conditions, there is preferential formation of two-dimensional nuclei of the new phase at saturations which are lower, the larger the difference between the free energies of formation of the two-dimensional and three-dimensional critical nuclei and the larger the difference between the activation energies of surface and volume diffusion. The rate of growth of the nuclei of the new phase during diffusional reaction is determined by the type of interface and by the saturation conditions of the mother phase by external elements and is largely dependent on the difference between the free energies of the contacting phases. (10 refs.)

Modulated structure of an Ising spin system on a triangular lattice. II. Complete devil's staircase ....See Entry 105255

Metastable zone width in salting-out crystallisation ....See Entry 107875

Self-sustaining crystallization of amorphous layers of water and heavy water ... .See Entry 107878

On the nucleation of melts under microgravity conditions ..... See Entry 107886

Critical fluctuations in a binary polymer mixture .... See Entry 107951

'Hot' crystallization centers in amorphous layers ....See Entry 108128

Nucleation and strain relaxation at the InAs/GaAs (100) heterojunction ....See Entry 108202

Influence of an epitaxial substrate on the growth rate of ammonium iodide crystals ....See Entry 108237

Effects of an order-disorder transition on surface deep levels in metastable $(GaAs)_{1-x}Ge_{2x}$ ....See Entry 108499

Experimental evidence of nucleation induced transition in a bistable chemical system .... See Entry 109733

64.70 PHASE EQUILIBRIA, PHASE TRANSITIONS, AND CRITICAL POINTS

(see also 81.30 Phase diagrams and microstructures developed by solidification and solid-solid phase transformations)

107871 Comparison of triple point temperatures realized in two different types of sealed cells. O.Tamura, H.Sakurai (Nat. Res. Lab. of Metrology, Ibaraki, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.6, p.L356-7 (June 1983).
The temperature differences between the triple points of neon, oxygen and argon realized in two types of sealed cells designed by the Istituto di Metrologia 'G. Colonnetti' (IMGC, Italy) and the National Research Laboratory of Metrology (NRLM, Japan) are measured. The triple point temperatures for neon and argon agree within the error of measurement between the two types of cells, while the oxygen triple point of the NRLM cell is 1.4 mK higher than that of the IMGC cell. (8 refs.)

107872 The stability of the phases in the Ln_2O_3-FeO-Fe_2O_3 systems which are stable at elevated temperatures (*Ln*: lanthanide elements and Y). N.Kimizuka, A.Yamamoto, H.Ohashi (Nat. Inst. for Res. in Inorganic Materials, Ibaraki-ken, Japan), T.Sugihara, T.Sekine.
J. Solid State Chem. (USA), vol.49, no.1, p.65-76 (Aug. 1983).
Thermochemical data on $LnFeO_3$, $Ln_3Fe_5O_{12}$, and $(LnFeO_3)_nFeO$ ($n=1$ and 2) which are stable in the Ln_2O_3-FeO-Fe_2O_3 systems at elevated temperatures are reevaluated and interpreted on the basis of a simple point charge ionic model (*Ln*:lanthanide elements and Y). As the radius of the *Ln* ion in each compound decreases, the $LnFeO_3$ compound (distorted perovskite type) becomes less stable, the $Ln_3Fe_5O_{12}$ compound (garnet type) is the most stable for Ln=Tb, and the $(LnFeO_3)_nFeO$ compounds (layered structures) become more stable. The stability of each phase is strongly dependent upon the fitting of *Ln* ion in *A*-site position for the perovskite structure, in the dodecahedral site position for the garnet structure, and in the octahedral site positions for the layered structure compounds, respectively. It is qualitatively useful to estimate the Madelung energies of a series of isostructural phases on the basis

of a simple point charge ionic model, especially as a guide for understanding a series of new phase diagrams which describe the isostructural phases. (30 refs.)

Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191) .... See Entry 105032

PHAB—an alloy phase diagram bibliographic database: a part of the ASM/NBS data program for alloy phase diagrams .... See Entry 105048

On the formation of transition metal-rich glassy phases in the systems Ni-As, Pd-As and Pt-As .... See Entry 107558

The system HfO_2-RE oxide with high RE oxide contents .... See Entry 107587

Statistical thermodynamic approach to some hyperstoichiometric dihydrides of lanthanides (La, Ce, Pr, Nd, Sm) and actinides (Np, Pu, Am) .... See Entry 107595

X-ray structure investigation of the Y-{Ti, Cr, Zr, Hf}=Ga alloy system .... See Entry 107601

Remarks on the La_2O_3-Li_2O binary system between 750° and 1000°C .... See Entry 107613

Phase transitions in deuterated compound $\{N(CD_3)_4\}_2CuBr_4$. See Entry 107914

Enthalpies of formation of Au-Ge and Au-Ag-Ge liquid alloys at 1373K .... See Entry 107981

Investigation of the thermodynamics of oxygen and the determination of phase boundaries in the system copper-oxygen-bismuth at 1200°C . See Entry 107989

Conductometric investigation of the KCl-$MnCl_2$ system .... See Entry 108000

Study of the behaviour of Al-Zn alloys by SAXS in the temperature range of the instable solid solution .... See Entry 109046

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A correlation of the thermodynamic properties and phase diagram of the system lead-silver using a Gaussian plus subregular formalism .... See Entry 109221

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Examination of phase equilibrium in Ti-Al-Zr-W-Mo alloys .... See Entry 109225

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Construction of the T-P-N state diagram of the Co-C system at pressures up to 100 kbar .... See Entry 109228

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The Nb-Ga-Cu phase diagram (superconducting compounds) .. See Entry 109231

Cu-Ti and Cu-Ti-Al solid state phase equilibria in the Cu-rich region .... See Entry 109234

Constitution of the binary Pd-Si system in the concentration range from 0 to 33.3 at.% Si .... See Entry 109235

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The Au-Pb phase diagram .... See Entry 109238

The In-Sn phase diagram .... See Entry 109239

Phase equilibria in the Ni-rich region of the Ni-Al-Zr system .... See Entry 109240

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Interactions of LiBr with calcite and calcium oxide powders .... See Entry 109247

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Phase equilibria in the binary systems $Pb(PO_3)_2$-$PbMoO_4(PbWO_4)$ and $Pb_2P_2O_7$-$PbMoO_4(PbWO_4)$ .... See Entry 109251

Phase diagram of the systems $Cu_{2-x}S$-ZnS and $Cu_{2-x}Se$-ZnSe .... See Entry 109253

Phase equilibria in the Ag_2Se-ZnSe and Ag_2Se-CdSe systems .... See Entry 109254

Phase equilibria of the Bi-Se-I system in the BiSeI-Bi and BiSeI-BiI sections .... See Entry 109255

Reactions in the Cu_2Se-In_2Se_3-Se ternary system .... See Entry 109256

The Tl_2Se-As system .... See Entry 109257

The $TlAsSe_2$-Tl system .... See Entry 109258

The Tl_4AsSe_2-AsSe system .... See Entry 109259

Crystal chemistry and phase relations in the system Li_2O-Fe_2O_3-TiO_2 .... See Entry 109260

Thermochemistry of Na_2O-WO_3 system at 1065 to 1239K ... See Entry 109263

Phase composition of aqueous/hydrocarbon systems containing organic salts, alcohol, and sodium chloride .... See Entry 109813

64.70D Solid-liquid transitions

(see also 81.30F Solidification)

107873 Influence of doping on the liquid-amorphous transition induced by picosecond laser irradiation of Si. S.U.Campisano, P.Baeri, Jing-Ping Zhang, E.Rimini (Istituto Dipartimentale di Fisica, Catania, Italy), A.M.Malvezzi.
Appl. Phys. Lett. (USA), vol.43, no.4, p.370-2 (15 Aug. 1983).
The effect of Bi doping on the quench of amorphous Si directly from the melt during 30-ps, 0.53-μm laser irradiation has been studied. The amorphous thickness (45 nm) in Bi implanted samples was observed to increase 50% over the corresponding undoped samples (25 nm). No change in the Bi profile was detected upon amorphization. (12 refs.)

107874 Instability of 'slow' solid-liquid interface relaxation before the hetero-LPE of III-V compounds. Yu.B.Bolkhovityanov, S.I.Chikichev (Inst. of Semiconductor Phys., Acad. of Sci., Novosibirsk, USSR).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.847-57 (1983).
Results of specially designed experiments supplemented by numerous literature examples have been analysed in an attempt to elucidate the processes occurring at the interface between saturated multicomponent liquid and a non-equilibrium solid before the hetero-LPE of nearly lattice-matched III-V compounds. The 'slow' interface relaxation which provides the moving of non-equilibrium solid-liquid system in the direction of thermodynamic equilibrium by solid-state diffusion (and which was previously believed to be the only way of equilibrium approach in lattice-matched systems) loses the stability in some cases, being replaced by 'fast' relaxation. It has been shown that the liquid-solid interface instability develops due to a collective action of several factors, and their particular combination produces definite mode of relaxation. The 'slow' relaxation would be unstable, if, as a result of underlying solid dissolution: (I) the lattice parameter of equilibrium solid decreases continuously with respect to that of the substrate, increasing thereby the driving force for dissolution; (II) the solubility of group V component in a changed liquid increases. In a majority of cases the switching to 'fast' relaxation is facilitated by (III) the initial negative difference between the lattice parameters of equilibrium and underlying solids at the growth temperature. (38 refs.)

107875 Metastable zone width in salting-out crystallisation. P.H.Karpinski, J.Nyvlt (Inst. of Chem. Engng. & Heat Systems, Tech. Univ., Wroclaw, Poland).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.959-65 (1983).
Measurements of the metastable zone width, giving information on nucleation characteristics, have been used for crystallisation by cooling until now. This approach is now adopted for salting-out of inorganic salts from aqueous solutions by addition of an organic solvent. Theoretical description is illustrated by precipitation of magnesium sulphate using methanol and ethanol as second solvents. (12 refs.)

107876 Field equations of a crystallization front. F.Vodak (Faculty of Civil Engng., Czech Tech. Univ., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.8, p.930-40 (1983).
The paper deals with the transition zone at the dividing surface in a solid-liquid system. This transition zone (the crystallization front) is modelled as a discontinuity surface in continuum. It is shown that the mechanical, thermodynamic, structural and morphological conditions of the front are described by thirty-eight scaler parameters. Equations representing the space-time evolution of these parameters are formulated. The relation of these equations to Stefan's problem is discussed. (22 refs.)

107877 Fusion in phosphate systems at temperatures up to 2970K. Z.Ya.Kanepe, Z.A.Konstant, B.A.Skrebe (Inst. of Inorganic Chem., Acad. of Sci., Latvian SSR).
Inorg. Mater. (USA), vol.18, no.8, p.1133-5 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1338-40 (Aug. 1982).
A method has been developed for determining the melting points of substances, including phosphates, up to temperatures of 2970K, by using a graphite atomiser in standard production. Interaction in the binary system $ScPO_4$-Sc_2O_3 has been investigated, and a phase diagram has been constructed for this system on the basis of the results obtained. (9 refs.)

107878 Self-sustaining crystallization of amorphous layers of water and heavy water. V.P.Koverda, N.M.Bogdanov, V.P.Skripov (Dept. of Phys.-Tech. Problems of Energetics, Acad. of Sci., Sverdlovsk, USSR).
J. Non-Cryst. Solids (Netherlands), vol.57, no.2, p.203-12 (1 Sept. 1983).
An experimental study of the kinetics of crystallization of the amorphous condensates H_2O and D_2O has been carried out and their glass-transition temperatures have been measured. The results are explained from the position of the mass crystallization theory, the nonstationary nucleation being taken into account. The conditions of emergence of self-sustaining crystallization of water amorphous layers are analyzed. (18 refs.)

107879 Use of classical Stefan problem for initializing solution in the numerical prediction of freezing. V.M.Gorislavets, V.A.Mitrokhin (All-Union Petroleum & Gas Sci.-Res. Inst. on Construction of Main Pipelines, USSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1304-8 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.847-50 (Nov. 1982). [received: Sept. 1983]
The exact solution of the classical Stefan problem is examined from the point of view of using it as an 'initial solution' in numerical solutions of appropriate problems. (11 refs.)

107880 Relationship between some thermodynamic parameters and the tendency of metallic melts to glassify. A.V.Gorokh, B.F.Belov.
Russ. Metall. (GB), no.2, p.183-6 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.201-4 (1982).
In the analysis of the changes in the thermophysical characteristics of substances during heating and cooling, a graph of the relationship between these characteristics and the enthalpy H rather than the temperature is more informative. The thermodynamic meaning of supercooling is that the derivative dT/dH of the cooling of a melt is larger than it is when a solid body is heated. The entropy, as a function of enthalpy, changes continuously during melting of a solid, which indicates that there is a state transitional between the liquid and solid states. During the change from the molten to the solid crystalline state, such a transitional state does not form, as evidenced by the sudden discontinuous spontaneous crystallisation of a supercooled melt. The prevention of spontaneous crystallisation and the associated adiabatic decrease in the configurational entropy of the substance is the main task in the problem of glassification of metallic melts. (9 refs.)

107881 Formation of disperse liquid zones at coherent boundaries in superheated FCC crystals. E.S.Kucherenko (Metall. Inst., Dnepropetrovsk, Ukrainian SSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.108-9 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.188-9 (Jan.-Feb. 1983). [received: Sept. 1983]
Gives the results of observations indicating the presence of defects of structure in coherent boundaries of annealing twins in FCC alloys, so that they play the part of effective sources of fusion centers. For deformed twins it has been observed that there is an increased degree of distortion of the regions in the crystal adjoining the coherent boundaries and that they are saturated with dislocations. Near the coherent boundaries of recrystallization twins, such zones were not observed. The investigations were made with the alloys Cu+7, 14, 15.5, 22% Zn, Cu+5, 10% Ga, and Cu+1.5, 3.5% Si (wt.%). (3 refs.)

107882 The role of cubic ice in freezing of a supercooled water droplet. T.Takahashi.
Solid State Phys. (Japan), vol.18, no.5, p.279-86 (May 1983). In Japanese.
To clarify the formation mechanism of snow polycrystals which are characterized by the misorientation of 70.5°-70.6° about [1120], the formation process of a cubic ice is discussed by the homogeneous and two-dimensional nucleation theory. (23 refs.)

107883 Monotectic alloy solidification—determination of the liquidus surface in the system succinnonitrile-ethanol-glycerol. R.N.Grugel, A.Hellawell (Dept. of Metall. Engng., Michigan Technol. Univ., Houghton MI, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.417-22
The microstructure of alloys undergoing a monotectic reaction, Liquid I$\rightleftarrows$solid I+liquid II, is related to the height of the liquid miscibility gap, upper consolute temperature, T_C, relative to that of the monotectic horizontal at T_M. It has been shown in the system Cu-Pb-Al that a transition in microstructure occurs as the temperature interval, T_C-T_M, changes with composition. In order to observe the structural change directly in a transparent material, it has been necessary to determine the liquidus surface for the system succinnonitrile (S)-ethanol (E)-glycerol (G). In this system monotectic reactions in the binary S-E and S-G systems are joined by a monovariant valley and a structural transition occurs at approximately 85.6 wt.% S, 7.5 wt.% E, 6.9 wt.% G, at a ratio of 48:52=G:E. (10 refs.)

107884 Particle transport induced by directional solidification. H.Klein, R.Nahle (DFVLR, Inst. for Space Simulation, Koln-Porz, Germany).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.37-40
Scientific objectives and technical implementation of the MAUS Experiment DG-315 to be flown on STS 7 are presented. The experiment studies particle transport mechanisms in multiphase dispersions using a transparent model system for optical observation. The motion of air bubbles and liquid Pb particles in molten CsCl during directional solidification is photographically recorded. The objectives are: firstly, measurement of the particle diameter dependence of the interface-tension-gradient driven velocity of the gaseous and liquid particles, and secondly, measurement of the particle diameter dependence of the critical velocity of the solidification front which separates the regimes of particle rejection by the interface, and particle trapping in the solid. (6 refs.)

107885 Precipitation of gas pores in metallic melts during cooling under microgravity. H.Shahani, H.Fredriksson (Dept. of Casting of Metals, Royal Inst. of Technol., Stockholm, Sweden).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.71-8
In the Swedish rocket program for Material Science research a series of experiments in pore formation in Al-base alloys have been performed. The alloys were melted under high pressure H_2-atmosphere on earth and remelted at low pressure in space. Due to the pressure difference pores were formed. The nucleation and growth of the pores were analysed as a function of the pressure difference and also as a function of the alloy composition. The results of the experiment and the theoretical aspects of pore growth are both discussed. (2 refs.)

107886 On the nucleation of melts under microgravity conditions. C.Barta, A.Triska (Inst. of Phys., Czechoslovak Acad. of Sci., Prague, Czechoslovakia), V.Ilyukhin, G.Zhukov.
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.79-83
Presents results of the qualitative analysis of causes and consequences which are characteristic for the processes that take place during the gradual cooling of a multicomponent melt at $g=1$ and $g\to 0$. At the same time the authors carry out a qualitative evaluation of the suitability of experimental materials for illustrating expected differences in the course of these proceses at $g=1$ and $g\to 0$. From this point of view the authors also judge the results of the MORAVA set of experiments. On the basis of the knowledge gained the authors then formulate a hypothesis concerning the causes and consequences of the phenomena observed. The aim of the new set of experiments MORAVA II, is to test the validity of the discovered facts. (10 refs.)

107887 Convection-Marangoni effects in solidification-microgravity. A.Sanfeld, A.Steinchen (Chimie-Phys. II, Univ. Libre de Bruxelles, Brussels, Belgium), B.Billia, L.Capella.
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.281-4
The influence of convection due to the difference of densities between solid and melt and of Marangoni effects on the morphological stability of the solidification front is investigated under microgravity. A new destabilizing contribution is predicted for large velocities of growth in Newtonian or Maxwellian systems. Marangoni convection might be coupled with the morphological contribution in oscillatory regimes, for large wavelengths. (9 refs.)

107888 Convection effects at solid-liquid interfaces—influence of gravity. M.E.Glicksman, Q.T.Fang (Materials Engng. Dept., Rensselaer Polytech. Inst., Troy, NY, USA), S.R.Coriell, R.F.Boisvert.
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.313-17
The stability of the flow between two vertical, infinite, rigid, coaxial cylinders held at different temperatures is analyzed by linear stability theory. For a Prandtl number of 22.8 and a radius ratio of 0.02, the flow is unstable to an axisymmetric perturbation at a critical Grashof number of 2150; the wave speed of the instability is comparable to the maximum velocity of the unperturbed flow. When the rigid outer cylinder-fluid interface is replaced by a crystal-melt interface which can change shape, two new modes of instability occur at lower Grashof numbers. These calculations were motivated by and are in general agreement with the authors recent experiments on succinonitrile. (19 refs.)

107889 The effect of the natural convection on the solidification of metallic alloys. H.Fredriksson (Dept. of Casting of Metals, Royal Inst. of Technol., Stockholm, Sweden).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.319-23
During solidification of metallic alloys various effects occur as a result of natural convection. Natural convection has an influence on the crystal structure as well as on the distribution of the alloying elements. The different phenomena are discussed, results are presented and analysed from a theoretical point of view. The effect of gravity on these phenomena is also discussed. (6 refs.)

107890 Processing/microstructure relationships in surface melting. R.J.Schaefer, R.Mehrabian (NBS, Wshington, DC, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.733-44
The development of predictive models for rapid surface melting and resolidification requires coupling of realistic heat flow models to emerging theories of rapid solidification processing. Attainment of unique microstructures and phases, for example through plane-front solidification and solute trapping, can be correlated to solid/liquid interface velocity, temperature and temperature gradients, and to theories of morphological stability. However, there are important limitations on achievable solid/liquid interface velocity depending upon the heating mode and heat flux distribution, melt thickness and location of the interface within the molten zone. An overview is given of the emerging guidelines for prediction and control of rapid solidification conditions and microstructures. Homogenization of the liquid by convection and diffusion is also discussed. Electron beam surface melting of alloy substrates is used as an example of these processes. (14 refs.)

Determination of high melting points of metals and slags by a contact method ....See Entry 105328

Nuclear response and phase transformation of melt grown, SbI_3-doped HgI_2 ....See Entry 106220

Transport near a vertical ice surface melting in water of various salinity levels ....See Entry 107104

Investigation of convective flows in model systems of directional solidification configurations ....See Entry 107161

Implications of the lack of wetting at the monotectic growth front ....See Entry 107581

Effects at boundaries of recrystallized twins in overheated FCC crystals ....See Entry 107715

Pulsed laser melting of metallic glasses ....See Entry 107760

Metastable Fe(Pd) alloys formed by pulsed electron beam melting ....See Entry 107769

Pulsed proton beam annealing of Co-Si thin film systems .....See Entry 107788

Pulsed ion beam interface melting of PtCr and CrTa alloys on Si structures ....See Entry 107789

Behavior of sodium near melting point found by measurement of sound velocity ....See Entry 107832

Change of ultrasonic wave velocity in indium near the melting point ....See Entry 107833

Pore motion and change of shape in a temperature field because of evaporation and condensation processes ....See Entry 107858

The equation of state for the hard sphere fluid at high density. The glass transition ....See Entry 107859

Evaporating of iron and cobalt at levitation melting ....See Entry 107895

On the problem of evaporating of metals at levitation melting ....See Entry 107896

Characterisation of the polymorphic component of 2-fluoronaphthalene ....See Entry 107921

Influence of crystallisation conditions on the size of cellular and cellular-dendritic substructure ....See Entry 107963

Towards a molecular theory of the solid-liquid phase boundary. Structural theory and effective lattice models ....See Entry 108119

'Hot' crystallization centers in amorphous layers ....See Entry 108128

A linear relationship between the ^{13}C ester carbon chemical shift and the melting point or S to N transition temperature of n-alkyl esters of biphenyl-4,4′-dicarboxylic acid ....See Entry 108808

New inorganic material with a high concentration of Nd^{3+} ions for obtaining stimulated emission at the $^4F_{3/2}\to{}^4I_{11/2}$ and $^4F_{3/2}\to{}^4I_{13/2}$ transitions ....See Entry 108978

On remeltings at the crystal growth from the melt ....See Entry 109132

Microcrystalline iron-base alloys made using a rapid solidification technology ....See Entry 109186

Structure and properties of rapidly solidified 7075 P/M aluminum alloy modified with nickel and zirconium ....See Entry 109187

Structure and properties of rapidly cooled (superconductive) Pb-Bi alloys ....See Entry 109232

Low-gravity experiments on liquid phase miscibility gap (LPMG) alloys—materials experiments assembly (MEA) ....See Entry 109246

The occurence, effect, and control of twinned columnar growth in aluminum alloys ....See Entry 109265

Impinging melt flow and metallic ribbon formation in the single-roll rapid solidification process ....See Entry 109266

Unidirectional solidification behaviors at high cooling rates in Al-Fe-Mn ternary eutectic alloys ....See Entry 109267

A study on the modification of eutectic Al-Si alloys by Sr in permanent mold casting ....See Entry 109268

Structural formation of high-speed steels during crystallization ....See Entry 109269

Structure and properties of alloys of the Al-Mn system quenched from the liquid state ....See Entry 109270

Form of growth of primary phases and micromorphology of controlled eutectics ....See Entry 109273

Investigation of the crystallisation of alloys in systems containing peritectic transformations ....See Entry 109274

Regularities in the precipitation of W-Re alloys from a mixture of their hexafluorides with hydrogen ....See Entry 109275

Ostwald ripening and solidification behaviour of near-monotectic Zn-Pb alloys ....See Entry 109276

Formation and thermal stability of an oxide dispersion in a rapidly solidified Ti-Er alloy ....See Entry 109320

Structure and wear properties of Al-Sn alloy produced by electroslag remelting ....See Entry 109524

Submicron conductor array fabricated from a recrystallized eutectic thin film ....See Entry 109604

Neutron diffraction study of cubic ice nucleation in a porous silica network ....See Entry 109790

64.70F Liquid-vapour transitions

107891 The coexistence curve of GeH_4 and correction-to-scaling. D.Balzarini, O.G.Mouritsen, P.Palffy-Muhoray (Dept. of Phys., Univ. of British Columbia, Vancouver, BC, Canada).
Can. J. Phys. (Canada), vol.61, no.9, p.1301-4 (Sept. 1983).
High-precision data for the coexistence curve of GeH_4 covering the reduced temperature range $10^{-6}<t<5\times10^{-2}$ have been derived from measurements of the refractive index by focal plane interference methods. The data are analyzed in terms of correction-to-scaling confluent singularities, $(\rho_l-\rho_v)/2\rho_c=A|t|^\beta(1+a_1|t|^\Delta+a_2|t|^{2\Delta})$, to yield the nonuniversal amplitudes. This is done by fitting the proposed theoretical expression to the data and by fixing the exponents to their renormalization group values. The data support the theoretical expression for $|t|\lesssim10^{-2}$. (16 refs.)

107892 Studies on the temperature dependence of vapour pressure of pure liquids and solutions. III. Measurements of rate of evaporation and (deduced) vapour pressure for n-butyl and iso-amyl alcohol from 10°C to 42°C. S.W.Ali (PCSIR Labs., Karachi, India), M.M.Qurashi.
Proc. Pak. Acad. Sci. (Pakistan), vol.19, no.1, p.1-13 (1982).
For pt.II see ibid., vol.17, no.1, p.12 (1980). In view of previous findings, it was considered worthwhile to study the corresponding behaviour of pure n-butyl and amyl alcohol. Accordingly, the authors present these measurements in the range of 30°C to 60°C for n-butyl alcohol, together with some comparative measurements for isoamyl alcohol, from 35° to 55°C. (6 refs.)

107893 X-ray total external reflectance-diffraction as a probe of the structure of the liquid-vapor interface. U.Mohanty, S.A.Rice (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
J. Chem. Phys. (USA), vol.79, no.5, p.2482-6 (1 Sept. 1983).
For potential use in the study of the structure of the liquid-vapor interface of a liquid metal, the authors analyze the scattering of a collimated beam of X-rays which strike the plane surface of a liquid metal at an angle below the range for total external reflection. The analysis of the diffraction pattern is based on the Von Laue model of a condensed phase scatterer and the distorted wave approximation. The X-ray total reflectance-diffraction is expresses in terms of the structure factor of the inhomogeneous transition zone between the liquid and vapor of a metal. (16 refs.)

107894 Vapor pressure isotope effects in liquid methyl fluoride. T.Ol, J.Shulman, A.Popowicz, T.Ishida (Dept. of Chem., State Univ. of New York, Stony Brook, NY, USA).
J. Phys. Chem. (USA), vol.87, no.16, p.3153-60 (4 Aug. 1983).
The vapour pressures of the isotopic methyl fluorides $^{12}CH_3F$, $^{12}CD_3F$, and $^{13}CH_3F$ have been measured at temperatures betwen 132.48 and 213.12K by differential manometric techniques in a precision cryostat. Throughout the whole temperature range of the measurements, $P(^{12}CH_3F)>P(^{12}CD_3F)$ and $P(^{12}CH_3F)<P(^{13}CH_3F)$. The data are best represented by $T\ \ln(f_c/f_g)=(2225.2\pm7.4)/T-(4.444\pm0.046)$ for the D/H effect and by $T\ \ln(f_c/f_g)=(56.58\pm2.09)/T-(0.6383\pm0.0133)$ for the $^{13}C/^{12}C$ effect. A series of calculations using Wilson's GF matrix method and a modified Schachtschneider-Snyder program resulted in temperature-dependent internal-external interactions in the liquid phase: presence of such interactions between the molecular translation in the direction of the molecular figure axis and the parallel normal modes ν_2 and ν_3 is a necessary requirement for satisfactory explanation of all isotopic vapor pressure and spectroscopic data of the liquid. The specific internal-external interactions found are consistent with the structure of CH_3F clusters obtained by ab inito molecular orbital calculations. (48 refs.)

107895 Evaporating of iron and cobalt at levitation melting. P.Kubicek, B.Wozniakova (CSAV, Ostrava, Czechoslovakia).
Kovove Mater. (Czechoslovakia), vol.21, no.4, p.467-78 (1983). In Czech.
The method of evaluation of experimental data concerning the evaporation of pure metals and binary systems for a general temperature course is analyzed. An application of radiotracers is considered for evaporation of binary systems. The process of condensation of metal vapor in the boundary layer is taken into consideration. (10 refs.)

107896 On the problem of evaporating of metals at levitation melting. P.Kubicek, B.Wozniakova (CSAV, Ostrava, Czechoslovakia).
Kovove Mater. (Czechoslovakia), vol.21, no.4, p.479-96 (1983). In Czech.
Semiempirical relations used for calculating the evaporation rate at levitation melting are compared with the theory of diffusion for a moving solid particle. The temperature field and the rate profile around the spherical particle are calculated. Theoretical conclusions are illustrated on the evaporation of iron in the flow of argon. (13 refs.)

Evaluation of binary PTxy vapor-liquid equilibrium data for C_6 hydrocarbons. Benzene+hexane ....See Entry 105045

Evaporative convection in minute drops on a plate with temperature gradient ....See Entry 107128

Dynamic equation of state of a gas containing vaporizing droplets ....See Entry 107309

Vapor-liquid equilibria calculations by means of an equation of state ....See Entry 107856

Modified Redlich-Kwong equation of state for saturated vapour-liquid equilibrium ....See Entry 107857

Thermal conductivity measurement of n-butane over wide temperature and pressure ranges ....See Entry 108078

Heat integration of distillation columns into overall processes ....See Entry 109785

64.70H Solid-vapour transitions

107897 Evaporation thermodynamics of lanthanum monotelluride. S.P.Gordienko, B.V.Fenochka (Inst. of Materials-Sci. Problems, Acad. of Sci., Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.11, p.1554-8 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1811-15 (Nov. 1982).
Mass spectrometry together with chemical and X-ray analyses has given the behaviour characteristics of lanthanum monotelluride of controlled composition under vacuum at 1670-2250K. The composition and pressure of the vapor have been established, together with the type of evaporation reaction, and the enthalpies have been determined for atomisation, sublimation, and formation of solid lanthanum monotelluride, together with the dissociation energy of the gaseous form. When complete isothermal evaporation is used, an analysis may be made of the chemical composition of the specimen at various stages of evaporation. Small amounts of oxygen (up to 0.3 mass %) substantially influence the thermodynamic characteristics. Estimates have also been made of the thermodynamic functions of solid and gaseous lanthanum monotelluride at temperatures of up to 200K. (11 refs.)

107898 Vapor pressures, vaporization reactions, and thermodynamics of vaporization of VS(s). J.G.Edwards, M.Pelino, J.S.Starzynski (Dept. of Chem., Univ. of Toledo, Toledo, OH, USA).
J. Chem. Phys. (USA), vol.79, no.5, p.2351-5 (1 Sept. 1983).
Two studies of the vaporization of VS(s) were conducted in the temperature range 1770-2069K by the simultaneous Knudsen-torsion-effusion method. The vapor pressure of VS(s) was best represented by the equation $\log(P/Pa)=-(2.161\pm0.057)\times10^4K/T+11.02\pm0.29$. Limiting thermodynamic results were obtained on the basis of the assumption that the partial pressure of V(g) was the vapor pressure of V(s). The $\Delta H°$(298K) of sublimation of VS(s) to give VS(g) was 551.5±2.1 kJ/mol, of dissociation of VS(g) to give gaseous atoms was 484.5±3.3 kJ/mol, and of formation of VS(s) was −243±5 kJ/mol. The second result agrees exactly with that of a mass spectrometric study in the literature, and indicates that the temperature range of the present study is near the temperature beyond which VS(s) does not vaporize congruently. (20 refs.)

107899 Surface mechanism of nonmetal molecule formation by evaporation of the $A^{II}B^{VI}$ group crystals in vacuum. S.V.Karbovskii, Yu.V.Masyutka, G.Ya.Pikus.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1236-42 (Aug. 1983). In Russian.
Evaporation of $CdSe_xTe_{1-x}$ solid solution crystals of variable composition was investigated experimentally and theoretically. Evaporation of two-atom nonmetal molecules from crystals of the $A^{II}B^{VI}$ group in vacuum occurs through the stage of formation and subsequent neutralization of the 'neutral atom-surface anion' complex on the crystal surface. (14 refs.)

Purification of mercuric iodide ....See Entry 109120

Saturated vapor pressure and heat of formation of As_4S_4 ......See Entry 109788

64.70J Liquid-liquid transitions

107900 Cloud points in ionic surfactant solutions. J.Appell, G.Porte (Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
J. Phys. Lett. (France), vol.44, no.16, p.L689-95 (15 Aug. 1983).
Experimental evidence is herein given of lower critical solution temperatures in high salt aqueous solutions of cetylpyridinium and cetyltrimethylammonium bromide, nitrate and chlorate. The critical behaviour of the solutions is followed using static and dynamic light scattering. The unique feature of this transition lies in the unusually large values of the correlation length $\xi(>10^3$ Å) more than 10°C below the critical temperature. The occurrence of the phase separation seems to be connected with the existence of giant rod-like flexible micelles in the solutions. The analogies with critical solutions of polymers are underlined. (15 refs.)

64.70K Solid-solid transitions

(see also 61.50K Crystallographic aspects of polymorphic and order-disorder transformations, 81.30H, 81.30K, 81.30M Microstructures developed by solid-solid phase transformations)

107901 Effect of H^+ on the $\beta\rightarrow\alpha$ transition in β-$LiIO_3$ after high pressure treatment. He Shou-an, Zhao You-xiang, Liu Jia-rui, Li Yin-yuan (Inst. of Phys., Acad. Sinica, Peking, China).
Acta Phys. Sin. (China), vol.32, no.4, p.466-72 (April 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)* [received: Sept. 1983]
Using the X-ray diffraction method, the authors have investigated the effects of high pressure and H^+ impregnation on $\beta\rightarrow\alpha$ transition in β-$LiIO_3$ crystals. The samples had been subjected to high pressure treatment (up to 80 kb) at room temperature and then preserved in ordinary environmental condition for different periods of time. The experimental results show that in $\beta\rightarrow\alpha$ transition in the samples treated as above the pressure can be understood to play a role of promoting the nucleation of α-phase in β-matrix, and the pressure dependence of the rate of nucleation $\dot{N}$ can be expressed in the form of $\dot{N}\propto e^{kp}$ ($k=26.8$/bar). The significant increase of quantity of α-phase in such samples may be attributed to the rapid growth of α-$LiIO_3$ nucleus under the influence of H^+ formed through the dissociation of adsorbed water molecules on the surface of α nucleus. This conclusion is supported by the similar effects in the experiment of H^+ impregnation of pressurized β-$LiIO_3$ samples. (13 refs.)

107902 The Li sites in the RT and low temperature phases of $LiKSO_4$ crystals. Meng Qing-an, Cao-juan (Inst. of Phys., Acad. Sinica, Peking China).
Acta Phys. Sin. (China), vol.32, no.4, p.525-9 (April 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)* [received: Sept. 1983]
A structural phase transition in crystal $LiKSO_4$ at $T_c=195$K was confirmed by NMR experiment previously. In this article the temperature dependence of the electric field gradient tensor at lithium site in the range of 110-300K is reported and combined with a simplified ion crystal model the crystal structure is discussed. It is shown that even in the room temperature phase, the lithium position should be at (2/3, 1/3, 0.706) instead of the position at (2/3, 1/3, 0.849) suggested previously by Bradley (1925). The phase transition is attributed to the displacement of lithium ions. The space group of the low temperature phase may be $R3$. (9 refs.)

107903 Structure transformation in mixed polycrystalline $Zn_{1-x}Cd_xS$ doped with Mn and Cu. B.Dogil, M.Grus, A.Jankowska, M.Lepek (Inst. of Experimental Phys., Univ. of Gdansk, Gdansk, Poland).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.K84-5 (1983).
Mixed compounds of $Zn_{1-x}Cd_xS$ doped with manganese (about 10^{-4} at. Mn/at.(Zn+Cd)) and copper (about 16×10^{-4} at. Cu/at.(Zn+Cd)) were

investigated. The samples were examined: (i) after preparation of polycrystalline powders; (ii) after pressing then; (iii) after heat treatment, using the EPR, X-ray, and dc conductivity methods. (no refs.)

107904 The composition dependence of the grey tin—white tin transition in dilute tin-germanium alloys. F.Vnuk, A.DeMonte, R.W.Smith (Dept. of Metall. Engng., Queen's Univ., Kingston, Ontario, Canada).
Mater. Lett. (Netherlands), vol.2, no.1, p.67-70 (July 1983).
It is shown that the temperature, T_c, at which the grey modification will convert to the white phase in dilute Sn-Ge alloys increases with the amount of germanium, according as $T_c=32.0+51.8C^{0.33}$. It is concluded that this increase in transition temperature is a hysteresis effect and is probably due to the reduced mobility of the β/α martensitic interface. (8 refs.)

107905 Influence of the interatomic long-range forces on the nature of ordering of a solid solution. A.I.Olemskoi (Polytech. Inst., Kursk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.18-24 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The process of ordering of a solid solution is regarded as a redistribution of the Fermi excitations between the states described by a wave vector (see A.I. Olemskoi, ibid., vol.54, 856, 1982). An allowance is made for the interaction of the second-nearest and further neighbours and the nature of the dispersion law of excitations is determined. A study is made of the influence of dispersion on the order parameter, on the thermodynamic characteristics and on the susceptibility of the spatial structure to ordering. It is shown that an increase in the interatomic interaction radius tends to change the nature of phase transitions from the second to the first order. (7 refs.) *A.T.*

107906 Investigation of short-range order in alloy Cu_3Au. Yu.S.Stark, A.S.Shteinberg, V.I.Dimitrov (Inst. of Steel & Alloys, Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.53-7 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The published experimental results are used to calculate the mixing potentials and the critical temperature of an order-disorder transition. The temperature dependences of the short-range order parameters are calculated allowing for the long-range mixing potential. (3 refs.) *A.T.*

107907 Phase transition in $Hg_3In_2Te_6$. G.G.Grushka, E.D.Skulish, Z.M.Grushka (Chernovtsy State Univ., Chernovtsy, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1180-1 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1388-90 (Aug. 1982).
Previous authors reported an order-disorder phase transition in the compound $Hg_3In_2Te_6$, on the basis of X-ray diffraction investigations made on single-crystal samples obtained by Bridgman's method and annealed to 500-900K for 200 h. Similar studies made by the present authors on single-crystal samples of $Hg_3In_2Te_6$ obtained by Bridgman's method and annealed at the same temperatures have confirmed the occurrence of a phase transition, but it cannot be interpreted as an order-disorder transition. It was established that synthesized and incubated single-crystals of $Hg_3In_2Te_6$ possess a purely sphalerite structure. Annealing of the samples at above 585K does not alter the form of the X-ray diffraction pattern was made of the influence of the annealing time on the structure of $Hg_3In_2Te_6$. (1 ref.)

107908 Features of structural changes accompanying the metal-semiconductor phase transition in an oxidized vanadium foil. M.F.Romanenko, Yu.I.Surov, V.Ya.Filipchenko, S.Kh.Finkel'shtein.
Inorg. Mater. (USA), vol.18, no.8, p.1191-3 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1398-9 (Aug. 1982).
The results are presented of an experimental study of the structural changes in VO_2 during the phase transition. The spreading of the temperature interval ΔT and the width of the structural hysteresis loop ΔT_h are considered. The investigations were carried out on vanadium foils with a thickness equal to ~200 μ, which were oxidized under various conditions. The selection of an oxidized vanadium foil as the object of study was governed by the prospective practical use of vanadium oxide film structures, on the one hand, and the fact that such a system is convenient for the investigation of the influence of deviations from stoichiometry on the phase transition on the other hand. The features of the structural changes in the VO_2 present in a vanadium oxide layer were studied by X-ray diffraction analysis. (8 refs.)

107909 Polymorphous transformations of graphitic boron nitride of various degrees of crystalline perfection at high pressures. A.V.Kurdyumov, I.S.Gladkaya, A.S.Golubev, G.A.Dubitskii, V.N.Slesarev, G.S.Oleinik, N.F.Ostrovskaya (Inst. of High-Pressure Phys., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1576-80 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1835-8 (Nov. 1982).
It has been shown that the mechanism of the polymorphous transformations of graphitic boron nitride at high pressures, as well as their rate and the type of BN modification formed, are determined by the degree of perfection in the original structure. The three-dimensionally ordered structure of BN_g undergoes a martensite transformation in the 20-1200°C at a pressure of 11 GPa, which results in the formation of the wurtzitic modification. Under the same conditions turbostratic BN_g is characterized by a diffusional transformation with the formation of a sphalerite phase. When partially ordered BN_g is compressed, both mechanisms for polymorphous transformations are manifested. (5 refs.)

107910 Structural instability of the ZrV_2 crystal lattice. E.M.Gololobov, V.F.Malishevskii, Zh.M.Tomilo, P.A.Kofman (Inst. of Solid-State Phys. & Semiconductors, Acad. of Sci., Belorussian SSR).
Inorg. Mater. (USA), vol.18, no.11, p.1580-2 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1839-41 (Nov. 1982).
A comprehensive investigation of the low-temperature phase transition in ZrV_2 has established that the structural instability of the crystal lattice appears at a significantly higher temperature than the phase transition at which the C15 cubic lattice is transformed to rhombohedral. Results are presented of a study of the thermal expansion, specific heat, and X-ray diffraction patterns of ZrV_2 at 80-300K. (12 refs.)

107911 Effect of hydrostatic pressure on the phase transitions in $\{N(CH_3)_4\}_2XBr_4$ (X:Zn,Co). K.Gesi, K.Ozawa (JAERI, Ibaraki, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2440-2 (July 1983).
Effect of hydrostatic pressure was studied for the phase transitions in tetramethylammonium tetrabromometallic compounds, $\{N(CH_3)_4\}_2XBr_4$ (X:Zn,Co). The transition temperatures in the -$ZnBr_4$ and -$CoBr_4$ compounds (14.8°C and 14.0°C, respectively, at 1 atm) linearly increase with increasing pressure with the ratios of 0.184 deg MPa^{-1} and 0.182 deg MPa^{-1}, respectively. Any intermediate phases were not observed at high pressures up to about 200 MPa.

107912 On the phase transition in $[(CH_3)_4N]_2ZnBr_4$. R.Perret (Lab. de Dielectriques, Univ. de Dijon, Dijon, France), Y.Beaucamps, G.Godefroy, P.Muralt, M.Ehrensperger, H.Arend, D.Altermatt.
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2523-5 (July 1983).
As determined by ^{79}Br-NQR the second order transition for $[(CH_3)_4N]_2ZnBr_4$ occurs between the space groups Pnma and $P2_1/n11$ in a very broad temperature range. The enthalpy change as found from differential scanning calorimetry is in agreement with an order-disorder transition based on the mobility of tetramethyl-ammonium ions. (6 refs.)

107913 Incommensurate-commensurate phase transition in Rb_2ZnBr_4. M.Iizumi, K.Gesi (Dept. of Phys., JAERI, Ibaraki, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2526-33 (July 1983).
The existence of the successive long-period superstructures, or the 'devil's staircase', in the temperature evolution of the incommensurately modulated structure has been examined in Rb_2ZnBr_4 by the neutron diffraction method. Detailed measurements of the third order satellite scattering in the temperature region close to the incommensurate-to-commensurate phase transition have shown that the temperature evolution takes place in more complicated manners than previously reported for this compound. At least three different modulations with distinct wave numbers separated by finite gaps coexist and each of them changes continuously with temperature accompanying the change in the population of the domains corresponding to the respective wave numbers. Assignment of some part of the wave number vs. temperature curves to the stairs with fractional numbers afforded no positive evidence of the 'devil's staircase'. (17 refs.)

107914 Phase transitions in deuterated compound $\{N(CD_3)_4\}_2CuBr_4$. K.Gesi (JAERI, Ibaraki, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2534-7 (July 1983).
Effect of deuteration on the phase transitions in tetramethylammonium tetrabromocuprate crystal was studied. At 1 atm. the deuterated compound $\{N(CD_3)_4\}_2CuBr_4$ shows three phase transitions at −2°C, −31°C, and −36°C on cooling, and it is ferroelectric between −31°C and −36°C. These transition temperatures almost coincide with those in the normal compound. The pressure-temperature phase diagram of the deuterated compound is also very close to that of the normal compound. Then the effect of deuteration on the phase transitions in tetramethylammonium tetrabromocuprate crystal is negligibly small making a sharp contrast with the considerable deuteration effects in ferroelectric tetramethylammonium tetrachlorozincate and -cobaltate crystals. (7 refs.)

107915 X-ray scattering in the normal and incommensurate phases of Rb_2ZnCl_4. S.R.Andrews, H.Mashiyama (Dept. of Phys., Univ. Edinburgh, Edinburgh, Scotland).
J. Phys. C (GB), vol.16, no.25, p.4985-96 (10 Sept. 1983).
The static critical behaviour at the normal to incommensurate phase transition in Rb_2ZnCl_4 has been investigated by means of diffuse X-ray scattering. The measured values of the critical exponents γ and ν are in good agreement with theoretical estimates for the $d=3XY$ model. Measurements of the diffuse scattering in the incommensurate phase just below T_c are consistent with those expected if there are nearly gapless phase excitations. At lower temperatures an asymmetry develops in the predominantly acoustic mode scattering emanating from the primary satellite reflections which is attributed to coupling of acoustic and phason modes. The temperature dependence of the intensity of several higher-order satellites has been measured at temperatures just above the lock-in transition but is not understood. (19 refs.)

107916 Ferroelastic phase transition in $BiVO_4$: III. Thermodynamics. W.I.F.David (Clarendon Lab., Univ. of Oxford, Oxford, England).
J. Phys. C (GB), vol.16, no.26, p.5093-118 (20 Sept. 1983).
For pt.II see ibid., vol.16, p.2455 (1983). The temperature and pressure dependences of the elastic and strain-related properties of the 'pseudo-proper' ferroelectric material $BiVO_4$ have been determined using mean-field theory. In the tetragonal paraelastic phase the elastic constants c_{11}-c_{12}, c_{66} and c_{16} are all predicted to behave anomalously near T_c although none are expected to vanish. From analysis of the acoustic properties of $BiVO_4$ zero-velocity pure transverse acoustic modes are expected to propagate along the ferroelastic domain wall directions at T_c. Predicted relationships between pressure and temperature-dependent properties agree well with experimental observations. The theory also accurately predicts the ratio of secondary and primary spontaneous strains in the ferroelastic phase. (30 refs.)

107917 Ferroelastic phase transition in $BiVO_4$: IV. Relationships between spontaneous strain and acoustic properties. W.I.F.David (Clarendon Lab., Univ. of Oxford, Oxford, England).
J. Phys. C (GB), vol.16, no.26, p.5119-26 (20 Sept. 1983).
For pt.III see ibid., vol.16, p.5093 (1983). The spontaneous strain properties of the ferroelastic material $BiVO_4$ are shown to be related to its acoustic properties. At the ferroelastic phase transition temperature, it is proved that a mutually perpendicular pair of pure transverse acoustic modes possess theoretically zero velocity. The propagation and displacement directions of these modes are collinear with the ferroelastic domain walls. The monoclinic ferroelastic strain in $BiVO_4$ results from the freezing-in of the pure transverse displacements of these soft acoustic modes. (19 refs.)

107918 Ferroelastic phase transition in $BiVO_4$: V. Temperature dependence of Bi^{3+} displacement and spontaneous strains. W.I.F.David, I.G.Wood (Clarendon Lab., Univ. of Oxford, Oxford, England).
J. Phys. C (GB), vol.16, no.26, p.5127-48 (20 Sept. 1983).
For pt.IV see ibid., vol.16, p.5119 (1983). Measurements of the Bi^{3+} displacement and the primary and secondary spontaneous strains in the ferroelastic material $BiVO_4$ have been made as a function of temperature by single-crystal X-ray diffraction. The results are discussed using both macroscopic and microscopic mean-field theories of the ferroelastic phase transition. Measurements of the temperature dependence of the optical absorption edge have also been made, which show that the band-gap in $BiVO_4$ varies markedly with temperature. A method for the analysis of structural distortions in ferroelastics based on bond-length/bond-strength relationships is described. A discussion of the structural mechanism of the phase transition in $BiVO_4$ is presented, indicating that the lone-electron pair on the Bi^{3+} ion plays a prominent role. (41 refs.)

107919 Ferroelastic phase transition in $BiVO_4$: VI. Some comments on the relationship between spontaneous deformation and domain walls in ferroelastics. W.I.F.David, I.G.Wood (Clarendon Lab., Univ. of Oxford, Oxford, England).
J. Phys. C (GB), vol.16, no.26, p.5149-66 (20 Sept. 1983).
For pt.V see ibid., vol.16, p.5127 (1983). The relationship between the domain wall orientation and the spontaneous strain in ferroelastics is discussed, with particular reference to the W′ walls in $BiVO_4$. The microscopic, wall-defining property is shown to be the coherence of the lattices of the twin components. This concept, commonly used in metallurgy, is valid for both finite and infinitesimal strains and is more fundamental than the macroscopic strain compatibility condition derived by previous workers in the field of ferroelasticity. Observations of domain walls in $BiVO_4$ as a function of temperature are presented which suggest that they may be of importance in determining the properties of the material close to the ferroelastic phase transition. (33 refs.)

107920 Thermodynamics of order-disorder transformations in vanadium carbide. G.H.Emmons, W.S.Williams (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
J. Mater. Sci. (GB), vol.18, no.9, p.2589-602 (Sept. 1983).
Some of the nonstoichiometric carbides of the transition metals (e.g. VC_x) undergo transformations to ordered phases at specific values of X. In a thermodynamic study of such order-disorder transformations the latent heats of the reactions $VC_{0.833}=V_6C_5$ and $VC_{0.875}=V_8C_7$ were measured using differential thermal analysis (DTA) and gave values of 5.7 ± 2.8 cal g^{-1} and 6.0 ± 2.4 cal g^{-1} (1 cal=4.1855 J), respectively. For well-annealed specimens intermediate in carbon-to-metal ratio between these two compositions, DTA indicated the coexistence of domains of both ordered phases. The implication is that the nonstoichiometric, disordered, NaCl-structure phase VC_x does not represent the lowest energy state of vanadium carbide at room temperature for any value of x. This result may apply to the other isomorphic carbides, i.e. TiC_x, ZrC_x, HfC_x, NbC_x and TaC_x. (26 refs.)

107921 Characterisation of the polymorphic component of 2-fluoronaphthalene. A.Meresse, P.L.Loyzance, N.B.Chanh, Y.Haget (Lab. de Cristallographie et de Phys. Cristalline, CNRS, Talence, France).
J. Phys. & Chem. Solids (GB), vol.44, no.9, p.891-7 (1983). In French.
The use of various techniques such as X-ray and neutron diffraction, Raman scattering, diffusion and calorimetry has allowed the authors to characterize the polymorphic behaviour of 2-fluoronaphthalene. Under atmospheric pressure, three crystalline forms can be detected between 80K and the melting temperature. The high temperature one, F_I, which is stable from 272K to the smelting point, is isomorphous with naphthalene (space group $P2_1/a$, $Z=2$); by cooling it can be preserved as a metastable form down to 154K, the 272-154K range being the stability domain of the form F_{III}. Below 154K, a new form, called $F_{III'}$, appears. The kinetics of the transformation $F_I \rightarrow F_{III}$ seem to be dependent upon the size of the crystals. The Raman spectra of F_I and F_{III} are identical, which suggests similar structural disorder in both phases. This is also supported by the low value of the entropy associated with the transition $F_{III} \rightarrow F_I$(0.55 J K^{-1} $mole^{-1}$). The unit cell parameters of the F_{III} and $f_{III'}$ forms have been determined from powder data using automatic indexing methods. The two solid-solid transitions are first order, the F_{III}-$F_{III'}$ one being 'explosive'. (15 refs.)

107922 Conditions for a phase transition in solids under nonhydrostatic compression. V.V.Avilov (L.D. Landau Inst. of Theoretical Phys., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.6, p.315-18 (20 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.6, p.266-9 (20 March 1983). [received: Sept. 1983]
The effect of shear stresses on the thermodynamic conditions for the appearance of nuclei accompanying a first-order phase transition in a solid is examined. It is shown that external shear stresses decrease the phase transition pressure compared to purely hydrostatic compression. (8 refs.)

107923 Stability of the martensitic phase boundaries in shape-memory alloys. E.Magyari (Inst. fur Phys., Univ. Basel, Basel, Switzerland).
J. Phys. F (GB), vol.13, no.9, p.L185-8 (Sept. 1983).
The stability of static martensitic phase boundaries (i.e. interphase interfaces or domain boundaries) in an unbounded crystal is examined in the framework of a one-dimensional Ginzburg-Landau theory. It is shown that at the three-phase coexistence temperature $T=0$ the kink-shaped boundaries interpolating the shear-strain field between the austenitic and one of the martensitic phases, as well as the phase boundaries interpolating between the martensitic domains in the two-phase sector of the model, are energetically stable. Both the pulse-shaped solitary-wave excitations of the metastable martensitic states in the one-phase sector, as well as the pulse-like excitations of the metastable austenitic state in the two-phase sector are energetically unstable. (9 refs.)

107924 Effect of pressure on the phase transition of the $[(C_6H_5)_3PCH_3]^+(TCNQ)_2^-$ anion radical salt as studied by differential thermal analysis under pressure. Y.Iida (Dept. of Chem., Faculty of Sci., Hokkaido Univ., Sapporo, Japan), K.Takamizawa.
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.8, p.1757-63 (Aug. 1983).
The anion radical salt of $[(C_6H_5)_3PCH_3]^+(TCNQ)_2^-$, where TCNQ is 7,7,8,8-tetracyanoquinodimethane, undergoes a solid-solid phase transition at 315.7K at atmospheric pressure, where sharp discontinuities were found in the temperature dependences of the electrical conductivity and magnetic susceptibility. The effect of pressure on this phase transition has been studied by differential thermal analysis in the pressure range up to 200 MPa. The transition temperature (T_p/K) is related to the pressure (p/MPa) by the expression $T_p=315.5_8-7.2_6\times10^{-2}\,p-8.1_0\times10^{-4}\,p^2-1.1_8\times10^{-6}\,p^3$. The mechanism of the phase transition is discussed on the basis of these results together with the crystal structure data. (19 refs.)

107925 Peierls dimerization at the Jahn-Teller phase transition in $PrCl_3$. R.M.Morra, R.L.Armstrong (Dept. of Phys., Univ. of Toronto, Toronto, Ontario, Canada), D.R.Taylor.
Phys. Rev. Lett. (USA), vol.51, no.9, p.809-12 (29 Aug. 1983).
A group-theoretical analysis of chlorine nuclear quadrupole resonance data restricts to two the possible space-group symmetries of the low-temperature phase of $PrCl_3$. Consideration of this result along with experimental information on the interactions and the susceptibilities allows the transition to be identified as a Jahn-Teller Peierls dimerization. It is similar to the spin-Peierls transition but different in that the spins involved are pseudospins associated with the Jahn-Teller coupling. (16 refs.)

107926 Divergent elastic response in the commensurate charge-density-wave state of $2H$-$TaSe_2$. P.Prelovsek, T.M.Rice (Inst. fur Theoretsche Phys., Eidgenossische Tech. Hochschule-Honggerberg, Zurich, Switzerland).
Phys. Rev. Lett. (USA), vol.51, no.10, p.903-6 (5 Sept. 1983).
It is shown that the double-honeycomb textures observed in $2H$-$TaSe_2$ have an anomalous elastic compliance due to the change in relative size of different orthorhombic domains. The restoring force against this change is proportional to the domain-wall, or partial discommensuration, energy and tends to zero as the commensurate-incommensurate transition is approached giving a divergent contribution to the elastic compliance—an effect observed by Barmatz, Testardi, and di Salvo (1975) some years ago. (12 refs.)

107927 Rigid sphere model applied to the phase transitions of complex compounds of the type K_2PtCl_6. M.Krupski (Inst. of Molecular Phys., Polish Acad. of Sci., Poznan, Poland).
Phys. Status Solidi a (Germany), vol.78, no.2, p.751-8 (16 Aug. 1983).
Applying the rigid sphere model, the stability condition for structures of the K_2PtCl_6 type is formulated. The model assumes free motion of the cation as a rigid sphere within a spherical cavity with a rigid wall, consisting of 12 halogen ions. Assuming for the ionic radii values typical for twelve-fold coordination, the temperature at which the cubic K_2PtCl_6 type lattice undergoes distortion is calculated from the lattice constant in satisfactory agreement with experimental data. (35 refs.)

107928 Recent progress in commensurate-incommensurate phase transformations. J.D.Axe (Brookhaven Nat. Lab., Upton, NY, USA).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.256-62 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Three topics are discussed. (i) The nature of long wavelength excitations in $Hg_{3-\delta}AsF_6$, where gapless excitations in addition to the conventional acoustic modes are observed. (ii) Thiourea in which new commensurate phases can be induced by an external electric field. (ii) Discommensurations in $2HTaSe_2$, where recent electron diffraction and high resolution X-ray data combine with neutron results to establish a quite complex and subtle behaviour. (29 refs.)

107929 Single-crystal-polycrystalline-aggregate phase transition due to internal intercrystallite adsorption of impurities. E.M.Epshtein.
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.91-2 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.164-5 (Jan.-Feb. 1983). [received: Sept. 1983]
Draws attention to the fact that the reduction in free energy in internal intercrystalline adsorption may compensate for the loss of free energy in the formation of an interface between the crystallites. Thus a polycrystalline state of a doped material may be thermodynamically more advantageous than a monocrystalline state. This means that prolonged annealing of a polycrystal does not necessarily lead to formation of a single crystal. A situation is also possible in which annealing leads to conversion of a single crystal to a polycrystal or to a decrease in the dimensions of the crystallites in a polycrystal. (4 refs.)

107930 Phase transitions in Bi_2WO_6 crystals. V.K.Yanovskii, V.I.Voronkova, V.A.Milyutin (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.185-7 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.316-19 (March-April 1983). [received: Sept. 1983]
The polymorphism of Bi_2WO_6 at high temperatures is investigated. The phase transition at 950-960°C involves marked changes in the crystal lattice and is reconstructive. The structure of the high-temperature phase is monoclinic, a derivative of fluorite, like the compounds $BiLnWO_6$. High-temperature X-ray diffraction also reveals a second-order phase transition at 700°C in the region of stability of the polar orthorhombic phase. None of these phase transitions is of the ordinary ferroelectric kind. The transition at 950-960°C can be regarded as pyroelectric. (18 refs.)

107931 Crystallization and phase transitions in lanthanide-α-aminoacid systems. O.K.Lezhneva, V.T.Panyushkin, N.N.Bukov (State Univ., Kuba, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.226-7 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.386-7 (March-April 1983). [received: Sept. 1983]
By X-ray and microscopic analysis and IR spectroscopy the authors studied the process of crystallization in the lanthanide-α-aminoacid systems, where the lanthanides were Nd and Tb, and the α-aminoacids were glycine and d-threonine. They elucidated the conditions for good crystal formation in these systems, preventing the precipitation of phases of the original components. Crystallization was effected by isothermal evaporation. Crystallization in these systems usually occurs in alkaline media. In the initial stage of the crystallization process in the systems, phases are formed with highly symmetrical packing of structural units. (3 refs.)

Neutron diffraction camera method applied in the study of phase transition .... See Entry 107490

Crystallography of dislocations inherited in martensitic transformations and twinning .... See Entry 107586

The system HfO_2-RE oxide with high RE oxide contents .... See Entry 107587

The phase transformations and thermal expansion of the solid electrolyte Cu_3BiS_3 between 25 and 300°C .... See Entry 107588

Structural instability of $Hf_xZr_{1-x}V_2$ Laves phases .... See Entry 107605

A new bismuth containing $Bi_{14}B_4O_{31}$ crystal .... See Entry 107650

Disordering and enhanced damping in Cu_3Au .... See Entry 107704

Effect of ageing on martensitic transformation during the deformation of metastable austenitic steels .... See Entry 107711

Doping of germanium telluride with bismuth and copper .... See Entry 107725

Dechanneling anomalies of high-energy ions at the charge-density-wave transition in $1T$-TaS_2 .... See Entry 107790

Static and dynamical elastic behaviour of squaric acid around its phase transition .... See Entry 107802

Creep in transforming polycrystalline materials .... See Entry 107813

Phase transformation under intense shock pressure loading .... See Entry 107830

Mode instability in NaCl structure under pressure .... See Entry 107840

Algebraic investigations in Landau model of structural phase transitions. III. Extended integrity bases and thermodynamic potential .... See Entry 107860

Multiple specific heat anomalies at the neutral-ionic phase transition in TTF-chloranil .... See Entry 107976

Electrical and thermal properties of Na_2SO_4 doped with $NaVO_3$, $Ln_2(SO_4)_3$ (Ln=Eu,Pr) .... See Entry 108023

Disorder phenomena in β-alumina .... See Entry 108034

Structural transformations in polycrystalline cadmium selenide films .... See Entry 108223

Charge orderings and lattice distortions in complex TCNQ salts .... See Entry 108316

On the cooperative Jahn-Teller effect in ternary chromium and copper halides .... See Entry 108363

Hysteresis in the electrical properties of orthorhombic tantalum trisulphide: evidence for an incommensurate-commensurate charge-density wave transition? .... See Entry 108401

Z-type jump in electrical conductivity of samarium manganite .... See Entry 108408

Effects of an order-disorder transition on surface deep levels in metastable $(GaAs)_{1-x}Ge_{2x}$ .... See Entry 108499

Order-disorder transition and spin waves in Ni_3Mn .... See Entry 108670

Critical slowing down of fluctuations in *p*-terphenyl and *p*-quaterphenyl observed by proton spin-lattice relaxation .... See Entry 108828

Mossbauer and magnetisation studies of the alloy $Fe_{0.69}Pd_{0.31}$ .... See Entry 108843

On the ferroelectric phase transition in $Li_2Ge_7O_{15}$ .... See Entry 108886

Order-disorder type phase transition in ferroelectric CsD_2PO_4 studied by X-ray structure analysis .... See Entry 108889

Phase transition in $\{N(CH_3)_4\}_2MnBr_4$ .... See Entry 108891

Anomalously narrow peak in the dielectric constant of $Cd_2Nb_2O_7$ near the diffuse phase transition .... See Entry 108892

Far-infrared powder spectrum of $(N(CH_3)_3D)(I)(TCNQ)$ .... See Entry 108934

Light scattering studies of rubidium cyanide under hydrostatic pressure .... See Entry 108955

Phase equilibria in iron ternary alloys. X. Critical evaluation of constitution of cobalt-iron-vanadium system .... See Entry 109218

The Zr-Fe phase diagram (0-66.6 at.% Fe) .... See Entry 109229

On the origin of increasing hydrogen pressures in the two solid phase regions of intermetallic compound-hydrogen systems .... See Entry 109233

Interaction of phosphorus with zirconium and cobalt .... See Entry 109252

A molybdenum sulfur binary phase diagram .... See Entry 109264

The isothermal δ-γ transformation of ferritic-austenitic iron-chromium-nickel alloys .... See Entry 109277

A continuum approach to transformation kinetics of metals .... See Entry 109278

Inhibition mechanism of the anatase-rutile phase transformation by rare earth oxides .... See Entry 109279

Influence of plastic deformation on phase transitions during ageing of titanium alloy VTZ-1 .... See Entry 109280

Investigation of compounds of the type $(A_{0.5}{}^{2+}Bi_{0.5})(B_{0.5}{}^{2+}Nb_{0.5})O_3$ .... See Entry 109281

Transformation behaviour of laser processed Fe-5%Cr, Fe-5%Ni and Fe-6%Cr-2%Ni alloys .... See Entry 109282

Transformation structures and strengthening mechanisms of laser processes Fe-Cr alloys .... See Entry 109283

Austenitization of steel during chip formation .... See Entry 109284

On the possibility of the transfer of iron on a quasi-liquid state during polymorphic transformation in hydrogen [dynamic superplasticity] .... See Entry 109285

On the phase transformations in samarium at temperatures 200-600°C .... See Entry 109286

Process occurring in supercooled austenite before pearlitic transformation .... See Entry 109287

Influence of rapid cooling on the polymorphic transformations in pure metals .... See Entry 109288

Effect of disorder on the martensitic phase transformation in Nb_3Sn .... See Entry 109289

The relation between the martensite retransformation rate and shape memory in Cu-12.4% Al alloy .... See Entry 109290

Internal friction in Cu-Al-Zn alloy in the region of a reversible martensitic transformation .... See Entry 109291

Characteristic features of the phase transformation in In-Hg alloys .... See Entry 109293

Diffuse scattering of electrons in the alloy $Ti_{50}Ni_{46}Nb_4$ during the pre-precipitation of the X-phase .... See Entry 109294

Direct observation of transformations during heating of steels in the column of an electron microscope .... See Entry 109295

Stress-induced martensitic transformation in a Ti-Ni single crystal .... See Entry 109296

A study of a cellular phase transformation in the ternary Ni-Al-Mo alloy system .... See Entry 109306

Toughening of structural ceramics .... See Entry 109319

On the microstructure of quenched, normalized and full-annealed, copper-modified 4340 steel .... See Entry 109344

Changes in the properties of β brass having a shape-memory effect in the process of aging .... See Entry 109359

Effect of composition and structure on the hot ductility of CrMn corrosion-resisting steels .... See Entry 109421

Slow crack growth behavior in transformation-toughened Al_2O_3-$ZrO_2(Y_2O_3)$ ceramics .... See Entry 109455

Acoustic emission study of microcracking damage in polycrystalline $(V,Cr)_2O_3$ during thermal cycling of the near-room-temperature phase transition .... See Entry 109489

Effect of deformation and heat treatment on phase transitions and properties of titanium alloys .... See Entry 109492

Metastable austenitic Cr-Mn steels .... See Entry 109525

64.70M Transitions in liquid crystals

107932 Effect of molecular structure on mesomorphism. XVI. Nematic-isotropic thermodynamics for oligomer models of liquid crystalline polymers. A.C.Griffin, T.R.Britt (Dept. of Chem., Univ. of Southern Mississippi, Hattiesburg, MS, USA).
Mol. Cryst. & Liq. Cryst. Lett. (GB), vol.92, no.4-5, p.149-55 (1983).
For pt.XV see A.C. Griffin and S. Gorman, Analytical Chem., vol.4. Thermodynamic measurements of ΔH and ΔS for the nematic-isotropic transition for a homologous series of Siamese Twin diester liquid crystals are reported. These diesters are structurally related as conceptual dimers in the monomer→oligomer→polymer sequence of liquid crystals with a 4,4′-distributed phenyl benzoate mesogenic moiety. Both ΔH and ΔS values show an odd:even alternation with carbon number intermediate in magnitude between those for the monomeric and the polymeric mesogens. It is concluded that the Twin diesters are good models for these oligomers in the monomer→oligomer→polymer progression. (7 refs.)

107933 Anisotropic steric effects and negative $\langle P_4\rangle$ in nematic liquid crystals. K.Feng, C.-W.Woo (Dept. of Phys., Univ. of California, San Diego, La Jolla, CA, USA), P.Sheng.
Phys. Rev. A (USA), vol.28, no.3, p.1587-95 (Sept. 1983).
Starting with a model intermolecular potential that includes $\hat{\Omega}.\hat{r}$ terms to account for anisotropic steric interactions, the authors carry out a statistical mechanical calculation in the cell approximation, and apply it specifically to the isotropic-nematic transition of methoxybenzylidene butylaniline (MBBA). The potential is determined to fit the experimental transition temperature T_{IN} and the discontinuity in the orientation order parameter $\langle P_2\rangle$ at transition. $\langle P_2\rangle$ and $\langle P_4\rangle$ are then calculated from solving a set of coupled self-consistency equations for the orientational and spatial parts of the distribution function, as are other phase-transition properties. There are improvements over model calculations which do not account for anisotropic steric effects, but the improvements are generally less than significant. The most striking result is that a stable nematic phase requires $\langle P_4\rangle$ to be negative at and near the transition. It is a theoretical result qualitatively consistent with experimental data but has not been attained until now. (19 refs.)

107934 Pretransitional effects in the isotropic phase of a lyotropic nematic liquid crystal. S.Kumar, J.D.Litster (Dept. of Phys., MIT, Cambridge, MA, USA), C.Rosenblatt.
Phys. Rev. A (USA), vol.28, no.3, p.1890-2 (Sept. 1983).
The authors report quantitative observations of the pretransitional fluctuations in short-range nematic order and the divergence of the magnetic birefringence in the isotropic phase of a lyotropic liquid crystal. The results are analyzed to obtain the anisotropy of the diamagnetic susceptibility and the coefficients in a Landau expansion of the free energy. (15 refs.)

107935 Study of the phase transition in some cholesteryl and B-nor cholesteryl derivatives. I.Cuculescu (Phys. Dept., Polytech. Inst., Bucharest, Rumania), S.Selinger, R.Schwartz.
Rev. Roum. Phys. (Rumania), vol.28, no.4, p.375-9 (1983).
The phase transition has been measured by thermodielectric effect, i.e. the thermoelectrets built up in liquid crystals when cooling the samples from isotropic to solid state. By recording the current across the samples as a function of temperature it is possible to point out very exactly the temperature at which the isotropic-liquid crystal phase transition begins. (6 refs.)

107936 Electric field effects on phase transitions in mixtures of cholesteryl esters. C.Motoc, M.Honciuc (Polytech. Inst., Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.6, p.541-6 (1983).
The behaviour of some cholesteryl laurate-cholesteryl caprylate mixtures under electric fields is investigated by using a small angle light scattering and following morphological charges under polarized light. It was shown that the temperature corresponding to the nucleation of cholesteric spherulites is lowered by d.c. electric fields and increased by magnetic fields. The temperature shift ΔT is quadratically dependent on the field intensity in accordance to Helfrich's (1970) findings. Under electric fields important undercooling effects are induced and changes in transition temperatures such as cholesteric-smectic and smectic-solid phase were noticed. Storage effects within the cholesteric and smectic phases are induced. For the 50:50% mixture, the morphological changes induced by an electrocaloric effect are described; this occurs as a consequence of its pyroelectric behaviour. (18 refs.)

107937 Liquid crystals—a simple spectroscopic method for determining the phase transitions. D.Grasso (Istituto Dipartimentale di Chimica e Chimica Industriale, Univ. di Catania, Catania, Italy).
Spectrochim. Acta Part A (GB), vol.39A, no.8, p.689-92 (1983).
A simple method for determining the phase transitions by UV absorption spectra is described. The transition temperatures and the thermal hysteresis, for *p*-octyloxy-benzylidene-*p*′-pentyloxy-aniline (OBPA) are reported. (4 refs.)

107938 Frequency dependence of structural transitions in a smectic-*A*. P.-A.V.Kazlauskas, L.S.Klenevskis (State Pedagogical Inst., Vilnius, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.236 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.398-9 (March-April 1983). [received: Sept. 1983]
The formation of electrohydrodynamic instability and 'memory' of confocal and homeotropic orientation in a smectic-A liquid crystal (SLC) in an electric field have been investigated. The authors have made observations of new transitions from a confocal texture in an SLC under the influence of an electric field of definite frequency and intensity. For this purpose, they took SLC prepared from equal weights of the low-polar component 4-n-hexyloxyphenyl-4′-n-butylbenzoate and the polar component 4-nitrophenyl-4′-n-heptylbenzoate plus 0.1% of an ionic additive (pyridinium dodecyl bromide) and 3% of n-hexyloxybenzoic acid. (3 refs.)

Neutron scattering study of convection in a double-diffusive system .... See Entry 107148

Discontinuous Freedericksz transition in the smectic C phase .... See Entry 107523

A molecular field treatment of nematic liquid crystalline mixtures. II. Calculations of nematic-isotropic transition temperatures for binary systems with 4,4′-di-*n*-alkoxyazoxybenzenes .... See Entry 107528

Commensurate and incommensurate structures in a nonequilibrium system .... See Entry 107536

Impurity molecule orientation and order parameter in the neighborhood of an impurity in a liquid crystal .... See Entry 107543

Properties of the concentrated xanthan gum solutions .... See Entry 108006

Dependence of interfacial tension of plane isotropic liquid-nematic liquid crystal boundary on elastic constants and phase transition parameters .... See Entry 108121

A linear relationship between the ^{13}C ester carbon chemical shift and the melting point or S to N transition temperature of n-alkyl esters of biphenyl-4,4′-dicarboxylic acid .... See Entry 108808

64.70P Glass transitions

107939 The role of TiO_2 and ZrO_2 in Na_2O-MO_2-SiO_2 glasses. D.Caferra, A.Grassi, S.Saiello, A.Buri, A.Marotta (Istituto di Chimica, Facolta di Ingegneria, Univ. di Napoli, Naples, Italy).
Mater. Lett. (Netherlands), vol.2, no.1, p.53-5 (July 1983).
The glass transition temperatures of $(1-x)Na_2O.{}^1/_2xMO_2.2SiO_2$ and $Na_2O.xMO_2.(2-x)SiO_2$ glasses, with M=Ti or Zr, have been related to the structural role and coordination of Ti and Zr. The role of network-former, intermediate or modifier of a cation has been fundamentally linked to ionic field strength; T_g values depend on ionic field strength and coordination. Titanium behaves like an intermediate oxide; its coordination ranges between four and six, depending on Ti/Si ratio. The role of zirconium changes according to the degree of substitution for Na or Si and progressively approaches that of a modifier ion. (10 refs.)

Bond character and properties of the mixed alkali system Na_2O-K_2O-Al_2O_3-SiO_2 .... See Entry 107554

Multiplicity of relaxational processes of recrystallized polychloroprene .... See Entry 107567

The equation of state for the hard sphere fluid at high density. The glass transition .... See Entry 107859

Relationship between some thermodynamic parameters and the tendency of metallic melts to glassify .... See Entry 107880

The $TlAsSe_2$-Tl system .... See Entry 109258

The Tl_4AsSe_2-AsSe system .... See Entry 109259

64.75 SOLUBILITY, SEGREGATION, AND MIXING

107940 Periodic precipitation of barium molybdate in silica gel. K.V.Kurien, V.K.Vaidyan, M.A.Ittyachen (Dept. of Phys., Univ. of Kerala, Trivandrum, India).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.889-94 (1983).
The mechanism of formation of the rhythmic pattern of precipitate of barium molybdate in one-dimensional Liesegang phenomenal is investigated quantitatively. The rhythmicity is found to be influenced by the molarity of inner and outer electrolytes and pH of the gel medium. The 'time-law', 'spacing-law' and 'Δx-law' are verified. (9 refs.)

107941 Studies of the mixing of glycerol in glycerol at the glycerol-vacuum interface using secondary ion mass spectrometry. W.V.Ligon,Jr. (Corporate Res. & Dev., General Electric Co., Schenectady, NY, USA).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.183-7 (1 Sept. 1983).
The mixing of glycerol-d_5 in glycerol-d_8 has been found to be slow on the time scale of a typical secondary ion mass spectrometry (SIMS) experiment. Surface renewal by processes such as diffusion is therefore an insufficient explanation of the exceptional sample longevity observed for SIMS spectra of molecules in glycerol solution. Other explanations for this longevity are suggested. (4 refs.)

107942 Microprobe investigation of solid solutions in the system ZrO_2-MgO-$MgCr_2O_4$. S.G.Sennikov, G.E.Revzin (All-Union Sci.-Res. & Planning Inst. of Aluminum, Magnesium & Electrode Industry, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1163-7 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1371-5 (Aug. 1982).
The existence in the system ZrO_2-MgO-$MgCr_2O_4$ of a solid solution based on zirconium dioxide was confirmed. Reaction of the components proceeds in a stepwise manner. First a binary solid solution of MgO in ZrO_2 of the cubic modification is formed; then the $MgCr_2O_4$ dissolves in this binary solution. (10 refs.)

107943 Solubility of silicon carbide in tin and gallium. Yu.M.Tairov, F.I.Raikhel', V.F.Tsvetkov (V.I. Ul'yanov Lenin Leningrad Electrical-Engng. Inst., Leningrad, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1182-3 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1390-1 (Aug. 1982).
Part of an investigation carried out to study the solubility of silicon carbide in metal melts is presented. In the study of the solubility of SiC in Ga and Sn, single-crystalline 6H-SiC wafers were used. From the obtained temperature dependences of the solubility of SiC in solutions of the Ga-Si and Sn-Si systems containing 2 wt.% Si, the dissolution energies Q_{Sic} and (assuming quasi-regularity of the solutions) interaction parameters α, where $\alpha=\alpha+bT$ were evaluated. Epitaxial SiC layers were grown with a 'case'-type container used to obtain epitaxial layers of $A^{III}B^{V}$ compounds. An X-ray diffraction investigation showed that the SiC films had a single-crystalline structure. (3 refs.)

107944 Calculation of the segregation coefficient of boron in the Si-SiO_2 system. Ya.D.Nisnevich (V.I. Lenin All-Union Electrical-Engng. Inst., USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1185-6 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1393 (Aug. 1982).
A calculation is presented of the values of the segregation coefficient m for the case of the diffusion of boron into silicon from a doped oxide in a neutral atmosphere with the use of the dependence of the surface concentration of boron N_B on the B_2O_3 content in the doped SiO_2 obtained on the basis of a thermodynamic analysis of the reaction of boron oxide with silicon. (4 refs.)

107945 Kinetics of the decomposition of a solid solution of aluminium antimonide in germanium. R.A.Akopyan, A.A.Abdullaev, S.Kh.Mamedova (Moscow Electrical Engng. Inst., Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1518-21 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1769-71 (Nov. 1982).
The decomposition of a complexly doped solid solution of donors and acceptors in germanium, introduced in equiatomic amounts, was investigated by the methods of measurement of the microhardness and Hall effect. A sharp slowdown of the decomposition process was detected and is attributed to a slowing of the diffusion process on account of the formation of donor-acceptor complexes of the (AlSb)° type. (3 refs.)

107946 Study of complex coacervation in low concentration by virial expansion method. II. Salt-containing systems. K.-i.Tainaka (Dept. of Phys., Ibaraki Univ., Ibaraki, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2603-9 (July 1983).
For pt.I see ibid., vol.46, p.1899 (1979). In a recent paper, the author developed a thermodynamic theory on the complex coacervation in the absence of low molecular ions, under the assumption that the coacervation is a condensation phenomenon of the aggregate of a polyanion and a polycation in aqueous solution, by obtaining the interaction potential U between these aggregates. In the present paper, the theory has been extended to a more complicated-phenomenon in salt-containing solutions. The phase separation of this three-component system is analyzed by a new method. This treatment has modified the interaction potential U. It has been found that the presence of salts not only suppresses in most cases but also enhances the coacervation in some cases. (12 refs.)

107947 Second phase development in Sr-doped TiO_2. H.C.Ling (Engng. Res. Center, Western Electric, Princeton, NJ, USA), M.F.Yan.
J. Mater. Sci. (GB), vol.18, no.9, p.2688-96 (Sept. 1983).
In the Ti-rich region of the SrO-TiO_2 system, a temperature-composition range is found to exhibit limited solubility of strontium, the maximum limit being 0.5 mol.% Sr. It is also found that a two-phase region exists between this solubility limit and $SrTiO_3$, in agreement with existing phase diagrams. When the strontium concentration is small (≥0.5 mol.%), strontium segregates to the grain boundaries to form a second phase of $SrTiO_3$ below the solubility limit. Above 1200°C, this second phase is continuous; shape instability causes it to break up into discrete particles below 1200°C. At higher strontium concentration (about 2 mol.% Sr), nucleation of $SrTiO_3$ crystallites occurs both inside the TiO_2 grains and at the grain boundaries. The morphology of these crystallites after long time annealing suggests that the 110 plane has the fastest growth rate. The appropriate range of composition and heat treatment to form a continuous $SrTiO_3$ grain boundary layer is discussed in relation to the optimum heat treatment to develop the best nonlinear electrical properties of varistor devices. (15 refs.)

107948 Mixing of phases in non-crystalline materials: Application to carbon. G.C.Summerfield (Dept. of Nuclear Engng., Univ. of Michigan, Ann Arbor, MI, USA), D.F.R.Mildner, J.M.Carpenter.
J. Non-Cryst. Solids (Netherlands), vol.57, no.2, p.289-303 (1 Sept. 1983).
The atomic structure of non-crystalline solids is described by the correlation function. When more than one phase is present, the simple addition of the correlation functions for the various phases in proportion to their concentrations within the system is not valid, except in the case of the completely phase-separated system. The overall correlation function must reflect the boundaries between the various phases within the system. The cross correlation functions between the phases have a dependence both on the degree of mixing of the phases and also on the sizes of the domains of the phases. The correlation function for a non-crystalline solid with more than one phase has been derived in a general way. Particular application has been made to non-crystalline carbon for which the correlation function given previously did not have the correct limits because of absence of the cross correlation terms. (18 refs.)

107949 Solubility of hydrogen and deuterium at low concentration in $Fe_{0.5}Ti_{0.5}$. J.-M.Welter, G.Arnold, H.Wenzl (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
J. Phys. F (GB), vol.13, no.9, p.1773-84 (Sept. 1983).
The concentrations of hydrogen and deuterium dissolved in $Fe_{0.5}Ti_{0.5}$ in equilibrium with the gas (pressure range, 0-120 bar; temperature range, 400-800K) were determined by electrical resistivity measurements. For both isotopes the electrical resistivity increases by 820 $\mu\Omega$ cm per unit concentration of x in $Fe_{0.5}Ti_{0.5}H_x/D_x$. Hydrogen and deuterium dissolve endothermically, and Sieverts' law is satisfied up to the highest obtainable concentration ($x\sim0.03$). For $Fe_{0.5}Ti_{0.5}H_x$ the x-p-T relation (with p in bar, T in K) is $\log_{10}x={}^1/_2\log_{10}p-1.86-556/T$. The partial molar enthalpies and excess entropies of solution at infinite dilution exhibit only a small isotope dependence. The solvus concentration of the solid solution $Fe_{0.5}Ti_{0.5}H_x$ is $\log_{10}x=1.1-1340/T$. (32 refs.)

107950 Hydrogen induced lattice expansion in nickel. G.J.Thomas (Sandia Nat. Labs., Livermore, CA, USA), W.D.Drotning.
Metall. Trans. A (USA), vol.14A, no.8, p.1545-8 (Aug. 1983).
The volume expansion due to low concentrations of dissolved hydrogen in nickel has been measured by observing the length change during isothermal desorption of precharged samples. The present measurements indicate a much smaller expansion than found previously in cathodically charged nickel. The lattice relaxation per hydrogen atom was measured to be 0.13±0.03 atomic volumes, compared to 0.28 at. vol. from the single previous determination. Measurements were also made of the hydrogen induced volume expansion in niobium to verify the experimental technique. Good agreement with literature values was found in this metal. (12 refs.)

107951 Critical fluctuations in a binary polymer mixture. C.Herkt-Maetzky, J.Schelten (Inst. fur Festkorperforschung, Kernforschungsanlage Julich, Julich, Germany).
Phys. Rev. Lett. (USA), vol.51, no.10, p.896-9 (5 Sept. 1983).
The critical opalescence of a binary polymer mixture consisting of polyvinyl methyl ether and deuterated polystyrene was measured by small-angle neutron scattering. In accordance with a mean-field treatment, it was found that the critical exponents ν and γ are 0.5 and 1, respectively; the Ornstein-Zernike scaling function describes the scattering data; and the spinodal is parabolically shaped. However, the dependence of the interaction parameter χ on the composition of the polymer mixture is in conflict with the theoretical result. (10 refs.)

107952 On the identification of new and normal phases in the system of cadmium-antimony alloys. A.A.Mohamed (Dept. of Phys., Ain Shams Univ., Cairo, Egypt), S.A.Saleh, E.A.Abou-Saif, M.Abd-Rabo, G.A.El-Ganainy.
Phys. Status Solidi a (Germany), vol.78, no.2, p.705-16 (16 Aug. 1983).
A set of Cd-Sb alloy samples of concentrations 7, 20, 37, 48, 50, 52, and 70 at.% Sb are prepared in evacuated silica tubes at 900°C. The X-ray diffraction analysis of some annealed samples shows a metastable phase, which is not previously identified by other workers. After studying decomposition and its crystal structure this phase is given the chemical formula Cd_5Sb_4 and a unit cell of orthorhombic shape with dimensions of 0.7309, 0.5427, and 0.506 nm for a, b, and c, respectively. The other phases Cd, Sb, CdCb, and Cd_4Sb_3 are identified in both quenched and annealed samples. Electron diffraction and metallurgical studies are used in the identification. Contradictions in the phase diagram of the Cd-Sb system are discussed. (15 refs.)

107953 Spinodal decomposition in Fe-Cr alloys studied by small angle neutron scattering. M.Furusaka, Y.Ishikawa (Phys. Dept., Tohoku Univ., Sendai, Japan), S.Yamaguchi, Y.Fujino.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.383-6 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The spinodal decomposition process in $Fe_{1-x}Cr_x$ has been studied by small angle neutron scattering for $x=0.2$, 0.3, 0.4 and 0.6. The spinodal and magnetic phase diagrams have been determined by measuring the critical scattering. The temporal variation of the scattering functions $S(k,t,T_a)$ has been studied at room temperature, after the sample had been annealed at T_a for a time interval t, followed by quenching. A remarkable result is that $S(k,t,T_a)$ of $Fe_{0.6}Cr_{0.4}$ and $Fe_{0.7}Cr_{0.3}$ are almost identical for the same annealing temperature, in spite of the fact that $Fe_{0.7}Cr_{0.3}$ was annealed above the spinodal line. This fact, together with the observation that $S(k,t,T_a)$ converges into the Lorentzian $c/(\kappa^2(T)+k^2)$ with very small $\kappa(\kappa^2\leq0.01\ A^{-2})$, is explained well by the recent nonlinear theories of Langer or Saito. (12 refs.)

107954 Phase separation and defects in crystals studied by small-angle neutron scattering. G.Kostorz (Inst. fur Angewandte Phys., ETH Zurich, Zurich, Switzerland).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.387-91 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Recent applications of small-angle scattering of neutrons to study alloy properties and microstructure are discussed. Results on the decomposition of Au-60 at.% Pt, on precipitate states in Al-6.8 at.% Zn and Ni-(12-14) at.% Al single crystals and on the dissolution of coherent precipitates in fatigued Cu-2 at.% Co single crystals are presented. (22 refs.)

107955 Decomposition kinetics in iron-chromium alloys. S.Katano, M.Iizumi (Div. of Phys., Tokai Res. Est., JAERI, Ibaraki, Japan).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.392-6 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The decomposition kinetics of Fe-Cr alloys aged at several temperatures have been investigated over a wide composition range by means of neutron small-angle scattering. The concentration and aging temperature dependence of time evolution of the scattered intensity are compared with predictions of recent theories and computer simulations. The experimental results show that the decomposition kinetics have much more complicated aspects than the results

of the theories and the computer simulations although several essential features of the kinetics are explained by these predictions. (9 refs.)

107956 Decomposition process in Al-Zn and Al-Zn-Mg alloys. S.Komura, K.Osamura, H.Fujii, T.Takeda (Faculty of Integrated Arts & Sci., Hiroshima Univ., Hiroshima, Japan).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.397-400 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Neutron small angle scattering from binary alloys Al-6.8% Zn and Al-10% Zn and energy alloys with a further addition of 0.1% Mg quenched from the homogeneous phase into the decomposing phase and aged at various temperatures was measured. The results show that the effect of aging at higher temperature is equivalent to that at lower temperature for a longer period especially for the ternary alloys. This is the indication that the decomposition process is mainly governed by the diffusion process of the atoms. (6 refs.)

107957 Weak-beam electron microscopy of radiation-induced segregation. H.Saka (Dept. of Metall., Nagoya Univ., Nagoya, Japan).
Philos. Mag. A (GB), vol.48, no.2, p.239-50 (Aug. 1983).
The segregation of solute atoms to dislocations during irradiation by 1 MeV electrons in a HVEM was studied by measuring the dissociation width of extended dislocations in Cu-5.1 at.% Si, Cu-5.3 at.% Ge, Ag-9.4 at.% In and Ag-9.6 at.% Al alloys. 'Weak-beam' electron microscopy was used. In Cu-Si (oversized solute), Cu-Ge (oversize) and Ag-Al (undersize), solute enrichment was observed near dislocations, while in Ag-In (oversize) solute depletion was observed. The results are discussed in terms of current mechanisms for radiation-induced segregation. (10 refs.)

107958 Interaction between platinum and melts of compounds containing bismuth oxides. V.V.Mechev, V.A.Kutvitskiy, A.F.Shimanskiy.
Russ. Metall. (GB), no.3, p.37-40 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.3, p.40-3 (1982).
A mechanism is proposed for the reactions between platinum and melts of bismuth germanate and zincate. Experimental results are given on the kinetics of dissolution of Pt in these melts in the range 1123-1373K. The rate constants and energy chracteristics of the interactions between platinum and $Bi_{12}GeO_{20}$ and $Bi_{12}ZnO_{19}$ melts are calculated. (6 refs.)

107959 Solubility of GaAs in Au-Ge eutectic melts [ohmic contacts]. W.E.Stanchina (Dept. of Electrical Engng., Univ. of Notre Dame, Notre Dame, IN, USA), J.M.Whelan.
Solid-State Electron. (GB), vol.26, no.8, p.817-19 (Aug. 1983).
The gold-germanium eutectic compound (88 w/o Au-12 w/o Ge) has been widely used in making ohmic contacts to gallium arsenide (1977). Specific contact resistances as low as $1\times10^{-6}\ \Omega-cm^2$ have been reported by Shiota et al. (1977). Alloying the GaAs/Au-Ge above the Au-Ge eutectic temperature of 356°C is an integral part of the ohmic contact fabrication. Therefore solubilities of GaAs in the liquid Au-Ge are quite important in determining the nature of the alloy. Otsubo et al. (1977) have studied these solubilities for the temperature range 450-650°C. The study described in this paper was conducted to extend GaAs in Au-Ge solubility data to lower temperatures which are more typical of those used to make device type contacts. (14 refs.)

107960 Stability and solubility of sphalerite in alkaline hydrothermal solutions. V.A.Kuznetsov, D.V.Kostomarov (Inst. of Crystallography, Acad. of Sci., USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.83-5 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.151-5 (Jan.-Feb. 1983). [received: Sept. 1983]
The authors study phase formation in the $ZnS-KOH-H_2O$ system and determine the region of stability of sphalerite between 300 and 500°C. They identify a new phase $K_2Zn_3S_4$. They show that when ZnS dissolves in dilute KOH solutions it preferentially forms the complex $ZnS(OH)^-$, but in concentrated solutions it forms $Zn(OH)_4{}^{2-}$. (12 refs.)

107961 On the dissolving of polymers and photoresists. A.Grossmann, L.Pohlmann (Zentralinst. fur Phys. Chem. der Acad. Wissenschaften, Berlin, Germany).
Z. Phys. Chem., Leipzig (Germany), vol.264, no.4, p.831-5 (1983). In German.
A model of the physico-chemical dissolving of photoresists and polymers is presented. According to the model a layer of constant thickness is formed at the surface of the polymer, which is permeable to the solvent. Diffusion of the solvent through this layer causes a delay in dissolution which has been experimentally observed. Model and experimental results are compared. (6 refs.)

107962 The migration, precipitation and dissolution of solute atoms in quenched Al-Ge, Al-Sn, and Cu-Ge alloys. I.Kanazawa, H.Murakami, T.Kurihara, T.Shimizu, T.Kusaka (Dept. of Phys., Tokyo Gakugei Univ., Tokyo, Japan) T.Iwashita, M.Doyama.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.493-5
Ageing behaviour of vacancies and Ge in quenched Al were studied by the positron annihilation Doppler broadening method. The dissolution of small unstable clusters of Ge atoms-vacancies were observed at relatively low temperatures. During the Ge precipitation, it was made clear that vacancies condense on incoherent Ge precipitates/matrix interfaces. Some tendency was observed in Al-Sn alloys. The study on quenched Cu-Ge alloys was also reported. (8 refs.)

Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191) .... See Entry 105032

The solubility of oxygen and ozone in liquids .... See Entry 105041

Concentration dependence of the heat of formation of binary liquid alloys .... See Entry 107520

Crystallization properties of lead glasses .... See Entry 107557

Order of magnitude analysis of solute macrosegregation in crystal growth from the melt .... See Entry 107582

Statistical thermodynamic approach to some hyperstoichiometric dihydrides of lanthanides (La, Ce, Pr, Nd, Sm) and actinides (Np, Pu, Am) .... See Entry 107595

New morphological types of CuSi precipitates in silicon and their electrical effects .... See Entry 107667

Doping of germanium telluride with bismuth and copper .... See Entry 107725

Calculations on the laser-induced diffusion of surface-deposited dopants on silicon .... See Entry 107734

Void formation and solute segregation in ion-irradiated niobium-base alloys .... See Entry 107786

Metastable zone width in salting-out crystallisation .... See Entry 107875

Precipitation of gas pores in metallic melts during cooling under microgravity .... See Entry 107885

Cloud points in ionic surfactant solutions .... See Entry 107900

Investigation of short-range order in alloy Cu_3Au .... See Entry 107906

Enthalpies of formation of Au-Ge and Au-Ag-Ge liquid alloys at 1373K .... See Entry 107981

Size effect, internal stress and diffusion driven boundary motion .... See Entry 108008

The mobility of vacancies and interstitials in Ag-Cu studied by high-voltage electron microscopy .... See Entry 108022

Room temperature exchange reaction at the Al-InP (110) interface: soft X-ray photoemission studies .... See Entry 108073

The surface composition of Pt-Cu alloys: experimental observations and theory of surface segregation .... See Entry 108131

Study of surface composition of iron-based metallic glasses by means of UV photoemission, angle resolved Auger electron and ion scattering spectroscopy .... See Entry 108140

Thermo-electromotive force of solid and liquid indium-based metallic solutions .... See Entry 108395

The research of superconductivity in the Ti-Pd system .... See Entry 108587

Knight shift of H adatoms on $Cu_{1-x}Ni_x$ alloy .... See Entry 108810

Study of the behaviour of Al-Zn alloys by SAXS in the temperature range of the instable solid solution .... See Entry 109046

Quantitative Auger-electron analysis of nonstoichiometric lead telluride .... See Entry 109063

Cementite decomposition in steel under plastic deformation .. See Entry 109212

Effect of repeated plastic deformation on the state of the carbide phase in steels .... See Entry 109213

Nitrogen solutions in liquid iron alloys .... See Entry 109222

Solubility of various metals in solid sodium and potassium .... See Entry 109226

Structure and properties of rapidly cooled (superconductive) Pb-Bi alloys .... See Entry 109232

The behaviour of a metallic dispersion under microgravity conditions .... See Entry 109245

Low-gravity experiments on liquid phase miscibility gap (LPMG) alloys—materials experiments assembly (MEA) .... See Entry 109246

Interactions of LiBr with calcite and calcium oxide powders .... See Entry 109247

Revised phase diagram of the system ZrO_2-CeO_2 below 1400°C .... See Entry 109261

Solid solubility of GeO_2 in SnO_2 .... See Entry 109262

Structural formation of high-speed steels during crystallization .... See Entry 109269

Regularities in the precipitation of W-Re alloys from a mixture of their hexafluorides with hydrogen .... See Entry 109275

Transformation behaviour of laser processed Fe-5%Cr, Fe-5%Ni and Fe-6%Cr-2%Ni alloys .... See Entry 109282

Effect of titanium on the grain boundary segregation of phosphorus in Fe-Ti-P and Fe-Ti-C-P alloys and on the embrittlement of steels .... See Entry 109297

Time dependence at 550 and 700°C of $M_{23}C_6$ precipitate composition in AISI 304 stainless steel .... See Entry 109298

A study of antimony segregation in Fe-Ni alloys .... See Entry 109299

Characteristics of precipitation of a supersaturated solid solution in Al-Zn alloy .... See Entry 109300

Grain-boundary segregation in low-alloy titanium-vanadium alloys .... See Entry 109301

Homogeneous nucleation of a precipitating phase in ordering alloys with domain walls .... See Entry 109302

On precipitation in rapidly solidified aluminium-silicon alloys .... See Entry 109303

A preliminary study of precipitation in Ti^{4+}-doped polycrystalline alumina .... See Entry 109304

Precipitation of $Mg_2Zr_5O_{12}$ in MgO-partially-stabilized ZrO_2 .... See Entry 109305

A study of a cellular phase transformation in the ternary Ni-Al-Mo alloy system .... See Entry 109306

Effect of the application of uniaxial stress on precipitation in an Al(Cu) alloy .... See Entry 109307

Conditions for combined precipitation of sulphide and nitride phases in silicon iron .... See Entry 109308

Precipitation of metastable and equilibrium phases in the decomposition of the β-solid solution in zirconium alloys .... See Entry 109309

Precipitation of helium and its effects on mechanical properties of metals .... See Entry 109310

Development of a new grade of stainless maraging steel and its aging characteristics .... See Entry 109312

Investigation of 'reverse solution' in beryllium bronze .... See Entry 109315

Effect of oriented aluminium nitride precipitates on the texture in 3% silicon iron .... See Entry 109336

Banding in the microstructure of hot strip of HSLA steel .... See Entry 109341

Nature of new X-ray diffuse scattering effects in ageing Al-Zn alloys .... See Entry 109348

Heat treatment of the Cu-Ni-Sn alloys .... See Entry 109352

Further observations on the formation mechanisms of precipitate-free zones in an aged Al-16 wt pct Ag alloy .... See Entry 109353

Structural changes and strengthening in strain aging of austenitic steel .... See Entry 109367

Influence of temperature and the degree of deformation on the structure and properties of medium-carbon steel .... See Entry 109368

New quenching experiments with high purity and carbon doped iron .... See Entry 109374

Influence of creep on the precipitate structure under conditions of long-term creep—investigation of a Fe-Cu model alloy .... See Entry 109431

Anisotropic embrittlement in high-hardness ESR 4340 steel forgings .... See Entry 109477

Modification of Kh12M steel .... See Entry 109526

Magnetic properties of alloy 40KhNYu-VI .... See Entry 109535

Mossbauer investigations on magnetically ordered precipitates in Cu-Ni-Fe .... See Entry 109536

Strain-induced anodic dissolution of Cu single crystals—effects of specimen geometry and slip morphology .... See Entry 109566

High-performance Ni-Cr-Mo-W alloys .... See Entry 109575

Titanium α-nitrogen solid solution formed by high temperature nitriding: diffusion of nitrogen, hardness, and crystallographic parameters .... See Entry 109578

Sensitization of 12 wt pct chromium, titanium-stabilized ferritic stainless steel .... See Entry 109579

Numerical calculation of the decarburisation of medium and high carbon steels at temperatures below the A_1 point .... See Entry 109589

Surface films and rate of dissolution .... See Entry 109593

A new technique of hydrogen charging of a TEM specimen . See Entry 109657

A systematic study on volumetric interactions of cyclohexanone with various aliphatic hydrocarbons .... See Entry 109784

Enthalpy of formation of rubidium vanadates .... See Entry 109789

Mixing in mechanically agitated gas-liquid contactors, bubble columns and modified bubble columns .... See Entry 109840

64.80 OTHER PHASE PROPERTIES OF SYSTEMS

107963 Influence of crystallisation conditions on the size of cellular and cellular-dendritic substructure. V.O.Esin, V.B.Vorontsov (Inst. of Metal Phys., Acad. of Sci., Sverdlovsk, USSR).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.933-8 (1983).
A relationship is shown to exist between the size of the cellular-dendritic substructure and the growth conditions. The dependence of the cell diameter on the crystallisation rate is non-monotonic, having a maximum in the region of low solidification rates. Theoretical calculations are compared with experimental data. (16 refs.)

107964 Homogeneity region of neodymium-gallium garnet. B.V.Mill', A.V.Butashin (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1186-8 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1394-5 (Aug. 1982).
The existence of a homogeneity region for the rare-earth gallium garnets $Ln_{3+x}Ga_{5-x}O_{12}$ (Ln denotes Pr-Lu and Y) as a result of the replacement of some of the octahedral Ga^{3+} ions by Ln^{3+} has been noted previously. The problem of nonstoichiometry was investigated in greatest detail for gadolinium-gallium garnet, whose congruent melt contains Gd_2O_3 and Ga_2O_3 in a 3.05:4.95 mole ratio (61.87 mole % Ga_2O_3). The homogeneity region of NGG in Czochralski-grown single crystals and in solid-phase reactions was studied. (9 refs.)

107965 X-ray diffraction study of nonstoichiometry with respect to oxygen in cobalt ferrospinel. V.I.Fadeeva (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1196-8 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1402-3 (Aug. 1982).
The nonstoichiometry with respect to oxygen in $Co_xFe_{3-x}O_{4+\gamma}$ for $x \leq 1$ corresponds to an appreciable oxygen excess, which decreases with increasing cobalt content. The growth of single crystals of ferrites from melts does not guarantee uniqueness of the chemical composition and properties of the samples obtained. The samples have not only different cationic compositions, but also different oxidation states of the ferrospinels. Such single crystals are of interest for X-ray diffraction investigations. The single-phase nature of the samples was established by X-ray diffraction analysis, and the lattice constants are equal to 0.8389 and 0.8386 nm for the first and second samples, respectively. The nonstoichiometry of the crystal is due to the formation of point defects of the vacancy or interstitial-ion types. The investigations of the structural realization of the oxygen nonstoichimetry in spinels reduces to the measurement of the mean-square static displacements of the ions $\bar{u}_{(i)}^2$ for each of the three sublattices. (6 refs.)

107966 Microstructure and microanalysis of bismuth molybdates. P.L.Gai (Dept. of Metall. & Sci. of Materials, Univ. of Oxford, Oxford, England).
J. Solid State Chem. (USA), vol.49, no.1, p.25-42 (Aug. 1983).
The microstructures of commercially important bismuth molybdate catalysts in relation to olefin oxidation reactions are examined by electron microscopy (EM) techniques. The microstructural characterization has been carried out using dynamic (in situ) EM, high resolution EM, and microanalysis. The coprecipitated catalyst system Bi_2MoO_6 or γ, together with the γ phase, contains small amounts of tetragonal Bi_2MoO_6 phase, $Bi_2Mo_3O_{12}$ (α phase), Bi_2O_3, and MoO_3. In reduction with propylene, at catalyst operating temperatures of 400-500°C, in the dynamic experiments conducted on α- and γ-phase crystallites under reaction conditions no evidence for extended defects such as crystallographic shear planes has been obtained; instead an ordered intermediate phase similar to (101) $Bi_2Mo_2O_9$ (β-phase) is observed which is found to be unstable. Observations by electron microscopy have been confirmed with parallel measurements made in a reactor connected to a gas chromatograph and mass spectrometer system. The possible influence of the microstructural changes on the catalytic behavior of the system is examined. (30 refs.)

107967 Neutron diffraction topographic observation of substructures in Cu-based alloys. H.Tomimitsu, K.Doi (Phys. Div., JAERI, Ibaraki-ken, Japan), K.Kamada.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.96-102 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Neutron diffraction topography was applied to the direct observation of the substructure in a Bridgman-grown Cu-14%Ni single crystal with the growth direction nearly parallel to [111]. The observed substructure consists of bundles of rods extending throughout the crystal along the [001] direction, every rod having a square-shaped cross section of about 1 mm^2 and being arrayed regularly in both the (100) and (010) planes. This conclusion is discussed in comparison with previous results for Cu-5%Ge. (3 refs.)

107968 Structure and non-stoichiometry of calcium aluminates. H.Schmid, L.C.De Jonghe (Materials & Molecular Res. Div., Lawrence Berkeley Lab., Berkeley, CA, USA).
Philos. Mag. A (GB), vol.48, no.2, p.287-97 (Aug. 1983).
Lattice imaging of reaction-sintered ceramic compounds in the $CaO-Al_2O_3$ system showed 00.1 syntactic intergrowths in the matrix $CaO.6Al_2O_3$ phase. The structure of these intergrowths could be interpreted in terms of the concepts used to describe various magnetoplumbite phases (Braun 1957). The observed formation of syntactic phases reveals that calcium aluminates can accommodate calcium oxide/alumina non-stoichiometry in a relatively wide range by altering the stacking sequence of three sub-unit cell 00.1 slabs. (18 refs.)

Search for correlations between electrical characteristics and stoichiometry in mercuric iodide .... See Entry 106227

Possibility of antistructural defects in undoped cadmium telluride .... See Entry 107675

Plastic-deformation dependence of the Gruneisen parameter strain derivatives .... See Entry 107854

Processing/microstructure relationships in surface melting ....See Entry 107890

Thermodynamics of order-disorder transformations in vanadium carbide .... See Entry 107920

Divergent elastic response in the commensurate charge-density-wave state of 2*H*-$TaSe_2$ .... See Entry 107926

Phase separation and defects in crystals studied by small-angle neutron scattering .... See Entry 107954

Stability and solubility of sphalerite in alkaline hydrothermal solutions .... See Entry 107960

The effect of the grain structure of Al_2O_3 substrate on the solid state reaction with a layer of NiO: a comparative backscattering spectrometry study. I .... See Entry 108075

Coherence of the phase boundary and deformation in the epitaxial system Ge/GaAs .... See Entry 108206

Microstructure and imperfections of glassy and glass-ceramic telluride semiconductors on the basis of positron annihilation .... See Entry 109040

On the study of austenite stabilization in the Cr13%Ni4-6% steels .... See Entry 109219

Structure and properties of rapidly cooled (superconductive) Pb-Bi alloys .... See Entry 109232

The Tl_2Se-As system .... See Entry 109257

Crystal chemistry and phase relations in the system $Li_2O-Fe_2O_3-TiO_2$ .... See Entry 109260

64.90 OTHER TOPICS IN EQUATIONS OF STATE, PHASE EQUILIBRIA, AND PHASE TRANSITIONS

107969 Experimental evidence of a phase transition in a microcluster. A.J.Stace (Dept. of Chem., Univ. of Southampton, Southampton, England).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.470-4 (19 Aug. 1983).
Experiments on the unimolecular decomposition of ion clusters of the type $Ar_n.(CH_3)_2O^+$ to form $Ar_n.CH_3OCH_2{}^+$ and $Ar_n.CHO^+$, show the total product ion intensity to be sensitive to the stagnation pressure behind the expansion nozzle. At sufficiently low pressures it is possible to form $Ar_n.(CH_3)_2O^+$ clusters alone with no evidence of any product ions. As the nozzle pressure is increased so the total product ion intensity is observed to increase also. These results are interpreted in terms of the argon component of the cluster undergoing a transition from a liquidlike to a solidlike state. (27 refs.)

65.00 THERMAL PROPERTIES OF CONDENSED MATTER

(see also 05.70 Thermodynamics, 63. Lattice dynamics; for thermal conduction in nonmetallic liquids, see 66.60; for thermal conduction in nonmetallic solids, see 66.70; for electronic thermal conduction, see 72.15, 72.20 and 74.30E; for thermodynamic properties of quantum fluids, see 67.40, 67.50, and 67.60; for thermal properties of solid helium, see 67.80)

65.20 HEAT CAPACITIES OF LIQUIDS

107970 Determination of the thermodynamic properties of water from measurements of the speed of sound in the temperature range 251.15-293.15K and the pressure range 0.1-350 MPa. J.P.Petitet, R.Tufeu, B.Le Neindre (Univ. Paris-Nord, Villetaneuse, France).
Int. J. Thermophys. (USA), vol.4, no.1, p.35-50 (March 1983).
The speed of sound in water has been measured in a broad region around the liquid-solid transition, that is in the temperature range from 251.15K to 293.15K and in the pressure range from 0.1 to 350 MPa. An iterative method of calculation was used to determine the thermodynamic properties in the same *P-T* diagram. Anomalies observed for the isothermal compressibility and the specific heat at constant pressure are discussed in terms of statistical mechanical considerations. (20 refs.)

107971 Critical heat capacity in a 3-methylpentane+nitroethane mixture near its consolute point. G.Sanchez, M.Meichle, C.W.Garland (Dept. of Chem., MIT, Cambridge, MA, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1647-53 (Sept. 1983).
A computerized high-resolution AC calorimetric technique has been used to measure the heat capacity C_{px} of a critical 3-methylpentane+nitroethane binary-liquid mixture. An analysis of these results yields universal parameters in good agreement with those expected for the $d=3$, $n=1$ (three-dimensional Ising) universality class. The critical exponent $\alpha=\alpha'$ lies in the range 0.11-0.12, the ratio A'/A of the amplitudes of the leading singularity in C_{px} above and below T_c is 1.79 ± 0.06. The ratio of the corrections-to-scaling amplitudes D'/D is ~ 1. The quantity $A_v \xi_0{}^3/k_B$, which relates the critical amplitude of the heat capacity to that of the correlation length, is also in agreement with the renormalization-group value for the three-dimensional Ising model as expected from two-scale-factor universality. (24 refs.)

Thermophysical characteristics of aprotonic solvents and electrolytes based on them .... See Entry 108079

65.40 HEAT CAPACITIES OF SOLIDS

(for specific heat of superconductors, see 74.30E; for specific heat of magnetic systems, see 75.40)

107972 Critical behavior in the heat capacity of ferroelectric TGS, TGSe, and TGFB. K.Ema (Dept. of Phys., Tokyo Inst. of Technol., Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2798-809 (Aug. 1983).
Measurements of the heat capacity were carried out on TGS, TGSe, and TGFB with an AC calorimetry technique to clarify its critical nature near the ferroelectric phase transition point. An anomalous heat capacity with logarithmic temperature dependence was found in all of the three crystals in a temperature range $T-T_c<10\sim20$K above T_c. The relation between this anomaly and the quality of sample was studied by examining crystals of different growth conditions. The effect of γ-ray irradiation on this anomaly was also examined to critcal fluctuation. The data are analyzed with a theory for an Ising-dipole system taking into account the effect of fluctuation to the first order. The observed heat capacity anomaly both above and below T_c is fitted satisfactorily with reasonable values of parameters. (40 refs.)

107973 Thermal conductivity of LiF containing dislocations at low temperatures. A.Kumar, A.K.Sinha, M.A.Ansari (Dept. of Phys. & Meteorology, Indian Inst. of Technol., Kharagpur, India).
Phys. Status Solidi b (Germany), vol.118, no.2, p.483-91 (1 Aug. 1983).
The thermal conductivity at very low temperatures of LiF crystals containing dislocations are analysed by using the Callaway model, Callaway's approximations, and approximations suggested by Kumar and Joshi (1971). It is found that the contribution of the effective phonon-dislocation scattering processes to the lattice thermal conductivity can be calculated by suitably combining the static and the dynamic phonon-dislocation scattering processes. (21 refs.)

107974 Specific heat of a K_2SeO_4 single crystal in the temperature range 0.6 to 7K. I.Henning, E.Hegenbarth (Section of Phys., Tech. Univ. Dresden, Dresden, Germany), B.Brezina.
Phys. Status Solidi a (Germany), vol.78, no.2, p.K167-70 (16 Aug. 1983).
The specific heat of a K_2SeO_4 single crystal was measured in the ferroelectric phase. The specific heat was measured by the heat-pulse method in a ^{3}He cryostat in the temperature range of 0.6 to 7K. (9 refs.)

107975 Thermal properties of a Bi_2O_3:Y_2O_3 oxygen conductor at low temperature. W.N.Lawless (CeramPhys. Inc., Westerville, OH, USA), S.L.Swartz.
Phys. Rev. B (USA), vol.28, no.4, p.2125-9 (15 Aug. 1983).
Specific-heat and thermal-conductivity measurements (1.7-40K) are reported for the first time on a Bi_2O_3:Y_2O_3 oxygen conductor having a stabilized, defect-fluorite structure. Glasslike behavior is found in the properties measured, and the magnitudes of the coefficients involved are very similar to those found in amorphous materials. The thermal conductivity has a plateau region ~20-30K and a T^2 temperature dependence below ~3K. The specific heat has a maximum in C/T^3 at 12K describable by a single Einstein term (ω=33.1 cm^{-1}) and a linear tunneling term resolvable below 3.5K. The fitted Debye temperature is 248.9K (±0.4%). This oxygen conductor has a large concentration of oxygen vacancies at elevated temperatures, but the Einstein term indicates that the majority of these vacancies is ordered at low temperatures. Using the vacancy concentrations from the Einstein term, the authors find excellent agreement with the theory of McWhan et al. (1977) for the coefficient of the tunneling term. Comparisons are made with the low-temperature properties of stabilized zirconias and the alkali-metal β-aluminas. (18 refs.)

107976 Multiple specific heat anomalies at the neutral-ionic phase transition in TTF-chloranil. C.Ayache (Service des Basses Temperatures, CENG, Grenoble, France), J.B.Torrance.
Solid State Commun. (USA), vol.47, no.10, p.789-93 (Sept. 1983).
The specific heat has been measured for the mixed stack organic compound TTF-chloranil from 10 to 300K. Both protonated and deuterated samples exhibited a large specific heat anomaly in the region of the neutral-ionic phase transition near 84K. This anomaly has very peculiar form, composed of a number of sharp peaks. In one sample, three very sharp, symmetric peaks were observed. Based on these specific heat data alone, it is difficult to determine the order of the phase transition. Complimentary measurements, however, that combine differential thermal analysis and cycling appear to rule out a simple first order phase transition. Significant and uncontrolled changes in c_p of unknown origin are observed and prevent a more quantitative analysis of the data. (18 refs.)

107977 Low-temperature specific heat of USb and UTe. H.Rudigier, Ch.Fierz, H.R.Otto, O.Vogt (Lab. fur Festkorperphys., ETH-Honggerberg, Zurich, Switzerland).
Solid State Commun. (USA), vol.47, no.10, p.803-6 (Sept. 1983).
The authors have measured the low-temperature specific heat c_p of single-crystalline samples of USb and UTe between 0.1 and 12K. From the experimental data they deduce values for the electronic specific-heat parameter γ of 0.2 mJ/mole K^2 and 10.3 mJ/mole K^2 for USb, and UTe, respectively. c_p data below 1K reveal the onset of nuclear specific heat with decreasing temperature. In temperature range, this contribution is much stronger for USb than for UTe. (22 refs.)

107978 Thermal conductivity and thermal capacity of glow discharge polymers. P.Fritzsch (Sektion Phys., Tech. Hochschule Karl-Marx-Stadt, Karl-Marx-Stadt, Germany).
Wiss. Z. Tech. Hochsch. Karl-Marx-Stadt (Germany), vol.25, no.2, p.197-203 (1983). In German.
Organic glow discharge polymers have a series of different properties which distinguish them from other polymers. The most important are thermal capacity and conductivity. Thermal capacity was measured between 1.5K and 36K. The specific heat capacity variations of phthalodinitril, malonic acid dinitril and chlorobenzol are given in the form of curves and the quantitative results of measurement are discussed. An attempt is made to explain the specific properties of these polymers by their chemical and atomic structure. The empirical results appear to agree well with theoretical considerations. (15 refs.) *G.R.S.*

Phonon spectrum of boron nitride with wurtzite structure ..... See Entry 107842

Determination of the phonon density of states from the thermodynamic functions of a crystal (scandium and yttrium) ..... See Entry 107844

Structural instability of the ZrV_2 crystal lattice ..... See Entry 107910

Disorder phenomena in β-alumina ..... See Entry 108034

Study of thermal properties, electrical conductivity, and the crystallization process of the glassy alloy $SeGe_{20}$ ..... See Entry 108085

Electron-electron interaction in 3d metals which b.c.c. structure ..... See Entry 108271

On the solution of the periodic Anderson model ..... See Entry 108352

Quadrupolar ordering in a non-magnetic cubic doublet system: Cs_2NaHoF_6 ..... See Entry 108800

Modified phase modulation-only approximation of incommensurate phases in K_2SeO_4-type crystals ..... See Entry 108893

65.50 THERMODYNAMIC PROPERTIES AND ENTROPY

107979 Note on the use of the Krupkowski relation in the thermodynamic study of A^{III}-B^{V} systems. V.Flemr, B.Hajek (Dept. of Inorganic Chem., Prague Inst. of Chem. Technol., Prague, Czechoslovakia).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.K71-2 (1983).
The authors point to the inconsistency of the Krupkowski relation with the stability condition for solutions. The types of solutions for which it can be used are exceptional. (3 refs.)

107980 Krupkowski's formalism and the stability condition for homogeneous phases. G.Knobloch, R.Apelt, E.Butter (Sektion Chem., Karl-Marx-Univ., Leipzig, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.K73-4 (1983).
To render a possible numerical approach to mixed phases, we are constrained to use more or less empirical relations for the description of the thermodynamic excess properties. One of them is the Krupkowski formalism. Flemr and Hajek (1983) dissuade from the use of this statement because, in their opinion, the stability condition for homogeneous phases in the infinite diluted region should be not fulfilled. However, their argumentation is based on an incorrect mathematical treatment of the stability criterion. The present authors conclude that homogeneous 'Krupkowski mixtures' are stable against phase decomposition in the regions of infinite dilution if $m>1$. The application of Krupkowski's formalism supposes the acceptance of this restriction. (4 refs.)

107981 Enthalpies of formation of Au-Ge and Au-Ag-Ge liquid alloys at 1373K. S.Hassam, M.Gaune-Escard (Lab. de Dynamique et Thermophys. des Fluides, Univ. de Provence, Marseille, France), J.P.Bros.
High Temp. Sci. (USA), vol.16, no.2, p.131-51 (April 1983). [received: Sept. 1983]
The enthalpies of formation of gold-germanium and gold-silver-germanium alloys were measured at 1373K over the entire concentration range. A high temperature calorimeter with a graphite resistance heater was used for the investigation. The detector consisted of 25 [(Pt-6% Rh) vs. (Pt-30% Rh)] thermocouples. The concentration dependence of the ternary enthalpies of mixing was satisfactorily represented by a polynomial relation. (31 refs.)

107982 Gadolinium monophosphide at elevated temperatures. S.P.Gordienko, V.F.Gol'nik, K.E.Mironov (Inst. of Problems in Materials Technol., USSR).
Inorg. Mater. (USA), vol.18, no.9, p.1233-6 (Sept. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.9, p.1448-51 (Sept. 1982). [received: Sept. 1983]
Mass spectrometric, chemical, X-ray diffraction, and differential thermal analyses were used to study gadolinium monophosphide under vacuum at high temperatures. The gadolinium monophosphide was found to dissociate at 2080-2465K to atomic gadolinium, phosphorus, and molecules of P_2. The van't Hoff and Gibbs-Helmholtz equations were used to determine the standard enthalpy of atomization from gadolinium monophosphide at $\Delta H_{at}{}^0(298)=1027.3$ kJ/mole and the standard enthalpy of the monophosphide formation as $\Delta H_f{}^0(298)=-313.8$ kJ/mole. (10 refs.)

107983 Partial molar volumes and partial molal adiabatic compressibilities of nitroamminecobalt(III) complexes in water at 25°C. F.Kawaizumi, K.Matsumoto, H.Nomura (Dept. of Chem. Engng., Nagoya Univ., Nagoya, Japan).
J. Phys. Chem. (USA), vol.87, no.16, p.3161-6 (4 Aug. 1983).
Densities and ultrasonic propagating velocities of aqueous solutions of a series of nitroamminecobalt(III) complexes have been measured at 25°C at concentrations less than 0.1 mol kg^{-1}. Partial molar volumes, $\bar{V}_2{}^\circ$, have been determined by extrapolation of the relationship between ϕ_v-$S_v m^{1/2}$ and m, where S_v is the coefficient given by the Debye-Huckel (DH) theory. In this relationship, nearly horizontal slopes have been observed for all samples. Infinite-dilution values of partial molal compressibility, $\phi_{Ks}{}^\circ$, have been evaluated from the linear extrapolation of the empirical plot of ϕ_{Ks} against $m^{1/2}$. The concentration dependence of ϕ_{Ks} of these complexes is much higher than those observed for ordinary electrolytes of the same valency type. Values of $\bar{V}_2{}^\circ$ and $\phi_{Ks}{}^\circ$ assigned to the complex ions $[Co(NO_2)_n(NH_3)_{6-n}]^{3-n}$ increase regularly with the number of the ligand $NO_2{}^-$ contained in the complex. Analysis of the observed variation of $\bar{V}_2{}^\circ$ and $\phi_{Ks}{}^\circ$ of complex ions has shown that even for nonelectrolytic complex $[Co(NO_2)_3(NH_3)_3]^0$, electrostriction should occur in solution. (24 refs.)

107984 High temperature thermodynamics of H_2 and D_2 in titanium, and in dilute titanium oxygen solid solutions. P.Dantzer (CNRS-ERA, Univ. of Paris-Sud, Orsay, France).
J. Phys. & Chem. Solids (GB), vol.44, no.9, p.913-23 (1983).
The Tian Calvet microcalorimetric method has been improved in order to determine $\Delta H_H(d)$, the partial molar enthalpy of mixing of hydrogen (deuterium) in the Ti-H_2(D_2) solid systems for compositions $0<(H/Ti)<1.85$, at 713K and in the αTiO_y+H_2 solid solutions ($y=(O/Ti)$) at 745K. The combined calorimetric and equilibrium method allows a precise evaluation of the partial molar entropies. The results of this study differ substantially from ealier published data. (38 refs.)

107985 The partial excess thermodynamic properties of hydrogen in palladium. T.Kuji, W.A.Oates (Dept. of Metall., Univ. of Newcastle, Shortland, NSW, Australia), B.S.Bowerman, T.B.Flanagan.
J. Phys. F (GB), vol.13, no.9, p.1785-800 (Sept. 1983).
New measurements of the hydrogen chemical potential and the partial enthalpy of hydrogen in Pd-H alloys are reported. These results are combined with information available in the literature to obtain a consistent set of values for the partial excess enthalpy and entropy of hydrogen as a function of composition. The partial excess entropy of hydrogen varies from negative values at low hydrogen concentrations to positive values at high hydrogen concentrations and it is demonstrated that the principal contribution to this excess entropy is configurational. Problems associated with trying to interpret these properties in terms of pairwise interaction models are discussed. (53 refs.)

107986 Thermodynamic properties of liquid mixtures of krypton+methane. S.F.Barreiros, J.C.G.Calado, M.Nunes da Ponte, W.B.Streett (Centro de Quimica Estrutural, Lisboa, Portugal).
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.8, p.1869-80 (Aug. 1983).
The equations of state of liquid methane and of a mixture of composition 0.475 Kr+0.525 CH_4 have been measured at 129.32, 134.32, 142.68 and 147.08K, from just above the saturation vapour pressure to the freezing pressure of krypton. Similar studies have been made at 142.68K for two other

mixtures with mole fraction of krypton $x=0.645$ and 0.339. The results show that the excess volume is small and negative at low pressures and increases slightly with pressure, becoming almost zero at high pressures. The changes in the excess functions G^E, H^E and TS^E with increasing pressure have been calculated. Neither the conformal solution theory (in the van-der-Waals-one-fluid form) nor a perturbed hard-sphere equation could account for the quantitative behaviour of the system. (20 refs.)

107987 Thermodynamics of hard dumbell mixtures. M.Wojcik, K.E.Gubbins (School of Chem. Engng., Cornell Univ., Ithaca, NY, USA).
Mol. Phys. (GB), vol.49, no.6, p.1401-15 (20 Aug. 1983).
Monte Carlo simulation results are reported for a variety of hard homonuclear diatomic fluid mixtures. The total and partial pressures are compared with the predictions of various analytic mixture equations of state, and the excess properties are discussed. The thermodynamic behaviour of the dense fluid mixtures is similar to that of hard convex body mixtures. An accurate mixture equation of state is recommended on the basis of the comparisons. (25 refs.)

107988 Cluster expansion for the thermodynamic potential of simple metals. K.Ebina (Dept. of Material Phys., Osaka Univ., Toyonaka, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1686-703 (June 1983).
A cluster expansion scheme is presented for the thermodynamic potential of simple metals based on the thermodynamic formulation of Luttinger and Ward (1960) in terms of the proper self-energy. The obtained expansion proves equivalent to a resummation of the anomalous terms in the simple structural expansion. The contribution from a specific cluster to the ground-state energy is examined numerically, with a particular interest in the role of Lloyd and Sholl's (1968) singularity appearing in the third-order perturbation. (18 refs.)

107989 Investigation of the thermodynamics of oxygen and the determination of phase boundaries in the system copper-oxygen-bismuth at 1200°C. S.Anik, M.G.Frohberg (Inst. fur Metall.-Allgemeine Metall., Tech. Univ. Berlin, Berlin, Germany).
Z. Metallkd. (Germany), vol.74, no.8, p.530-4 (Aug. 1983). In German.
By means of MgO-stabilized ZrO_2 as solid electrolyte the oxygen activities in the system Cu-O-Bi were measured at 1200°C. The results enabled the determination of the phase relations and the position of the conodes. In the homogeneous metal rich melt the oxygen activities were measured. The interaction parameters calculated from the experimental values are ${}^{B}\epsilon_O{}^{Cu}=-6.78$ and ${}^{Cu}\epsilon_O{}^{Bi}=-7.05$. The small difference of these values is discussed. (23 refs.)

Evaluation of binary PTxy vapor-liquid equilibrium data for C_6 hydrocarbons. Benzene+hexane .... See Entry 105045

Evaluation of binary excess enthalpy data for C_6 hydrocarbons. Benzene+hexane .... See Entry 105046

Evaluation of binary excess volume data for C_6 hydrocarbons. Benzene+hexane .... See Entry 105047

Exact solution of a directed-site animals-enumeration problem in three dimensions .... See Entry 105273

Calorimetric study of the 4-propionyl-4′-n-alkanoyloxy azobenzene series .... See Entry 107532

Statistical thermodynamic approach to some hyperstoichiometric dihydrides of lanthanides (La, Ce, Pr, Nd, Sm) and actinides (Np, Pu, Am) .... See Entry 107595

Dynamics and thermodynamics of anharmonic crystals near the instability point .... See Entry 107838

On the translation mode of the kink lattice of a quasi-one-dimensional Peierls-Frohlich system with a nearly half-filled band .... See Entry 107843

Kinetics of the chemo-epitaxial formation of a new phase during diffusional reaction .... See Entry 107870

Relationship between some thermodynamic parameters and the tendency of metallic melts to glassify .... See Entry 107880

Vapor pressures, vaporization reactions, and thermodynamics of vaporization of VS(s) .... See Entry 107898

Ferroelastic phase transition in $BiVO_4$: III. Thermodynamics .... See Entry 107916

Thermodynamics of order-disorder transformations in vanadium carbide .... See Entry 107920

Solubility of hydrogen and deuterium at low concentration in $Fe_{0.5}Ti_{0.5}$ .... See Entry 107949

Possible diffusion mechanism in group IV transition metals .... See Entry 108009

An invariant formulation of multicomponent diffusion in crystals .... See Entry 108013

Charge orderings and lattice distortions in complex TCNQ salts .... See Entry 108316

Method of measuring the kinetic and thermodynamic properties in binary stratified systems by means of scattered light spectra .... See Entry 108964

The high pressure disproportionation of Spinel $MgAl_2O_4$ .... See Entry 109214

A correlation of the thermodynamic properties and phase diagram of the system lead-silver using a Gaussian plus subregular formalism .... See Entry 109221

Nitrogen solutions in liquid iron alloys .... See Entry 109222

Activity of arsenic and tin in Fe-As-Sn melts .... See Entry 109223

Thermodynamic properties of solid U-Sb alloys .... See Entry 109230

Thermochemistry of Na_2O-WO_3 system at 1065 to 1239K ... See Entry 109263

Thermodynamic analysis and kinetics of dissociation of SiC .... See Entry 109723

Analyses of G^E data for binary systems in terms of generalized quasi-lattice theory .... See Entry 109794

65.70 THERMAL EXPANSION AND THERMOMECHANICAL EFFECTS

(see also 64.30 Equations of state; for electronic thermal conduction, see 72.15 and 72.20; for thermal conductivity of superconductors, see 74.30E; for pyroelectric and electrocaloric effects, see 77.70)

107990 The oxide β-Ga_2O_3: force field, thermal expansion, and rigidity anisotropy. D.Dohy, J.R.Gavarri (Lab. de Chimie-Phys., Univ. Paris XIII, Villetaneuse, France).
J. Solid State Chem. (USA), vol.49, no.1, p.107-17 (Aug. 1983). In French.
The thermal expansion tensor of the gallium oxide β-Ga_2O_3 was determined from low temperature X-ray diffraction. At $T=250$K the principal directions of the tensor ($\alpha_3\simeq\alpha_a=2\times10^{-6}$ K^{-1}, $\alpha_2=\alpha_b=5.9\times10^{-}6$ K^{-1}, $\alpha_1\simeq\alpha_c=5\times10^{-6}K^{-1}$) are close to the mean directions associated with the various chemical bonds of the monoclinic structure. The components α_a, α_b, and α_c are directly linked to the thermal bond expansions. These can be estimated from values of stretching force constants available in a previous vibrational study. The structure may be described in terms of an infinite set of rigid blocks weakly bound to each other along the **c** direction. The Debye temperature ($\Theta_D\simeq730$K) can be calculated using the Debye model. This value leads to an estimate of the mean force constant (1.75 mdyne/Å) close to that obtained by spectroscopic data. Through these numerical values, one can evaluate the compressibility (0.5×10^{-11} Pa^{-1}) and the Gruneisen constant (~0.96). These parameters, characteristic of the compound and of its crystal structure, were obtained from structural data. In addition, previous mechanical and morphological properties are also interpreted and correlated with disorder effects. (14 refs.)

107991 Thermal expansion of amorphous $Pd_{0.775}Si_{0.165}Cu_{0.06}$. W.M.MacDonald, E.J.Cotts, A.C.Anderson (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
Phys. Rev. Lett. (USA), vol.51, no.10, p.939 (5 Sept. 1983).
The thermal expansion of glassy PdSiCu has been reported to be negative at temperatures below 2.5K and to be associated with a large negative Gruneisen parameter. This anomaly was attributed to the two-level states (TLS) found in glassy metals and other amorphous solids. In a study of the low-temperature thermal expansions α of a series of amorphous solids and disordered crystals, the authors have failed to observe a negative expansion for glassy PdSiCu. (7 refs.)

107992 Thermal expansion of thin gold films. A.T.Pugachev, N.P.Churakova.
Russ. Metall. (GB), no.3, p.104-6 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.3, p.121-2 (1982).
The linear expansion coefficient of the gold films 50-100 Å thick is 15-20% higher than the value of a for thick gold. The increase of a is caused by a dimensional effect resulting from the influence of the surface and near-surface layers on the thermal expansion of the thin films. (8 refs.)

107993 Mismatch in the thermal expansion coefficients in $Ga_{1-x}Al_xP$-GaP heterostructures. V.N.Bessolov, S.G.Konnikov, V.E.Umanskii, Yu.P.Yakovlev (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.28, no.2, p.257-8 (Feb. 1983). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.53, no.2, p.411-12 (Feb. 1983). [received: Sept. 1983]
The authors determined the thermal expansion coefficients of GaP, $Ga_{1-x}Al_xP$, and AlP. They grew layers of $Ga_{1-x}Al_xP$ solid solutions of thickness ~2 μm on a GaP substrate [(100) face] by liquid-phase epitaxy at temperatures $T_g=950$-1100°C. They studied the samples over a wide range of temperatures using a widely diverging beam in a scanning electron microscope. By using an attachment permitting X-ray diffraction analysis over a broad range of temperatures they were able to carry out measurements in the 25-650°C range; the temperature was recorded and held constant to better than ±2°C. The value of x in the $Ga_{1-x}Al_xP$ layers was determined by microscopic X-ray analysis. (9 refs.)

Recommended values for the thermal expansivity of silicon from 0 to 1000K .... See Entry 105042

Reconstruction of the intensity distribution of heating radiation from the thermal damage profile of a thin plate .... See Entry 106800

Thermomechanical effects in cholestric liquid crystals .... See Entry 107530

The phase transformations and thermal expansion of the solid electrolyte Cu_3BiS_3 between 25 and 300°C .... See Entry 107588

Doping of germanium telluride with bismuth and copper .... See Entry 107725

Thermoelastic wave generation by resistive heating in silicon .... See Entry 107823

Structural instability of the ZrV_2 crystal lattice .... See Entry 107910

The nature of temperature dependence of energy gaps in layer semiconductors .... See Entry 108289

Antiferromagnetism of YMn_2 intermetallic compound .... See Entry 108647

Magnetic properties and thermal expansion of $(Zr_{1-x}Ta_x)Fe_2$ .... See Entry 108687

65.90 OTHER TOPICS IN THERMAL PROPERTIES OF CONDENSED MATTER

107994 Thermal analysis of complex sulfates of hafnium and sodium. Yu.P.Sozinova, D.L.Motov, R.A.Popova, S.D.Nikitina (S.M. Kirov Inst. of Chem. & Technol. of Rare Earth Elements & Mineral Raw Materials, Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1155-9 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1363-6 (Aug. 1982).
Thermal analysis of sulfate compounds of hafnium and sodium was conducted; differences in the behavior of basic and neutral salts were established. (6 refs.)

A new probe of the optical properties of surfaces .... See Entry 105379

Calorimetric investigation of electrohydrodynamic instabilities in liquid crystals .... See Entry 107266

Some problems concerning infrared emission measurements ... See Entry 108956

66.00 TRANSPORT PROPERTIES OF CONDENSED MATTER (NONELECTRONIC)

66.10 DIFFUSION AND IONIC CONDUCTION IN LIQUIDS

107995 Thermal Soret diffusion in the liquid phase epitaxial growth of binary III-V compounds. Chung-Ping Chien, B.L.Mattes (Electron Phys. Lab., Univ. of Michigan, Ann Arbor, MI, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.648-55 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Steady-state liquid phase epitaxial nucleation and growth conditions have been achieved in the growth of III-V compounds that yield terrace and miniscus line-free layers and uniform submicron thickness control. A theoretical analysis of transient thermodynamic transport through super- and undersaturated melts appears to show that the thermal Soret effect is a very strong coupling force between solute and heat transport. When nucleation and growth are initiated at near steady-state equilibrium liquidus conditions, at the substrate interface with a temperature gradient, melt-back and spontaneous nucleation are minimized. This appears to indicate that near the interface localized nonuniformities exist in supersaturated melts that yield unstable conditions for nucleation and growth. The Soret thermal diffusion coefficient has been evaluated in terms of the solute and solvent masses and the temperature dependence of the diffusion coefficient. At a noninteracting interface the steady-state solute concentration is always greater than the equilibrium liquidus concentration with a positive temperature gradient to the III-V source. The increased concentration is a result due to zero net solute flux at this interface where equal but opposite driving forces are developed as steady-state conditions are approached. At a very critical time during melt saturation the equilibrium liquidus concentration is reached when the substrate should be brought into contact with the melt to avoid melt-back and spontaneous nucleation. The critical time determined in this analysis appears to be in agreement with the experimental results. (16 refs.)

107996 A reduction rule in heats of transfer for aqueous 1-1 electrolytes. N.Takeyama, K.Nakashima (Dept. of Industrial Chem., Saga Univ., Saga, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2692-8 (Aug. 1983).
Common to aqueous 1-1 electrolytes MX, after the empirical estimation of a constant thermal diffusion coefficient $D_0'=20.2\times10^{-8}$ cm^2 s^{-1}K^{-1} at 298.2K, ascribable to water, a reduction rule has been found between the heat of transfer Q^*(MX) and the reduced one q^*(MX), as shown by $Q^*(\mathrm{MX})=q^*(\mathrm{MX})-2RT^2D_0'/D^0(\mathrm{MX})$, where R is the gas constant, T is kept at 298.2K, and D^0(MX) is the limiting diffusion coefficient. In the relative error 0.1%, discarding $Q^*(\mathrm{LiCl})D^0(\mathrm{LiCl})/2RT^2D_0'$ in comparison with unity, one may take a reference $q^*(\mathrm{LiCl})=2RT^2D_0'/D^0(\mathrm{LiCl})$ to the reduced ionic heats of transfer q^*(ion). Using the additivity in Q^*(MX) and q^*(MX), together with the Nernst relation for D^0(MX), the authors propose rational ionic heats of transfer Q_r^*(MX) for 17 aqueous univalent ions, which agree fairly with the conventional values by Snowdon and Turner.

107997 Thermodynamics of thermal diffusion in aqueous ionic solutions. N.Takeyama, K.Nakashima (Dept. of Industrial Chem., Saga Univ., Saga, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2699-705 (Aug. 1983).
Transforming fluxes of aqueous ions and of water in an apparatus system into those relative to water within the linear theory of nonequilibrium thermodynamics, the authors have expressed the thermal diffusion coefficient as a difference between those of water and of the electrolyte, together with the diffusion coefficient in an invariant form under the transformation in ideal dilute conditions. Thereby the heat of transfer may be formulated in an exact agreement with the reduction rule proposed by the present authors, by which individual ionic thermal diffusion coefficients are evaluated for 17 aqueous univalent ions. (7 refs.)

107998 Measurements of self-diffusion coefficients of the nitrate ion in aqueous solutions of potassium nitrate and calcium nitrate. T.Hashitani (Faculty of General Education, Tokyo Univ. of Agriculture & Technol., Tokyo, Japan), K.Tanaka.
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.8, p.1765-8 (Aug. 1983).
Self-diffusion coefficients of nitrate ions in aqueous solutions of potassium and calcium nitrate have been measured at 298.2K over the concentration range 0.001-0.5 mol. dm^{-3} using a diaphragm cell with ^{15}NO$_3^-$ as tracer. Activation energies for the self-diffusion of nitrate ions in 0.01 and 0.1 mol. dm^{-3} potassium nitrate and calcium nitrate solutions have also been determined from measurements at temperatures from 278 to 308K. These are compared with those for ammonium ions. (6 refs.)

107999 Diffusional behaviour of entangled star polymers. J.Klein, D.Fletcher (Cavendish Lab., Univ. of Cambridge, Cambridge, England), L.J.Fetters.
Nature (GB), vol.304, no.5926, p.526-7 (11 Aug. 1983).
Reports a critical study of the diffusion coefficient D of a series of model linear and three-arm star-branched polymers, diffusing in an entangled linear polymer melt matrix, designed to elucidate dynamic mechanisms for the entangled stars. Measuring D as a function of diffusant degree of polymerization N the authors find, for the linear molecules, $D\propto N^{-2}$, as expected for purely reptative motion. For the case of moderately short stars, however, D falls considerably faster than an inverse square power law, and is well fitted by an exponential type relation $D\propto \mathrm{e}^{-\alpha N}$. There is evidence that for the longest stars used in the present study it is the release of entanglements by reptation of the linear matrix molecules which dominates the dynamics. This is the first direct indication of such 'tube-renewal' effects in a system of entangled polymers. (12 refs.)

108000 Conductometric investigation of the KCl-MnCl$_2$ system. R.A.Uzbekov, B.P.Burylev, Z.V.Kakhovskaya (Kuban State Univ., Krasnodar, USSR).
Sov. Electrochem. (USA), vol.18, no.12, p.1427-30 (Dec. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.12, p.1598-601 (Dec. 1982).
A method for studying the phase diagrams of binary salt systems on the basis of the temperature dependence of their electrical conductivity has been proposed. (13 refs.)

108001 Influence of surface tension of the solvent on duration of induction period of diffusion in methanol-polymethyl methacrylate system. S.O.Granik, E.F.Samarin, B.P.Shtarkman.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.8, p.1621-4 (Aug. 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The new concept of the nature of induction period of diffusion often observed in various polymer-solvent systems is stated. For the PMMA-methanol system the unique relation of duration of induction period with the value of surface tension of methanol is shown. The model of the mechanism of diffusion of the solvent into the polymer is proposed for the initial stage of diffusional process. (9 refs.)

108002 Features of self-diffusion of the solvent in the polymer-low-molecular compound system. A.I.Maklakov.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.8, p.1625-30 (Aug. 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
In polymer-low-molecular compound systems at $T>T_g+(80\text{-}100^\circ)$ (T_g is the glass transition temperature of the system) with assumption about the independent behaviour of holes being necessary for diffusion, the temperature dependences of coefficient of self-diffusion of the solvent D are shown to be described by equation of Arrhenius type with the constant activation energy E_D. This fact is observed experimentally. The decrease of D with increasing of the polymer content in the system is a result of kinematic limitations for the motion of small molecules. Increase of E_D with decreasing of the solvent content is mainly related to enhancing of the energy of the formation of the hole. (11 refs.)

108003 Thermodynamics of irreversible processes in molten salts: problems of interdiffusion measurements under microgravity. J.Richter, A.Hahne (Inst. fur Phys. Chem, RWTH Aachen, Aachen, Germany).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.153-60
One attempt for the description of the structure of molten salts are the friction coefficients, which combine thermodynamic with transport data. One of these transport data is the diffusion coefficient which must be measured in differential steps as a function of the composition of the melt. The most suitable method for these measurements is the optical one. Reliable values are only obtained, if the diffusion is the only transport process, which is not superposed by any other transport phenomena as convection in melts at high temperature. Results are given for the molten KNO$_3$-AgNO$_3$ mixture at 300°C and the experimental set up and the filling procedure under microgravity are presented. (12 refs.)

108004 Measurements of diffusion coefficient of copper in liquid lead in microgravity by the grain boundary grooving technique. O.Minster, C.Vahlas, C.Senillou, L.Coudurier, N.Eustathopoulos, P.Desre (Lab. Thermodynamique et Phys.-Chimie Metallurgiques, ENSEEG, Saint-Martin d'Heres, France).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.301-6
Presents results concerning the diffusion coefficient, D, of copper in liquid lead, obtained in microgravity and on Earth by the grain boundary grooving (GBG) technique. Linear dimensions (depth and width) of the grooves, formed in the grain boundaries of bicrystals of Cu in equilibrium with Pb-Cu alloys, have been measured after an annealing time of 8 h, at four temperatures between 900 and 1200 K. Comparison of groove dimensions obtained on Earth and in microgravity, indicates that the apparent diffusion coefficient on Earth is higher (by about 40%) than that obtained in microgravity. This difference is attributed to microconvection produced in the vicinity of the solid-liquid interface by solute concentration gradients parallel to the interface. (22 refs.)

A simple high-pressure sample cell for diffusion coefficient measurements by the spin-echo technique .... See Entry 105347

Diffusion of free radicals as studied by tomography .... See Entry 108775

Method of measuring the kinetic and thermodynamic properties in binary stratified systems by means of scattered light spectra .... See Entry 108964

Reactions in glass melt systems .... See Entry 109708

Kinetics of the interaction of a liquid diffusing into another one as studied by reflection spectroscopy (ATR) .... See Entry 109736

Magnetoelectrolysis .... See Entry 109758

Energy consumption of aluminium smelting cells containing solid wetted cathodes .... See Entry 109759

Diffusion with hydrolysis equilibria: transport coefficients of aqueous SO$_2$, NH$_3$ and Na$_2$CO$_3$ .... See Entry 109783

Study of the temperature dependence of the rate of oxygen exchange across an air-water interface .... See Entry 110488

66.20 DIFFUSIVE MOMENTUM TRANSPORT

(inc. viscosity of liquids)

108005 Polymer conformation and viscometric behaviour. I. Conformational transition in poly(benzyl methacrylate) in dilute solutions. L.Gargallo, M.I.Munoz, D.Radic (Lab. de Fisico Quimica Molecular, Pontificia Univ. Catolica de Chile, Santiago, Chile).
Polym. Bull. (Germany), vol.10, no.5-6, p.264-70 (Aug. 1983).
The viscometric and refractometric behaviour of poly(benzylmethacrylate) (PBM) in isobutyl methylketone (IMK) was studied as a function of the temperature. The viscometric relations in IMK and toluene were established by membrane osmometry and GPC at 25°C. The viscometric results show discontinuities in the intrinsic viscosity [η] in IMK and sharp changes in the conformational and thermodynamic parameters K$_\theta$ and B. The variation on the unperturbed dimensions of the polymer chain was attributed to a conformational transition. The influence of the side groups was analyzed. The conformational behaviour of this polymer was compared with the saturated corresponding poly (cyclohexylmethyl methacrylate). (14 refs.)

108006 Properties of the concentrated xanthan gum solutions. M.Milas, M.Rinaudo (Univ. Sci. et Medicale de Grenoble, Martin d'Heres, France).
Polym. Bull. (Germany), vol.10, no.5-6, p.271-3 (Aug. 1983).
Viscosity measurements have been carried out on concentrated aqueous solutions of the polyelectrolytic polysaccharide xanthan in the range where the solutions of xanthan exhibit a transition between isotropic and cholesteric phases. The critical volume fractions of the polymer corresponding to both transitions (isotropic-biphasic; biphasic-cholesteric) are discussed in term of the Flory theory for rigid rod like molecules. (10 refs.)

108007 Viscosity of some strong electrolytes in DMF-H_2O binary solvents at 35°C. N.C.Dey, B.K.Saikia (Regional Res. Lab., Jorhat, India), I.Haque.
Trans. SAEST (India), vol.18, no.1, p.49-57 (Jan.-March 1983).
The viscosities of dilute solutions of KCl, KBr, KI, Me_4NBr, Et_4NBr and Pr_4NBr in different binary solvents of DMF-H_2O were analysed by the Jones-Dole empirical equation. The viscosity coefficients were split into ionic components and the ion-solvent interactions and discussed in terms of flow volumes. (13 refs.)

Transition of linear flexible-chain polymers from the fluid to the high-elastic state, spurt effect, and superspurting modes of their motion . See Entry 107200

Molecular structure and physical properties of rigid polymers in solutions .... See Entry 107518

Breakdown of conventional hydrodynamics for smectic-*A*, hexatic-*B*, and cholesteric liquid crystals .... See Entry 107537

Density and viscosity of melts in the system Pb-Sn-Te and critical rates of growing $Pb_{1-x}Sn_xTe$ single crystals by the Czochralski method .... See Entry 107795

Determination of the first and second normal stress differences in the truncated-cone-and-plate apparatus. I. Measurements on a polyisobutylene/decalin solution .... See Entry 107798

Thermodynamics of irreversible processes in molten salts: problems of interdiffusion measurements under microgravity .... See Entry 108003

'Hot' crystallization centers in amorphous layers .... See Entry 108128

Flow birefringence and angles of its orientation in solutions of poly-α-methyl styrene .... See Entry 108919

66.30 DIFFUSION IN SOLIDS

108008 Size effect, internal stress and diffusion driven boundary motion. P.G.Shewmon (Dept. of Metall. Engng., Ohio State Univ., Columbus, OH, USA), Zong-Sen Yu.
Metall. Trans. A (USA), vol.14A, no.8, p.1579-82 (Aug. 1983).
Diffusion driven boundary motion (DDBM) was studied in the iron-zinc system using thicker iron sheets (127 μm) than in previous work, to check the effect of restraint on the thin DDBM produced surface layer. The sheets were exposed to zinc vapor at 600°C for varying times. The DDBM layer formed through the nucleation of many small grains on the surface which then grew down to a depth of roughly 20 μm and spread to cover the surface in four hours. Samples of iron several millimeters thick developed no such DDBM layer after exposure to the same atmosphere for eight days. It is suggested that the volume change accompanying DDBM is accommodated by plastic strain of the core of the 127 μm iron, but the thicker sample constraints such nucleation and growth. The solid solution layer thickens with time at roughly constant rate, while its zinc content rises toward that of the equilibrium surface layer. This strongly suggested repeated sweeping of the layer by DDBM driven motion of boundaries in the layer. (13 refs.)

The isothermal δ-γ transformation of ferritic-austenitic iron-chromium-nickel alloys .... See Entry 109277

Optimization of the vanadium oxide (V_6O_{13}) electrode in a nonaqueous secondary lithium cell .... See Entry 109876

66.30D Theory of diffusion and ionic conduction in solids

108009 Possible diffusion mechanism in group IV transition metals. G.V.Samsonov, L.F.Pryadko, E.G.Borisenko.
Bull. Acad. Serbe Sci. & Arts Cl. Sci. Tech. (Yugoslavia), no.20, p.55-61 (1982). In Russian.
The anomalous diffusion process in group IV d-metals is described on the basis of a new atomic mechanism: in the activated state, a geometric atom configuration is formed as well as chemical bonding corresponding to the ω-phase. Taking into account existing data on the relative stability of the ω-state in these metals, it is possible to describe the whole complex anomalous behaviour of the investigated elements in diffusion processes: the deviation of the diffusion coefficient temperature dependence from the Arrhenius plot, the negative value of the diffusion activation entropy, superfast diffusion of d-element impurities with $n_{(s+d)}>4$, and low activation volume. (12 refs.) *V.G.P.*

108010 Diffusion in an inhomogeneously deformed medium. A.F.Zhuravlev (Inst. of Phys. of Metals, Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.592-6 (1982). [received: Aug. 1983]
In the case of inhomogeneous deformations of the medium, the expressions for the coordinate derivatives also change. The author develops a consistent derivation of the diffusion equation for a medium subjected to plastic deformations. (3 refs.)

108011 Diffusion in concentrated lattice gases. IV. Diffusion coefficient of tracer particle with different jump rate. R.Kutner, K.W.Kehr (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
Philos. Mag. A (GB), vol.48, no.2, p.199-213 (Aug. 1983).
For pt.III see Phys. Rev. B, vol.26, p.2967 (1983). The authors have investigated tracer diffusion in a three-dimensional lattice gas of arbitrary concentration by Monte-Carlo simulation. The tracer particle has a jump rate which differs from that of the other particles. Results are presented for the tracer correlation factor for various concentrations and ratios of the jump rates. At high particle concentration, Manning's theory for impurity diffusion is applicable. The critical behaviour near the percolation threshold of the vacancies is compared with the scaling laws given by Gefen, Aharony and Alexander (1983) and their generalization to a finite jump rate of the other particles. A recent theory proposed by Nakazato and Kitahara (1980) provides a good description of the data at small particle concentration. (27 refs.)

108012 Diffusion-induced changes in the defect structure of solids (review). B.Ya.Lyubov.
Russ. Metall. (GB), no.1, p.56-67 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.64-79 (1982).
A number of problems are considered in the diffusion theory of vacancies and impurity atoms in structurally non-uniform solids, associated with changes in their defect structure (non-conservative movement of dislocations, formation and development of discontinuities in alloys, etc.). The described mathematical diffusion theory problems are non-trivial. The presence of stress fields, sources and sinks for diffusing particles and, in particular, moving boundaries in this area, complicate the computing methods used and each particular case requires special choice and improvement in the method. (46 refs.)

108013 An invariant formulation of multicomponent diffusion in crystals. J.W.Cahn (Center for Materials Sci., NBS, Washington, DC, USA), F.C.Larche.
Scr. Metall. (USA), vol.17, no.7, p.927-32 (July 1983).
Presents a formulation which grew out of a thermodynamic study. It incorporates some important thermodynamic properties that result from constraints that crystallinity imposes. Consistent with this crystallinity it uses the lattice as a coordinate system. The resulting formulation showed some unexpected invariances to what appeared to be an awkward conventional choice. (16 refs.)

108014 A kinetic model for self-interstitial trapping at solutes. C.Abromeit, H.Wollenberger (Hahn-Meitner-Inst. fur Kernforschung Berlin GmbH, Berlin, Germany).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.349-52
From damage rate measurements at different irradiation temperatures in the stage II range the product of the solute trapping radius multiplied by the trap concentration depends on temperature as T^{-2} which cannot be understood by stationary drift diffusion in a solute interstitial interaction potential. Furthermore, details of the interstitial agglomeration at solutes as derived from the defect build-up and recovery by means of resistivity, hyperfine interaction and mechanical relaxation measurements support the suggestion of nonstationary conditions at the trapping sites. A model is presented for time dependent discrete lattice diffusion of the self-interstitials near the solute. By numerical fits to experimental data the jump behaviour of Cu self-interstitials near solutes is determined. (11 refs.)

108015 Tracer diffusion in nonstoichiometric crystals. K.W.Kehr (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany), R.Kutner, K.Binder.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.582-5
The dynamical process of diffusion of tagged particles in nonstoichiometric crystals has been studied in a lattice-gas model. The mean-square displacement and the waiting-time distributions of a tagged particle have been obtained by numerical simulations. The frequency-dependent tracer diffusion coefficient has been derived in the approximation of correlated consecutive jumps. The calculations have been extended to the case of a different jump rate of the tagged particle. (9 refs.)

108016 Site blocking effect in diffusion on a lattice. K.Kitahara (Faculty of Liberal Arts, Shizuoka Univ., Shizuoka, Japan), K.Nakazato.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.586-8
Diffusion constants of a system of particles of several types are calculated as functions of concentrations by using a model in which more than one particle cannot occupy the same lattice site at the same time and by performing a systematic expansion in the power of $c_0(1-c_0)$, where c_0 is the concentration of vacancies. (5 refs.)

Study of self-interstitial-atom solute-atom-complexes by mechanical relaxation .... See Entry 107690

Kinetics of the chemo-epitaxial formation of a new phase during diffusional reaction .... See Entry 107870

A classical hopping conduction and oscillation: AC conductivity .... See Entry 108029

The relationship between measured activation enthalpy and pre-exponential factor: rate processes in ionic crystals in the intrinsic-extrinsic region .... See Entry 108035

Tunnelling contribution in non-radiative processes .... See Entry 109015

66.30F Self-diffusion in metals, semimetals, and alloys

108017 Kirkendall effect in Cu-Sn alloys. A.G.Guy (Dept. of Phys. & Space Sci., Florida Inst. of Technol., Melbourne, FL, USA).
Scr. Metall. (USA), vol.17, no.7, p.967-8 (July 1983).
The author comments on the work of K. Hoshino, Y. Iijima and K. Hirano (see Trans. JIM, vol.21, p.674, 1980). The results of Hoshino et al. merit comment because they purport to demonstrate the absence of the well-documented anomaly in the Kirkendall effect in Cu-Sn alloys. The anomaly was first reported in a classic study by da Silva and Mehl (1951) and was confirmed by Oikawa and Hosoi (1975) using more accurate experimental techniques. Hoshino et al. explain the disagreement by stating that the two previous investigations, '...have not taken into account the difference in the partial molar volumes between copper and tin in Cu-Sn alloys.' This statement is incorrect, for in fact both da Silva and Mehl, and Oikawa and Hosoi employed a suitable correction for difference in atomic size. (7 refs.)

108018 Reply to 'Kirkendall effect in Cu-Sn alloys' by Prof. A.G. Guy. K.Hoshino, Y.Iijima, K.Hirano (Dept. of Materials Sci., Faculty of Engng., Tohoku Univ., Sendai, Japan).
Scr. Metall. (USA), vol.17, no.7, p.969-70 (July 1983).
The authors reply to the comments made by A.G. Guy (see ibid., vol.17, no.7, p.967, 1983). Hoshino et al. contend that an equation derived by Guy is incorrect and that no anomaly is exhibited by the Kirkendall effect in Cu-Sn alloys. (8 refs.)

108019 Migration energies of a vacancy and a divacancy in aluminum. O.Takai, M.Doyama, Y.Hisamatsu (Dept. of Metall. & Materials Sci., Univ. of Tokyo, Tokyo, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.117-19
The migration energies of a vacancy and a divacancy in aluminum have been calculated in terms of the pseudopotential theory considering the lattice relaxation around a migrating atom. Only the structural energies were considered under the condition of constant volume. The migration energy can be obtained by comparing the total energy of an activated configuration with that of a normal configuration. The authors did not consider the lattice relaxation around a vacancy or a divacancy, but considered the lattice relaxation when the migrating atom reached at the saddle point. The calculated migration energy of a vacancy was 0.51 eV and that of a divacancy was 0.26 eV. (9 refs.)

108020 A method for investigating migration of point defects. B.Nielsen, K.Petersen (Lab. of Appl. Phys. II, Tech. Univ. of Denmark, Lyngby, Denmark).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.195-8
By use of the signal from positrons annihilating in voids it is possible to develop a method distinguishing whether mono-vacancies or interstitals are migrating at a certain temperature. This method, the void response method, was used to investigate molybdenum and it was found that mono-vacancies are migrating in Stage III. (6 refs.)

108021 Interstitialcy transport in dilute alloys under irradiation. H.Wollenberger (Hahn-Meitner-Inst. fur Kernforschung Berlin GmbH, Berlin, Germany).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.339-45
The configuration of self-interstitials has been shown to be of the dumbbell type wherever a firm determination of the structure was possible. Migration of such a defect should cause self-diffusion. Yet this effect needs to be demonstrated experimentally. Impurity diffusion via interstitialcy migration requires formation of the mixed dumbbell and mobility of this defect. The author reviews quantitative experimental information on the impurity diffusion of the solutes Be and Ni in Cu. (35 refs.)

108022 The mobility of vacancies and interstitials in Ag-Cu studied by high-voltage electron microscopy. H.Takahashi (Metals Res. Inst., Hokkaido Univ., Sapporo, Japan), K.Urban.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.346-8
A study has been carried out by high-voltage electron microscopy on the relative mobility of vacancies and interstitials in an Ag-0.17 at.% Cu alloy at temperatures between 345K and 775K. It is found that in the whole temperature range the mobility of vacancies is higher than that of interstitials. This can be explained by the formation of interstitial-solute complexes retarding interstitial motion. During prolonged irradiation, solute segregation occurs to sinks with the result that the interstitial mobility increases to the extent that it eventually surpasses that of the vacancies. (7 refs.)

The migration, precipitation and dissolution of solute atoms in quenched Al-Ge, Al-Sn, and Cu-Ge alloys .... See Entry 107962

Kinetics of growth of phases by mutual diffusion in three-component multiphase metallic systems .... See Entry 109217

Further observations on the formation mechanisms of precipitate-free zones in an aged Al-16 wt pct Ag alloy .... See Entry 109353

66.30H Self-diffusion and ionic conduction in nonmetals

108023 Electrical and thermal properties of Na_2SO_4 doped with $NaVO_3$, $Ln_2(SO_4)_3$ (Ln=Eu,Pr). N.Imanaka, G.Adachi, J.Shiokawa (Dept. of Appl. Chem., Osaka Univ., Osaka, Japan).
Can. J. Chem. (Canada), vol.61, no.7, p.1557-61 (July 1983).
In order to develop useful solid electrolytes for SO_2 detectors, Na_2SO_4, Na_2SO_4-$Eu_2(SO_4)_3$, Na_2SO_4-$NaVO_3$ and Na_2SO_4-$NaVO_3$-$Ln_2(SO_4)_3$ (Ln=Eu,Pr) systems have been prepared and their electrical and thermal properties have been measured. By doping Na_2SO_4 with $Eu_2(SO_4)_3$, the electrical conductivity increases and the apparent activation energy of the Na_2SO_4-$Eu_2(SO_4)_3$ system shows a value between those of Na_2SO_4-III and Na_2SO_4-I. Addition of $NaVO_3$ and $Ln_2(SO_4)_3$ (Ln=Eu,Pr) to Na_2SO_4 suppressed the phase transformation, by stabilizing the structure of the Na_2SO_4-I phase even at a relatively low temperature. (32 refs.)

108024 Anomalous temperature dependence of the self-diffusion coefficient in silicon. V.M.Vorob'ev, V.A.Murav'ev, V.A.Panteleev (Physicotech. Res. Inst., N.I. Lobachevskii State Univ., Gor'kii, USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1515-18 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1765-8 (Nov. 1982).
The authors have proposed a new vacancy mechanism of self-diffusion in silicon, based on the possibility of elementary vacancy hops into both the first and the second coordination spheres. The model provides an explanation of the experimentally observed anomaly in the self-diffusion coefficient D(T). An analytical expression has been obtained for D(T), taking into account correlation effects. The migration energy for vacancies has been estimated for the new type of hop to be $\epsilon_2 \approx 1.1$ eV, which agrees well with the reorientation energies of defects of the E-center type in Si. (18 refs.)

108025 Tellurium self-diffusion and point defects in lead telluride. Yu.N.Simirskii, L.P.Firsova (M.V. Lomonosov State Univ., Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.9, p.1291-4 (Sept. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.9, p.1510-13 (Sept. 1982). [received: Sept. 1983]
Radioactive tracers have been used to determine the tellurium self-diffusion coefficient in lead tellurides with various deviations from stoichiometry on the tellurium-rich side. It is found that the self-diffusion coefficient of tellurium at 973K is only weakly dependent on the vapor pressure of the tellurium in equilibrium with the solid. (12 refs.)

108026 Defects and diffusion in MnO. P.Kofstad (Dept. of Chem., Univ. of Oslo, Oslo, Norway).
J. Phys. & Chem. Solids (GB), vol.44, no.9, p.879-89 (1983).
Diffusional transport of manganese through MnO scales has been studied at temperatures from 900-1200°C by means of a novel diffusion/evaporation method and by the two-stage oxidation (Rosenburg) method. In the phase field of $Mn_{1-v}O$ near the MnO_3O_4 phase boundary the manganese self-diffusion coefficient and the concentration of defects is concluded to be proportional to $p_A{}^{1/2}$, where A is O_2. The concentration of defects increases with decreasing temperature at constant partial pressure of oxygen. In this nonstoichiometry range $Mn_{1-y}O$ has properties similar to wustite, $Fe_{1-y}O$ and it is concluded that the important cation defects are defect clusters. The results may be explained assuming that the defect clusters consist of four vacancies on octahedral sites and one interstitial on a tetrahedral site. Values for the concentration of defects, the self-diffusion of manganese ions and of the defects have been calculated. For the phase field near the Mn/MnO phase boundary it is concluded that Mn-interstitials predominate. (22 refs.)

108027 Gravity-induced EMF in superionic conductor $RbAg_4I_5$. M.E.Kompan (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.6, p.327-30 (20 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.6, p.275-8 (20 March 1983). [received: Sept. 1983]
The electric field arising due to redistribution of mobile Ag^+ cations under the action of gravity is observed experimentally in the superionic conductor $RbAg_4I_5$. It is shown that under the experimental conditions the action of gravity on mobile cations is equivalent to the action of an EMF. (4 refs.)

108028 Magnetic resonance study of diffusive phenomena in the phases of the NaF-BiF_3 system. J.Senegas, C.Chartier, J.Grannec (Lab. de Chimie du Solide, Univ. de Bordeaux I, Talence, France).
J. Solid State Chem. (USA), vol.49, no.1, p.99-106 (Aug. 1983). In French.
^{19}F and ^{23}Na wide-line NMR studies are reported on $NaBiF_4$ and the solid solution $Na_{1-x}Bi_xF_{1+2x}$ for $x=0.62$ and $x=0.68$ in the $-100°$ to $+200°C$ temperature range. No sodium mobility could be detected in $NaBiF_4$, but the mobility is significant in the solid solution. The fluorine motions are weakly activated (0.28 eV) in $NaBiF_4$ and result only from short-range motion (correlated motions or reorientations). In the solid solution the concentration of mobile fluoride ions increases with temperature. Compared to the values given by complex impedance measurements, the activation energies in this thermal range (0.18 eV for $x=0.62$ and 0.20 eV for $x=0.68$) may be correlated with phenomena preceding the long range conductivity which appears at higher temperature. (9 refs.)

108029 A classical hopping conduction and oscillation: AC conductivity. T.Ishii (School of Engng., Okayama Univ., Okayama, Japan).
Solid State Commun. (USA), vol.47, no.9, p.717-20 (Sept. 1983).
Frequency-dependent conductivity for hopping and oscillation of particles is discussed in the context of the master equation where attention is only paid to a thermal activation type of hopping. On adopting the Einstein oscillators, which is of particular interest in superionic conductors, the author gives an exact expression of the conductivity which involves the above twofold motions of particle, hopping and oscillation. The crossover between the is surely found by performing numerical calculations for physical parameters corresponding to those of Na-β-Al_2O_3. (6 refs.)

108030 Effect of copper on the electrical conductivity of the solid electrolyte $RbAg_4I_5$. V.N.Zagorodnev, N.V.Lichkova, E.B.Yakimov (Inst. of Solid-State Phys., Acad. of Sci., Moscow, USSR).
Sov. Electrochem. (USA), vol.18, no.12, p.1472-5 (Dec. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.12, p.1650-3 (Dec. 1982).
Solid electrolytes, i.e. crystals with high ionic conductivity, are presently attracting the attention of researchers because of their promising wide, practical application. Perhaps the greatest degree of attention is being directed towards $RbAg_4I_5$ which possesses high ionic conductivity at room temperature. This is because the number of cationic sites in the crystal lattice far exceeds the number of silver ions so that the sites form zigzag channels that penetrate the entire crystal. It was therefore considered of interest to discover how the electrical properties of $RbAg_4I_5$ are affected by various crystal-lattice defects that can disrupt the channel structures. One such defect is a low-mobility impurity that can displace silver and thereby block the channel. The effect of impurities on the electrical conductivity of $RbAg_4I_5$ has been studied but the results are in poor agreement. This may be due basically to variations of factors, such as grain boundaries, in the real structure since the work was carried out on polycrystalline samples and on sprayed films. A study of the grain boundary effect is also of interest as conductivity along the boundaries plays an important part in generating the electrical properties of polycrystals with ionic conductivity. (10 refs.)

108031 Investigation of the electric double layer on platinum and gold electrodes in a solid electrolyte Ag_4RbI_5. I.D.Remez (Inst. of Electrochem., Acad. of Sci., Sverdlovsk, USSR).
Sov. Electrochem. (USA), vol.18, no.12, p.1481-4 (Dec. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.12, p.1660-3 (Dec. 1982).
The solid electrolyte Ag_4RbI_5 was prepared in a high degree of purity. Within the range of pressing pressures on the samples $(43\text{-}49)\times10^7$ Pa, the values of the double-layer capacitance and the conductivity of the electrolyte remained practically constant. When the pressure was lowered, a substantial decrease in the value of the double-layer capacitance and conductivity was observed, while at increased pressures the appearance of cracks was observed (overpressing). Since Ag_4RbI_5 has very high conductivity at room temperature, during pressing shortening of the electrodes must be excluded. This was achieved by the use of Teflon linings. The specific double-layer capacitance was determined on the geometrical surface of the investigated electrodes. (14 refs.)

108032 Electrical conductivity of glasses of the system SiO_2-PbO-BaO-K_2O-Na_2O. L.Sasek, Nguyen Van Tu (Dept. of the Technol. of Silicates, Inst. of Chem. Technol., Prague, Czechoslovakia).
Silikaty (Czechoslovakia), vol.27, no.3, p.199-213 (1983). In Czech.
Deals with the effect of chemical composition on specific electrical conductivity of lead glasses. The planned factor experiment method was used for determining regressive equations allowing the authors to calculate the temperature dependence of specific electrical conductivity from the chemical composition of glass. The regressive coefficients further served for the establishment of factors which express quantitatively the change in specific electrical conductivity due to substitution of 1 wt.% of silica by another oxide. The respective change in specific electrical conductivity is expressed in terms of change in temperature required for maintaining the original value of specific electrical conductivity exhibited by the glass before the substitution of oxides. The calculated factor values express very comprehensively the effects of the individual oxides on replacement of 1 wt.% of SiO_2 for the given oxide, and permit them to determine very rapidly the respective change in electrical conductivity for a given substitution of oxides. The greatest effect in this respect is exhibited by soda, the smallest by baria. The influence of the individual oxides on the specific electrical conductivity is identical with the effects of the given oxides on the viscosity of lead glasses. (23 refs.)

108033 Ionic conductivity of fluorite-type fluorides. P.Hagenmuller, J.-M.Reau, C.Lucat, G.Villeneuve (Univ. de Bordeaux I, Talence, France).
Silikaty (Czechoslovakia), vol.27, no.3, p.225-31 (1983). In Czech.
The monovalent cation-fluorine bond in $MBiF_4$(M-K,Rb,Tl) increases the mobility, but in derived solid solutions $M_{1-x}Bi_xF_{2x+1}$ it is again suppressed due to a higher Bi^{3+} content. The authors succeeded to improve the conductivity of β-PbF_2 by partial replacing of Pb^{2+} by Bi^{3+} cations in $Pb_{1-x}Bi_xF_{2+x}$ series, where anionic disordering exists. Similar results were obtained for the $Pb_{1-x}ThF_{2+2x}$ solid solutions and particularly for $PbSnF_4$ which is the best anionic conductor so far known. The reason in all cases is the high polarizability of Bi^{3+}, Th^{4+} and Sn^{2+} cations, respectively. Conducting fluorides seem to be suitable materials for secondary microbatteries; an example if the $Bi/Pb|PbF_2|BiF_3/Bi$ chain. Another application is the determination of gas pressure by such galvanic chains working at room temperature. (11 refs.)

108034 Disorder phenomena in β-alumina. U.Strom (Naval Res. Lab., Washington, DC, USA).
Solid State Ionics (Netherlands), vol.8, no.4, p.255-79 (July 1983).
Experimental and theoretical results are reviewed relevant to the conduction plane disorder in the nonstoichiometric fast ion conductor Naβ-alumina. Thermal, dielectric, acoustic, nuclear magnetic resonance and electron spin resonance measurements at low temperatures (<50K) can be interpreted in terms of the tunneling mode formalism previously proposed for glasses. Experimental results at higher temperatures exhibit behavior similar to glasses near their glass transition. (89 refs.)

108035 The relationship between measured activation enthalpy and pre-exponential factor: rate processes in ionic crystals in the intrinsic-extrinsic region. T.Dosdale, R.J.Brook (Dept. of Ceramics, Univ. of Leeds, Leeds, England).
Solid State Ionics (Netherlands), vol.8, no.4, p.297-304 (July 1983).
In measurements of activated processes, such as diffusion, ionic conduction, creep and sintering, it is common to use Arrhenius plots of the measured quantity, $A(T)$, to give the logarithm of the pre-exponential factor, log A_0, and the experimental activation enthalpy, h. It is shown that, in the cases of conduction and diffusion in ionic crystals, well-defined relationships can exist between the values of log A_0, log A and h, measured on similar samples with differing doping or impurity levels. These relationships are derived for ionic crystals showing either Frenkel, Schottky, or interstitial disorder. In the resulting plots of log A_0 versus h, approximately linear regions are shown to exist, similar to those described by the compensation law for glasses and by the Meyer-Neldel rule for semiconductors. (11 refs.)

108036 Ion transport and structure in silver borate glasses. G.Chiodelli, G.Campari Vigano, G.Flor, A.Magistris (Dipartimento di Chimica Fisica, Univ. di Pavia, Pavia, Italy), M.Villa.
Solid State Ionics (Netherlands), vol.8, no.4, p.311-18 (July 1983).
A study of ionic conductivity in silver borate glasses is presented, which includes (i) a full characterization of the ion transport properties in the $AgI:Ag_2O:B_2O_3$ glasses, (ii) results for glasses where iodine is totally or partially substituted by another halide, (iii) mixed-cation effects. The authors discuss the relationship between local order and ion transport properties of borate glasses and vitreous electrolyte systems. (22 refs.)

108037 Effect of LiX (X=F, Cl, Br, I) and Na_2SO_4 on the electrical conductivity of Li_2SO_4:Li_2CO_3 eutectic. V.K.Deshpande, K.Singh (Dept. of Phys., Nagpur Univ., Nagpur, India).
Solid State Ionics (Netherlands), vol.8, no.4, p.319-22 (July 1983).
The effect of addition of LiX (X=F, Cl, Br, I) and Na_2SO_4 on the electrical conductivity of the eutectic composition of Li_2SO_4 and Li_2CO_3 has been studied. The eutectic composition with 10 mol.% Na_2SO_4 gives high conductivity and this could be applied in power sources. (11 refs.)

108038 Atomic defects and diffusion in metals. R.W.Siegel (Materials Sci. Div., Argonne Nat. Lab., Argonne, IL, USA).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.533-40
The self-diffusion data for FCC and refractory BCC metals are briefly reviewed with respect to (i) the available monovacancy formation and migration properties and (ii) the high-temperature diffusion enhancement above that expected for mass transport via atomic exchange with monovacancies. While the atomic-defect mechanism for low-temperature self-diffusion can be attributed to monovacancies, the mechanisms responsible for high-temperature mass transport are not so easily defined at present; both divacancies and interstitials must be seriously considered. Possibilities for improving our understanding are discussed. (69 refs.)

108039 The effect of hydrostatic pressure on self-diffusion in silver and gold. H.Mehrer, G.Rein (Max-Planck-Inst. fur Metallforschung, Inst. fur Phys., Stuttgart, Germany).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.547-50
The pressure dependence of self-diffusion in silver and gold has been measured down to fairly low values of the diffusivities using radio-tracers in combination with a sputter-sectioning technique. At low enough temperatures the activation volumes of the monovacancy can be observed. The authors obtain 0.65 Ω (Ω=atomic volume) for Ag and 0.73 Ω for Au. In the case of Ag experiments were performed for a whole series of temperatures. The measured activation volumes increase from 0.65 Ω at 594K to about 0.9 Ω near the melting temperature. It is concluded that this result is mainly due to an increasing contribution of divacancies with increasing temperature. (14 refs.)

108040 An analysis of self-diffusion data in FCC metals. W.Schule (Materials Sci. Div., Joint Res. Centre, Ispra, Italy).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.551-3
The results of an analysis of self-diffusion data in copper, silver, gold, aluminium, nickel, and platinum are reported. It is found that the contribution of single and divacancy self-diffusion varies considerably from metal to metal and that a divacancy contribution is especially small in gold and relatively large in copper and silver, even below 700°C. A temperature dependency of the parameters Q_{1v}, Q_{2v}, D_{01}, and D_{02} can be excluded for all metals except perhaps for silver, a temperature dependency of which, however, is also unlikely. (16 refs.)

108041 Self-diffusion of ^{67}Cu in copper. S.Fujikawa, K.Hirano (Dept. of Materials Sci., Tohoku Univ., Sendai, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.554-7
The self-diffusion coefficients in copper were determined by the serial sectioning method using carrier-free ^{67}Cu electroplating and a precision microtome at twenty-four temperatures in the range between 992 and 1355K. The linear Arrhenius relationship rigidly holds in the overall temperature range of the present work except 1355K. The reliable values of the frequency factor and the activation energy of the self-diffusion in copper were determined using the mean value of the diffusivity at each temperature. The curvature in the Arrhenius plot of the self-diffusion in copper was discussed. (10 refs.)

108042 Isotope effect for self-diffusion in silver at low temperatures. H.Mehrer, F.Hutter (Inst. fur Theoretische & Angewandte Phys., Univ. Stuttgart, Stuttgart, Germany).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.558-61
The simultaneous diffusion of ^{105}Ag and ^{110}Ag in silver single crystals has been measured in the temperature range 625 to 870K using a sputtering-technique for serial sectioning of the specimens. In this range the diffusivities vary between 2.7×10^{-20} and 3.8×10^{-16} m^2s^{-1}. The present work is the first isotope effect experiment for very low diffusivities. The strength of the isotope effect fΔK is 0.75 and is independent of temperature within the experimental error. This indicates that in the low-temperature range self-diffusion is dominated by monovacancies (f=0.781) with a ΔK which is close to unity. (9 refs.)

108043 Isotope effect and diffusion of cadmium in copper. K.Hoshino, Y.Iijima, K.Hirano (Dept. of Materials Sci., Tohoku Univ., Sendai, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.562-5
Isotope effect for the diffusion of ^{109}Cd and ^{115m}Cd in Cu has been measured in the temperature range from 983 to 1309K. Based on the isotope effect data, the correlation factor f_i has been found to be 0.38 at 1309K and to decrease with decreasing temperature to 0.15 at 983K. In addition, the solute enhancement factor for the diffusion of ^{64}Cu in dilute Cu-Cd alloys at 1076K has been measured, and the relative jump frequencies of the Cd atom and neighbouring Cu atoms in the five-frequency model have been evaluated. The results suggest that the attraction between a Cd atom and a vacancy is highly strong in the copper matrix. (14 refs.)

108044 Diffusion in Ni-Sn dilute alloys. Y.Iijima (Dept. of Materials Sci., Tohoku Univ., Sendai, Japan), M.Kikuchi, K.Hoshino, K.Hirano.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.566-9
Tracer diffusion coefficient of nickel and interdiffusion coefficient in Ni-Sn dilute alloys containing up to 7 at.% Sn at 1373K have been determined. From Kirkendall marker shifts in various couples consisting of pure Ni and Ni-Sn dilute alloys, the intrinsic diffusion coefficients have been determined. Combining the solute enhancement factor for solvent diffusion with the vacancy flow factor for interdiffusion, an appropriate numerical set of the correlation factor and the jump frequency ratios in the five-frequency model have been evaluated. The result suggests highly correlated jumps of a tin atom to a vacancy in nickel. (11 refs.)

108045 Solute-enhanced self-diffusion in FCC alloys. S.Ishioka, M.Koiwa, H.Nakajima (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.574-7
The diffusion coefficient of a random walker on an imperfect FCC lattice is calculated rigorously. The validity of the Howard-Manning treatment (1967) of the solvent-enhanced self-diffusion is discussed in the light of the result of calculations. (3 refs.)

108046 Mechanisms of the anomalous diffusion in β-zirconium and β-hafnium. C.Herzig, L.Manke, W.Bussmann (Inst. fur Metallforschung, Univ. Munster, Munster, Germany).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.578-81
Diffusion mechanisms for the explanation of anomalous diffusion are discussed. Diffusion and isotope effect experiments in β-Zr, β-Zr-Nb alloys, and β-Hf are reported. The results are interpreted by a vacancy mechanism which is enhanced by photon induced displacive fluctuations (ω-embryos) at lower temperatures. (25 refs.)

The phase transformations and thermal expansion of the solid electrolyte Cu_3BiS_3 between 25 and 300°C ....See Entry 107588

Experimental determinations of the concentration and the mobility of interstitials in pure ice crystals ....See Entry 107687

Vacancies in carbon-doped iron ....See Entry 107692

Characterisation of the polymorphic component of 2-fluoronaphthalene ....See Entry 107921

Thermal properties of a Bi_2O_3:Y_2O_3 oxygen conductor at low temperature ....See Entry 107975

Surface study of a Ag electrode on a solid electrolyte used as oxygen sensor ....See Entry 108130

Unusual isotope effects for diffusion in $VH_{0.50}$ and $VT_{0.50}$ ....See Entry 108827

Electrical relaxation in pure and alkali metal thiocyanate complexed poly(ethylene oxide) ....See Entry 108873

Solid electrolyte batteries and fast ion conducting glasses. Factors affecting a proposed merger ....See Entry 109880

66.30J Diffusion, migration, and displacement of impurities

108047 Pulsed ion beam technique for measuring diffusion coefficient of a slow diffusant in polymers. T.Venkatesan, D.Edelson, W.L.Brown (Bell Labs., Murray Hill, NJ, USA).
Appl. Phys. Lett. (USA), vol.43, no.4, p.364-6 (15 Aug. 1983).
The determination of diffusion coefficients (D) of small molecules in a polymer for D below 10^{-10} cm^2 s^{-1} is a difficult measurement using conventional self-supporting polymer membrane techniques. The authors propose a new method for obtaining similar information by irradiating a polymer with a pulsed ion beam and studying the evolving gaseous products. Product molecules that are not limited by the rate of their production in the film tend to exhibit diffusion limited dynamical characteristics in their transient evolution from the surface. By numerically modeling the diffusion problem the authors can extract diffusion coefficients from the data. Since thin films (<1 μm) can be used in these experiments, diffusion coefficients less than 10^{-10} cm^2 s^{-1}, typical of many molecules in polymers, can be measured with ease. (8 refs.)

108048 Extremely rapid out diffusion of sulfur in InP. A.K.Chin, I.Camlibel, T.T.Sheng, W.A.Bonner (Bell Labs., Murray Hill, NJ, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.495-7 (1 Sept. 1983).
During sealed ampoule annealing of *n*-type (S,Se,Sn)InP crystals at 550°C, an unexpected diffusion front was observed whose apparent diffusivity exceeded that of the rapidly diffusion Zn impurity by about two orders of magnitude. Using luminescence techniques, this diffusion front was correlated with changes in the ionized impurity level. In this letter, the authors show that for annealed InP:S (2×10^{18} cm^{-3}) crystals the donor profile obtained from cathodoluminescence (CL) intensity measurements corresponds to the ^{34}S profile obtained by secondary ion mass spectroscopy. Although dislocations are generally paths along which impurities can rapidly migrate, CL imaging shows that dislocations impede rather than enhance sulfur out diffu-

sion. Further study is required to determine the rapid out-diffusion mechanism. (10 refs.)

108049 Diffusion and redistribution of carbon in iron and its alloys during deformation. O.M.Smirnov, V.A.Lazarev (Inst. of Metall. & Phys. of Metals, Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.115-19 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
It was found that the diffusion mobility and the nature of the distribution of carbon atoms in iron and in an iron-chromium alloy changed with the rate of deformation at 650 and 400°C. (10 refs.) *A.T.*

108050 Diffusion of carbon in amorphous alloy $Co_{70}Fe_5Si_{15}B_{10}$. S.G.Urytu, P.L.Gruzin (Inst. of Metall. & Phys. of Metals, Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.200-1 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The diffusion of carbon was studied by the radioisotope spectrometric method applied to an amorphous ribbon. The results yielded the temperature dependence of the diffusion coefficient in the range 200-400°C. (8 refs.) *A.T.*

108051 Diffusion of copper in explosion-deformed metals. A.N.Bekrenev (V.V. Kuibyshev Polytech. Inst., Kuibyshev, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.206-8 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of the diffusion mobility of copper atoms in explosion-deformed nickel, titanium, and titanium alloy VT9. Preliminary deformation by explosion accelerated diffusion. A substructure with a high density of dislocations facilitated motion of diffusing atoms along dislocation tubes. At relatively low pressures (up to 10-20 GPa) the diffusion coefficient of copper in nickel and titanium increased when the pressure was raised. However, at high pressures the diffusion mobility decreased on increase in the pressure. The latter effect was due to dislocation complexes which acted as traps of the diffusing copper atoms. (6 refs.) *A.T.*

108052 Diffusion behavior in titanium-chromium hydrides. R.C.Bowman,Jr., B.D.Craft, A.Attalla (Monsanto Res. Corp., Miamisburg, OH, USA), J.R.Johnson.
Int. J. Hydrogen Energy (GB), vol.8, no.10, p.801-8 (1983).
NMR measurements of the proton relaxation times T_1, $T_{1\rho}$, and T_2 have been performed on the low (i.e. α-phase) and intermediate (i.e. α'-phase) hydrogen concentrations in CO-stabilized $TiCr_2H_x$ with both the hexagonal (C14) and cubic (C15) Laves structures. The relaxation times indicate rapid proton diffusion above 200K for all the $TiCr_2H_x$ phases; however, large differences in the diffusion activation energies are observed. This behaviour is structure sensitive and has been associated with variations between interstitial site occupancies and diffusion pathways for the C15 and C14 structures. The estimated 300K diffusion constants in the α'-phase of $TiCr_2H_x$ are comparable to the literature values for $HfV_2H_{2.1}$, $LaNi_5H_{6.5}$ and $PdH_{0.70}$ but are orders of magnitude larger than the proton diffusion constant in $TiFeH_{1.0}$. (31 refs.)

108053 Effect of argon ion sputtering of surface on hydrogen permeation through vanadium. M.Yamawaki, T.Namba, T.Yoneoka (Dept. of Nuclear Engng., Univ. of Tokyo, Tokyo, Japan), K.Shida, M.Kanno.
J. Nucl. Sci. & Technol. (Japan), vol.20, no.5, p.405-13 (May 1983).
In order to measure the hydrogen permeation rate through V with an atomically cleaned surface, an Ar ion sputtering apparatus has been installed in the hydrogen permeability measuring system. The permeation rate of the initial specimen was found to be increased by about one order of magnitude after Ar ion sputtering of its upstream side surface. Repeating of such a sputter-cleaning was not so much effective in increasing the steady state permeation rate as the initial sputtering was, but it accelerated the transient response rate by a factor of 2 or 3. The transient response rate was also accelerated by the increase of hydrogen pressure, but this effect tended to be diminished by the sputter-cleaning of specimen surface. The surface impurity layer on the downstream side of specimen was also inferred to act as a diffusion barrier affecting the steady state permeation rate. The present value of activation energy for hydrogen permeation through V at temperatures below 873K was the smallest one ever obtained, showing that the surface effect was minimised in the present study on the account of the surface sputter-cleaning in addition to the ultra high vacuum system. (11 refs.)

108054 The diffusion of silver in InP. R.Chauoui, B.Tuck (Dept. of Electrical & Electronic Engng., Univ. of Nottingham, Nottingham, England).
J. Phys. D (GB), vol.16, no.9, p.1721-35 (14 Sept. 1983).
The paper describes a large number of experiments in which radiotracer silver was diffused into the III-V semiconductor InP over a wide range of experimental conditions. Diffusion profiles were plotted. The diffusions were performed over the temperature range 550-900°C for diffusion times between 2 min and 97 h. The ambient phosphorus vapour pressure was also varied over a wide range. Most of the experiments were carried out on undoped material, but doped n-type, p-type and semi-insulating materials were also used. The results cannot be explained by any simple diffusion theory and it would appear that a rather complex set of phenomena is in operation during the diffusions. The variation of surface concentration with phosphorus vapour pressure implies either that the silver atoms occupy phosphorus sites or that they are involved in some complex when occupying lattice sites. The latter explanation is considered the more likely and the complex $(V_pAg_{In}V_p)$ is proposed as a possibility. The very fast diffusion which is observed strongly suggests that the silver atoms diffuse in the interstitial state and the ion Ag_I^+ is proposed as the most likely. At lower diffusion temperatures most of the atoms in the bulk of the semiconductor probably remain interstitial, but at higher temperature, some of them join the lattice. (19 refs.)

108055 Diffusivity of hydrogen and deuterium at low concentration in $Fe_{0.5}Ti_{0.5}$. G.Arnold, J.-M.Welter (KFA Julich, Julich, Germany).
Metall. Trans. A (USA), vol.14A, no.8, p.1573-7 (Aug. 1983).
The diffusion coefficients of hydrogen and deuterium were measured in the solid solution phase $Fe_{0.5}Ti_{0.5}H_x/D_x$ ($x<0.03$) in an absorption/desorption experiment with palladium coated bulk samples. The pressure and temperature ranges covered were 1 to 120 bar and 370 to 800K, respectively. For $x\to 0$, the diffusion coefficients obey Arrhenius laws. They are (in cm^2 per second with T in K): $10.1\times10^{-4}\times\exp\ (-5890/T)$ and $5.5\times10^{-4}\times\exp(-5710/T)$ for hydrogen, $8.2\times10^{-4}\times\exp(-6080/T)$ and $5.5\times10^{-4}\times\exp(-5980/T)$ for deuterium, as measured during absorption and desorption, respectively. The pick-up and release of hydrogen by uncoated samples was controlled predominantly by surface effects. (15 refs.)

108056 Superdiffusion of 4*T*-hydrogen in vanadium. T.Suzuki, H.Namazue, S.Koike, H.Hayakawa (Dept. of Appl. Phys., Sci. Univ. of Tokyo, Tokyo, Japan).
Phys. Rev. Lett. (USA), vol.51, no.9, p.798-800 (29 Aug. 1983).
Room-temperature X-ray diffuse scattering experiments are reported for hydrogen in solution in vanadium. Uniaxial stress (below the elastic limit) results in transformation of all hydrogen atoms from 1*T* into 4*T* states; each hydrogen is delocalized over four neighboring *T* sites via tunneling. The diffusion coefficient of the 4*T* hydrogen, D_{4T}, is measured from 340 to 200K under an external ⟨111⟩ stress. It is extraordinarily large as compared to the existing data and satisfies the relation $D_{4T}=D_0\exp(-E/kT)$, where $D_0=1.6\times10^{-3}$ cm^2/s and $E=6$ meV. (6 refs.)

108057 Diffusion induced grain boundary migration in Ni-C alloys. T.A.Parthasarathy, P.G.Shewmon (Dept. of Metall. Engng., Ohio State Univ., Columbus, OH, USA).
Scr. Metall. (USA), vol.17, no.7, p.943-6 (July 1983).
The authors report an observation of diffusion induced grain boundary motion in which the solute is an interstitial. It is shown that at 600°C carbon diffuses along nickel grain boundaries orders of magnitude faster than through the lattice. (13 refs.)

108058 Diffusion of zinc into ion implanted iron doped indium phosphide. P.N.Favennec, L.Henry, M.Salvi, A.M.Huber, G.Morillot (CNET, Lannion, France).
Solid-State Electron. (GB), vol.26, no.8, p.771-5 (Aug. 1983).
A study has been made on the diffusion of zinc into iron-doped InP slices which have been previously implanted with various ion species. Chemical profiles of zinc and iron and hole profiles have been measured. The profiles depend strongly on the implanted ion species (argon, oxygen, fluorine, chlorine). The results cannot be attributed solely to radiation damage, but suggest the chemical influence of the particular ion species of the zinc diffusion mechanism. During the indiffusion of zinc from the surface to the bulk, there is, in the same time, a diffusion of iron in an opposite direction. The rearrangement of the iron distribution is mainly due to the presence of zinc impurities. (15 refs.)

108059 Hydrogen mobility in crystalline and amorphous Zr_2PdH_x. R.C.Bowman,Jr., A.Attalla (Monsanto Res. Corp.-Mound, Miamisburg, OH, USA), A.J.Maeland, W.L.Johnson.
Solid State Commun. (USA), vol.47, no.10, p.779-82 (Sept. 1983).
NMR measurements of proton rotating-frame relaxation times were made to deduce hydrogen diffusion parameters for crystalline and amorphous Zr_2PdH_x. Enhanced proton mobility was observed in glassy a-Zr_2PdH_x sample. Both host crystal structure and $Zr_2PdH_{2.9}$ relative to diffusion behavior in any crystalline proton site occupancy make significant contributions to the diffusion process where smaller activation energies correspond to jumps involving octahedral sites. (14 refs.)

108060 Behavior of liquid inclusions in a crystal in the force field of a centrifuge. V.S.Kruzhanov, L.V.Starukhina (State Univ., Khar'kov, Ukrainian SSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.217-19 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.372-6 (March-April 1983). [received: Sept. 1983]
The authors have investigated the motion and deformation of inclusions of aqueous solution in a KCl crystal in the 'gravitational' field of a centrifuge. The velocity and shape of the inclusions depend on their dimensions. As the dimensions of the inclusions increase, there is a transition from motion governed by processes at the crystal-solution boundary to diffusion-limited motion. The authors give a qualitative theoretical description of the observed phenomena. (8 refs.)

108061 Study of helium diffusion in calcium fluoride using a mass spectrometer under static conditions. E.V.Popov, A.Ya.Kupryazhkin (S.M. Kirov Ural Polytech. Inst., Sverdlovsk, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.28, no.2, p.224-5 (Feb. 1983). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.53, no.2, p.365-8 (Feb. 1983). [received: Sept. 1983]
Because of low diffusion mobility and solubility of helium in calcium fluoride crystals and the high background noise from the measurement chambers (gas given off by the chamber walls) in desorption experiments, accurate determination of solubility and diffusion coefficients is impossible using a mass spectrometer under dynamic conditions. In order to eliminate background noise, the samples must be specially prepared (saturated) and the amount of degassing in different, separated chambers in the diffusion cell must be measured. In order to improve the sensitivity of the mass spectrometer, it is advisable to record the gas sample (accumulation of gas in a closed volume) under static conditions. The authors designed and built a diffusion cell consisting of two parts, a saturation and a measurement chamber. (9 refs.)

108062 Fast diffusion of copper (I) ions in NaI. K.Budde (Abteilung Chem., Ruhr-Univ., Bochum, Germany).
Solid State Ionics (Netherlands), vol.8, no.4, p.341-7 (July 1983).
Results are presented for NMR investigations into the diffusion of Cu^+ in NaI. The NMR results show that a considerable amount of the copper (I) ions is incorporated interstitially and that the mean jump frequency ν_{Cu} of the Cu^+ ions is much higher than that of the host cations: $^{\nu}Cu/^{\nu}Na\approx 820$ at 320°C. Two values for the temperature dependence of ν_{Cu} are found: $E_1=1.63$ eV ($T<300$°C) and $E_2=0.61$ eV ($T>300$°C). The nature of the mechanism of the Cu^+-migration in NaI is discussed and a model proposed. The interstitial incorporation and fast diffusion of the Cu^+ ions is confirmed by a comparison with the results for CdI_2 doped NaI. CdI_2 is incorporated substitutionally and the mean jump frequency ν_{Cd} is lower than that of the host ions: $\nu_{Cd}<10^8$ s^{-1} at 650°C. For the pure substance conductivity measurements were performed too, for comparison. The agreement of NMR and conductivity data is good. From both $\Delta H_m=0.59$ eV and $\Delta H_s=2.08$ eV were calculated in excellent agreement with recently reported data. It is shown that the presence of oxygen in the samples leads to wrong data. A method for removing this impurity is described. (36 refs.)

108063 Impurity redistribution studies on laser-formed silicides. A.S.Wakita, T.W.Sigmon, J.F.Gibbons (Stanford Electronics Labs., Stanford, CA, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.721-6
$^4He^+$ backscattering and SIMS were used to study impurity redistribution during laser formation of refractory silicides. Thin films of Mo and W were evaporated on to ⟨100⟩ p-type silicon substrates, which were As or B implanted to doses of 1×10^{15} to 1×10^{16} cm^{-2}. These samples were laser reacted with multiple or single laser scans at various powers. Analysis of these films indicate impurity movement into the forming silicide layer. Impurity concentrations in the films were observed to be as high as 7.8×10^{20} cm^{-3} for As in WSi_2, however a reduction in this concentration occurred with subsequent thermal annealing. (4 refs.)

108064 Diffusion of helium in metals. W.Schilling (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.303-8
The experimental information presently available on the interstitial migration energies, dissociation energies from vacancies and effective activation energy for diffusion at high temperature of helium in metals is reviewed. From a discussion of these energies it can be concluded that in the FCC metals

nickel, gold and aluminum helium occupies predominantly substitutional sites, also in thermal equilibrium at high temperatures. For the BCC metals, molybdenum and tungsten, the evidence is more for interstitial occupancy in thermal equilibrium. The diffusion mechanism at high temperatures has been clearly identified for nickel as the dissociative mechanism (dissociation of a substitutional helium into interstitial helium plus vacancy and rapid migration of the interstitial helium until retrapping at another vacancy). Also for gold the dissociative mechanism seems to hold whereas for aluminum the normal vacancy mechanism seems to prevail. (18 refs.)

108065 Migration of implanted He in stainless steel as observed by trapping at ^{111}In atoms. M.Deicher, G.Grubel, T.Wichert (Fakultat fur Phys., Univ. Konstanz, Konstanz, Germany).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.309-11
Radioactive ^{111}In atoms are implanted in stainless steel (Ni 72/Cr 16/Fe 8) at room temperature. In contrast to pure metals no distinct In-defect complexes are observed with help of the PAC technique. When He atoms are implanted subsequently to the In atoms the formation of several In-He complexes is observed after annealing at 800K. The results are compared with those obtained in He release experiments. (5 refs.)

108066 Jump frequency analysis on impurity diffusion in Cu based on new data. K.Hirano (Dept. of Materials Sci., Tohoku Univ., Sendai, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.541-6
Using new experimental data on the enhancement factor, the vacancy flow factor and the isotope effect, an appropriate numerical set of the correlation factor and the three kinds of jump frequency ratios for the five frequencies have been estimated for the impurity diffusion of polyvalent elements (Zr, Cd, In, Sr and Sb) in Cu. It can be concluded that the attraction between an impurity atom such as Cd, In, Sn or Sb and a vacancy in Cu is highly strong, and a vacancy makes many consecutive exchanges in an impurity atom (Cd, In, Sn or Sb) rather than with any solvent atom neighbouring the vacancy. The attraction between the Zn atom and a vacancy is rather weak. (33 refs.)

Study of relaxational properties of elastomers by diffusional method .... See Entry 107568

Photodoping of Ag into single crystal As_2S_3 .... See Entry 107726

Interaction between vacancies and hydrogen atoms in aluminum .... See Entry 107748

The interactions between gas impurities and defects in Mo studied by the positron annihilation technique .... See Entry 107749

Calculation of the segregation coefficient of boron in the Si-SiO_2 system .... See Entry 107944

Diffusion in concentrated lattice gases. IV. Diffusion coefficient of tracer particle with different jump rate .... See Entry 108011

Electron-beam-induced current measurements in silicon-on-insulator films prepared by zone-melting recrystallization .... See Entry 108578

Diffusion-induced quadrupole relaxation of ^{27}Al nuclei in dilute Al-Ti, Al-Cr, Al-Mn, and Al-Cu alloys at high temperatures .... See Entry 108829

Mossbauer study of cage motion in Ag^{57}Co/^{57}Fe .... See Entry 108840

Mossbauer studies of defect-impurity interaction and impurity diffusion in metals .... See Entry 108850

Theory of Mossbauer line broadening due to diffusion .... See Entry 108852

The effect of self radiation on the aging of zinc-sulfide phosphors .... See Entry 109020

Hydrogen diffusion and hydride formation at the metal-hydride interface .... See Entry 109096

An investigation into the kinetics of migration of ferrite grain boundaries in a low-carbon steel during decarburisation .... See Entry 109361

Growth of a system of interacting pores when a metal is saturated by hydrogen (hydrogen corrosion) .... See Entry 109588

A new technique of hydrogen charging of a TEM specimen . See Entry 109657

66.30L Diffusion, migration, and displacement of other defects

108067 Application of a solvation shell analysis to the diffusivity of an interstitial species in binary substitutional solutions. D.Farkas (Dept. of Materials Engng., Virginia Polytech. Inst., Blacksburg, VA, USA).
J. Phys. & Chem. Solids (GB), vol.44, no.9, p.899-904 (1983).
A model is presented for the effect of substitutional solute elements on the diffusion coefficient of an interstitial species for low concentrations of both solutes. The model is based on the theory of absolute reaction rates and a Wagner random, noninteractive model for the substitutional solution, with Maxwell-Boltzmann statistics for the distribution of the interstitial atoms. Simplifying assumptions are made concerning the configuration of activated complexes, treating them as formed by the interstitial atom and the two nearest lattice atoms. The calculations are compared with experimental data reviewed for the diffusivity of carbon in Fe-Cr, Fe-Mn, Fe-Co and Fe-Ni alloys. (14 refs.)

108068 'Uphill' diffusion of vacancies and the instability of irradiated materials. Yu.N.Devyatko, V.N.Tronin (Moscow Engng.-Phys. Inst., Moscow, USSR).
JETP Lett. (USA), vol.37, no.6, p.330-3 (20 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.6, p.278-81 (20 March 1983). [received: Sept. 1983]
A mechanism is proposed for the 'uphill' diffusion of vacancies against the gradient of a substitutional impurity. The influence of this diffusion of mechanism is manifested in the possibility of unstable behavior arising in the irradiated material. (3 refs.)

Surface damage of Cu/Ni alloys by low energy noble gas ion bombardment .... See Entry 107784

Diffusion in concentrated lattice gases. IV. Diffusion coefficient of tracer particle with different jump rate .... See Entry 108011

Defects and diffusion in MnO .... See Entry 108026

66.30N Chemical interdiffusion

108069 Initial reactions at the interface of Pt and amorphous silicon. R.J.Nemanich, M.J.Thompson, W.B.Jackson, C.C.Tsai, B.L.Stafford (Xerox Palo Alto Res. Center, Palo Alto, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.519-23 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The initial reactions at the interface of Pt on *a*-Si:H are probed by interference enhanced Raman scattering, TEM, and Auger, and the atomic structural changes are correlated with electrical properties determined from current-voltage and internal photoemission measurements. It is shown that a disordered Pt-Si intermixed phase of less than 20 Å thick exists at the interface immediately after deposition, and this phase grows thicker with annealing to 150°C. Annealing at 200°C causes the nucleation of crystalline silicide phases. The Schottky diodes exhibit rectification over greater than ten orders of magnitude of current density. Initially, the as-deposited diodes exhibit an ideality parameter of $\sim$1.11. Subsequently, the value drops to 1.04 as the silicide develops. Internal photoemission results indicate deviations from expected behavior. (14 refs.)

108070 Modulation of atomic interdiffusion at the Si(111)-Au interface. A.Franciosi, D.G.O'Neill, J.H.Weaver (Dept. of Chem. Engng. & Materials Sci., Univ. of Minnesota, Minneapolis, MN, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.524-9 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The authors attained a wide modulation of the Si(111)-Au interface reaction by deposition of controlled amounts of Cr on the semiconductor surface before in situ junction formation. Synchrotron radiation photoemission studies show that Cr deposition gives rise to a Si/Cr reacted interlayer that dramatically affects the subsequent Si-Au interdiffusion. Negligible interdiffusion of Cr and Au atoms was found in all cases so that the Si-Au intermixing depends upon an exchange reaction at the Si/Cr-Au interface in which Si is the only moving species. Large reduction of the interdiffusion occurs sharply above a critical value of Cr deposition (10 monolayers) that corresponds to a fully reacted Si(111)-Cr interface. (29 refs.)

108071 Similarities in chemical intermixing at the Cu/InP and Cu/Si interfaces. T.Kendelewicz, G.Rossi, W.G.Petro, I.A.Babalola, I.Lindau, W.E.Spicer (Stanford Electronics Labs., Stanford Univ., Stanford, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.564-9 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
In this work the authors present a comparative study of the electronic and atomic structure of the interactive Cu/Si and Cu/InP interfaces. They use surface sensitive techniques, including soft X-ray photoemission and photon- and electron-induced Auger electron spectroscopy (AES), to show the strikingly similar chemical reactions and electronic properties at both interfaces. For both Cu/Si and Cu/InP, the valence band spectra and core level intensity profiles show intermixing of the metal with the substrate atoms. Moreover, for both semiconductors, the increase in Cu coverage induces an increase of the width of the Si$L_{2,3}VV$($\sim$92 eV) and P$L_{2,3}VV$($\sim$120 eV) Auger peaks at the earliest stage of barrier formation followed by a 4.4 eV splitting for higher coverages. These experimental observations lead to very similar models of the chemical reaction at the interface and the formation of the intermixed region and indicate bonding between Cu and P or Si for the InP and Si interfaces. In the case of the Cu/InP interface, the authors observe segregation of In to the surface and the formation of metallic islands. (14 refs.)

108072 Auger depth profiling studies of interdiffusion and chemical trapping at metal-InP interfaces. Y.Shapira, L.J.Brillson (Xerox Webster Res. Center, Webster, NY, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.618-22 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The authors have used Auger electron spectroscopy (AES) combined with Ar^+ sputtering to profile the chemical composition of UHV-cleaved InP(110) interfaces with Au, Al, Cu, Ni, Ti, and Ag films. They observe pronounced anion and cation segregation to the free metal surface which depend sensitively on the metal-InP reactivity. Reactive metal (e.g. Al, Ti or Ni) interlayers at Au-InP interfaces decrease anion diffusion and surface segregation monotonically with increasing interlayer thickness and AES depth profiles indicate a P accumulation at or just below the intimate metal-InP interface. These and other sputter-AES studies suggest that the lower (higher) Schottky barriers of reactive (unreactive) metals are associated with cation (anion) depletion within the InP bulk and on anion accumulation at the intimate InP-metal interfaces. (23 refs.)

108073 Room temperature exchange reaction at the Al-InP (110) interface: soft X-ray photoemission studies. T.Kendelewicz, W.G.Petro, I.A.Babalola, J.A.Silberman, I.Lindau, W.E.Spicer (Stanford Electronics Labs., Stanford Univ., Stanford, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.623-7 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
A room temperature exchange reaction between an Al adsorbate and In atoms from the InP(110) surface has been observed during the early stages ($\sim$0.5 to 5 Å) of interface formation by means of soft X-ray photoemission spectroscopy of the Al 2*p* in In 4*d* core levels. As much as 8 Å of deposited Al was found to be required to slow down the transport of Al metal to the front of the reaction to the extent that an overlayer of nonreacted Al metal began to be observed on the surface. For all stages of barrier formation a segregation of In atoms, monitored by the chemical shift of the In 4*d* core lines, has been observed. A moderate heating (up to 200°C) of a 12 Å deposition extends the exchange reaction deeper into the bulk. These results are discussed in the context of the widely studied Al-GaAs interface. (20 refs.)

108074 Effect of high pressure on interdiffusion in an Al-Mg alloy. Y.Minamino, T.Yamane, A.Shimomura (Dept. of Material Sci. & Engng., Osaka Univ., Osaka, Japan), M.Shimada, M.Koizumi, N.Ogawa, J.Takahashi, H.Kimura.
J. Mater. Sci. (GB), vol.18, no.9, p.2679-87 (Sept. 1983).
Interdiffusion in the Al-4.06 at.% Mg alloy has been investigated under high pressure in the temperature range 690 to 877K. The diffusion coefficients decreased with pressure. The activation volume and energy of interdiffusion were determined. (39 refs.)

108075 The effect of the grain structure of Al_2O_3 substrate on the solid state reaction with a layer of NiO: a comparative backscattering spectrometry study. I. G.de Roos (Dept. of Phys., State Univ. Utrecht, Utrecht, Netherlands), J.H.W.de Wit, J.M.Fluit, J.W.Geus.
Surf. & Interface Anal. (GB), vol.5, no.4, p.167-9 (Aug. 1983). (International Conference on Quantitative Surface Analysis, Teddington, England, 24-25 Nov. 1981).
The solid state reaction of Al_2O_3-NiO reaction couples was investigated by means of Rutherford backscattering spectrometry. NiO films on the alumina substrates were obtained by vapour-deposition of Ni and subsequent oxidation at 800°C in air. Substrates of about the same surface roughness, thus providing equal contact areas for the reaction couples, were used. The materials were characterized by scanning electron microscopy. In spite of the different structure and a grain size that varied within a factor of 10, of the Al_2O_3 materials, no obvious difference in the spectra based on the used reaction couples could be detected. Suggested substantial contribution to the reaction from surface diffusion and grain boundary diffusion along the substrate grain boundaries could therefore be rejected. (4 refs.)

Diffusion in Ni-Sn dilute alloys .... See Entry 108044

Dipole driven diffusion across polar heterojunction interfaces .... See Entry 108076

Diffusion permeability of single interphase boundaries in the Cu-Mo system .... See Entry 108196

Characterization of the Fe/MgO interface .... See Entry 108204

Formation and properties of the copper silicon (111) interface .... See Entry 108215

Time and temperature dependences of phosphorus evolution from InP .... See Entry 108222

The effect of surface oxygen on the intermixing and Schottky barrier at GaAs(110)-Au interfaces .... See Entry 108493

DLTS determination of the Mo acceptor level in Mo-$GaAs_{0.6}P_{0.4}$ Schottky diodes .... See Entry 108508

Schottky barrier formation and intermixing of noble metals on GaAs(110) .... See Entry 108513

Failure of stainless steels in contact with tin-phosphorus bronze .... See Entry 109583

66.30Q Electromigration

108076 Dipole driven diffusion across polar heterojunction interfaces. E.A.Kraut (Microelectronics Res. & Dev. Center, Rockwell Internat., Thousand Oaks, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.643 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Summary form only given. It is suggested that abrupt polar Ge-GaAs heterojunction interfaces may tend to grow in such a way as to match the average bulk Ge potential to the average bulk GaAs potential using only a few transition planes to accomplish this. The degree to which the crystal fails to completely eliminate the interface dipole is a measure of the variation of the polar valence band discontinuity ΔE_v from that for the abrupt nonpolar Ge-GaAs (110) heterojunction. The mechanism which the crystal may employ to eliminate the interface dipole could possibly involve electric field enhanced diffusion in the transition region separating bulk Ge from bulk GaAs. (6 refs.)

66.60 THERMAL CONDUCTION IN NONMETALLIC LIQUIDS

(for thermal conduction in liquid metals, see 72.15C)

108077 Thermal conductivity of carbon disulphide at pressures up to 500 MPa. U.V.Mardolcar, W.A.Wakeham (Dept. of Chem. Engng. & Chem. Technol., Imperial Coll., London, England).
Int. J. Thermophys. (USA), vol.4, no.1, p.1-10 (March 1983).
Presents new, absolute measurements of the thermal conductivity of carbon disulphide in the temperature range 36-74°C and the pressure range 40-500 MPa. The measurements have been carried out in a transient hot-wire instrument, and the radiation-free thermal conductivity reported has an estimated uncertainty of ±0.5%. The correction for the contribution to heat transfer arising from absorption of radiation is particularly small for carbon disulphide, and it is proposed as a suitable standard reference material for liquid thermal conductivity. (19 refs.)

108078 Thermal conductivity measurement of n-butane over wide temperature and pressure ranges. C.A.Nieto de Castro (Dept. de Quimica, Faculdade de Ciencias, Univ. Lisboa, Lisboa, Portugal), R.Tufeu, B.Le Neindre.
Int. J. Thermophys. (USA), vol.4, no.1, p.11-33 (March 1983).
The thermal conductivity of n-butane has been measured by a coaxial-cylinder method over a pressure range from 0.1 MPa up to 70 MPa and a temperature range from room temperature to 600K, covering all fluid states. The estimated accuracy of the method is about 2%. Special emphasis has been given to the behaviour of the thermal conductivity near the critical point, and the critical enhancement has been studied for $3.6K<\Delta T<176K$. The effect of inelastic collisions upon transport properties of the dilute gas has been discussed. The results obtained for the reduced critical enhancement as a function of the reduced critical temperature confirm the universality of the critical exponent, for the n-alkanes, whereas the reduced excess thermal conductivity outside the critical region is a function of the reduced density and of the n-alkane. (25 refs.)

108079 Thermophysical characteristics of aprotonic solvents and electrolytes based on them. I.G.Gurevich, K.B.Gisina, V.K.Shchitnikov, B.I.Tumanov (A.V. Lykov Inst. of Heat & Mass Transfer, Acad. of Sci., Minsk, Belorussian SSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1132-5 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.623-6 (Oct. 1982). [received: Sept. 1983]
Measured and computed values of the thermal conductivity and heat capacity of a number of organic solvents and electrolytes based on them are presented. (7 refs.)

108080 Thermal conductivity of methyl and butyl propionates at various temperatures and pressures. T.F.Klimova, K.D.Guseinov (Azerbaidzhan State Pedagogical Inst., Azerbaidzhan SSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1135-9 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.626-30 (Oct. 1982). [received: Sept. 1983]
Experimental data are presented on the thermal conductivities of methyl and butyl propionates in the liquid and gaseous phases, including the saturation line, over the temperature range 300-600K and pressures of 0.1-50 MPa. (12 refs.)

66.70 NONELECTRONIC THERMAL CONDUCTION AND HEAT-PULSE PROPAGATION IN NONMETALLIC SOLIDS

(for thermal conduction in solid metals, see 72.15C and 72.15E; for statistical mechanics of lattice vibrations, see 63.70)

108081 Observation of thermal conductivity anomaly of thallium halides. Y.Suemune (Musashino Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2816-19 (Aug. 1983).
Temperature dependence of thermal conductivities of thallium halides, TlCl and TlBr has been measured below room temperature. The thermal conductivities of both compounds were found to show an anomalous behavior apparently different from the typical lattice thermal conductivity behavior. The first was the occurrence of a broad conductivity minimum near 200K unlike other alkali halides showing the usual inverse temperature dependence above 100K or so. The second was lower magnitude of the conductivities than those of the usual high-purity alkali halides by an order or two. These unusual characteristics are not satisfactorily understood by any conventional models with regard to several phonon scattering mechanisms in dielectric materials. (11 refs.)

108082 Thermal transport in heavily deformed and γ-irradiated LiF at temperatures near 1K. E.J.Cotts, S.E.Shore, A.C.Anderson (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
J. Phys. & Chem. Solids (GB), vol.44, no.9, p.865-8 (1983).
The thermal conductivity κ of heavily deformed LiF crystals has been measured at temperatures $T \gtrsim 0.5$K following exposure of the sampls to γ irradiation. The results are in agreement with recent measurements of ballistic phonon propagation in similar samples at an equivalent temperature of $\approx$4K. A fraction of the phonons have a mean free path of order 1 cm in the heavily deformed crystal, and γ-irradiation increases the fraction having a long mean free path. The measurements support a dynamic (as opposed to static) model of phonon-dislocation interaction. (13 refs.)

108083 Optoacoustic effect and the thermal diffusivity of solids. S.A.Vinokurov.
J. Eng. Phys. (USA), vol.44, no.1, p.50-5 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.60-6 (Jan. 1983). [received: Sept. 1983]
An optoacoustic method for determining the thermal diffusivity is investigated theoretically. The results are confirmed by experimental data. (7 refs.)

108084 Thermal conductivities of a cracked solid. A.Hoenig (Dept. of Math., John Jay Coll. of Criminal Justice, New York, NY, USA).
J. Compos. Mater. (USA), vol.17, no.3, p.231-7 (May 1983).
Formulas are presented which describe the effect of flat elliptical cracks on the effective thermal conductivity of an otherwise homogeneous body. The cracks are assumed randomly and isotropically distributed throughout the body, and may either be dry or composed of any material with a conductivity differing from that of the matrix. Effective conductivities depend solely upon a crack density parameter when the cracks are dry, and additionally upon a saturation parameter and the crack planform aspect ratio otherwise. (8 refs.)

108085 Study of thermal properties, electrical conductivity, and the crystallization process of the glassy alloy $SeGe_{20}$. A.A.El-Sharkawy, M.S.Zaghloul, A.M.Sanad (Dept of Phys., Al-Azhar Univ., Cairo, Egypt).
Phys. Status Solidi a (Germany), vol.78, no.2, p.457-62 (16 Aug. 1983).
The samples are prepared by introducing 5% of selenium in pure germanium. The samples are subjected to heat treatment at temperatures of 80, 90 and 100°C. These temperatures are selected by differential thermal analysis (DTA). After annealing of the samples at these temperatures, the electrical conductivity σ_{20} at 20°C, the activation energy E_g of the conductivity process, and the density d are determined and taken as a measure of the crystallization rate of the annealed samples. The crystallization process depends on the selected annealing temperature and also on the time of annealing. The estimated value of activation energy of the crystallization of the process is equal to 9.55×10^4 J/mol. It is found also that the process of crystallization of the annealed glassy alloy $SeGe_{20}$ is one-dimensional. The thermal properties (thermal conductivity λ, thermal diffusivity a, and specific heat capacity c_p) of the heat treated $SeGe_{20}$ at temperature 100°C are measured. It is found that the main mechanism of heat transfer is due to phonons. The calculated values of the role of electrons and bipolars are very small. (7 refs.)

108086 Effect of empty spaces on the lattice thermal conductivity of noncrystalline material at low temperatures: Application to borosilicate glass. K.S.Dubey (Dept. of Phys., Coll. of Sci., Univ. of Basrah, Basrah, Iraq).
Phys. Status Solidi a (Germany), vol.78, no.2, p.K195-200 (16 Aug. 1983).
The lattice thermal conductivity (LTC) of a noncrystalline material decreases monotonously with decreasing temperature below room temperature and it becomes nearly temperature independent near 10K which is known as the plateau temperature. The author studies the effect of scattering of phonons by the empty spaces on the LTC of a noncrystalline material at low temperatures, by calculating the LTC of borosilicate glass in the temperature range 0.04 to 1.5K for five different values of the empty space scattering strength. The separate percentage contributions % K_{BE} and % K_{EM} have also been studied. (K_{BE} is the contribution due to those phonons which can interact with the crystal boundaries, and K_{EM} that due to those phonons which can interact with the empty spaces but cannot interact with the crystal boundaries). (20 refs.)

108087 Influence of defects of chemical structure of polyimides on their thermal resistance. A.K.Mikitaev, A.S.Beriketov, A.S.Korshak, A.Zh.Taova.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.8, p.1691-6 (Aug. 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The thermal resistance of the range of polyimides has been evaluated as a function of the composition of the model copolymer: polyimide+defect. The repeat-unit heterogeneity is shown to decrease the thermal resistance. The same defects (bridge groups) depending on their nature and geometry are shown to have the contrary effect on thermal characteristics. This fact should be taken into account for prediction of properties of polyimides. (18 refs.)

Mechanical, thermal, and microstructural properties of neutron-irradiated SiC ....See Entry 107777

Thermal properties of a Bi_2O_3:Y_2O_3 oxygen conductor at low temperature ....See Entry 107975

Thermal conductivity and thermal capacity of glow discharge polymers ....See Entry 107978

Disorder phenomena in β-alumina .... See Entry 108034

Stability of the thermoelectric properties of p-type solid solutions based on Bi_2Te_3 ....See Entry 108460

67.00 QUANTUM FLUIDS AND SOLIDS; LIQUID AND SOLID HELIUM

(see also 05.30 Quantum statistical mechanics)

67.20 QUANTUM EFFECTS ON THE STRUCTURE AND DYNAMICS OF NONDEGENERATE FLUIDS

Remarks on the stability conditions in a superconducting system ....See Entry 108599

67.40 BOSON DEGENERACY AND SUPERFLUIDITY OF HELIUM-4

108088 Influence of helium I layer formation on the copper-helium-4 Kapitza resistance at helium II bath temperatures. Y.I.Kim, Li-He Lin, C.Chuang, T.H.K.Frederking (Univ. of California, Los Angeles, CA, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.451-3 (1 Sept. 1983).
The transient Kapitza resistance between copper and helium II caused by a step input in power has been studied near 2K. The resistance is affected by formation of a helium I layer whose thickness, of the order 10^{-4}-10^{-5} cm, is evaluated as a function of the heat flux density. (9 refs.)

108089 Paired-phonon analysis of impurities in bose fluids. K.E.Kurten, M.L.Ristig (Inst. fur Theoretische Phys., Univ. zu Koln, Koln, Germany).
Nuovo Cimento D (Italy), vol.2D, ser.1. no.4, p.1057-64 (July-Aug. 1983).
The paired-phonon analysis for boson mixtures is employed in conjunction with the hypernetted-chain approximation to study the ground-state properties of an impurity embedded in liquid ^{4}He. Chemical potentials, volume coefficients and other thermodynamic quantities as well as some of the most interesting optimal correlation functions are calculated for various impurities interacting with the ^{4}He background atoms via Lennard-Jones potentials of differing strength. (13 refs.)

108090 Superheat limit of ^{4}He and its quantum deviation from classical behavior. K.Nishigaki, Y.Saji (Kobe Univ. of Mercantile Marine, Kobe, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2293-6 (July 1983).
The superheating of normal liquid ^{4}He was investigated by means of continuous heating of a liquid specimen in a small glass capillary over a temperature range 2.26K to 4.88K. The maximum superheating data obtained were compared with the prediction from the homogeneous nucleation theory and the data for various liquids in terms of the reduced coordinates. It is confirmed that the agreement between the homogeneous nucleation theory and experiment on ^{4}He is satisfactory, and the scaled superheating depends parametrically on the quantum parameter Λ^*, i.e. the deviations of the data for quantum liquids from the classical behavior become pronounced as the parameter is increased.

108091 Hydrodynamics and heat transfer in superfluid helium. S.K.Nemirovskii (Thermophys. Inst., Acad. of Sci., Novosibirsk, USSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1172-86 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.676-92 (Oct. 1982). [received: Sept. 1983]
Presents a survey intended to describe the present status of the hydrodynamics of a superfluid liquid. Attention has been concentrated mainly on questions related to heat transfer is a volume of He II. (30 refs.)

108092 Superfluidity in a dilute bose gas. B.C.Crooker, B.Hebral, E.N.Smith, Y.Takano, J.D.Reppy (Lab. of Atomic & Solid State Phys., Cornell Univ., Ithaca, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.8, p.666-9 (22 Aug. 1983).
Superfluid ^{4}He films adsorbed on porous Vycor glass have been studied in the low-density limit where the superfluid interparticle spacing is more than an order of magnitude greater than the atomic hard-core diameter. For the lowest transition temperatures observed, the influence of critical fluctuations near T_c is much reduced and a range of crossover to behavior more characteristic of the dilute Bose gas is observed. (6 refs.)

108093 Electronic structure of multielectron bubbles in liquid helium. M.M.Salomaa (Low Temperature Labs., Helsinki Univ. of Technol., Epsoo, Finland), G.A.Williams.
Phys. Scr. (Sweden), vol.T4, p.204-7 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).
A quantum-statistical generalized Thomas-Fermi model is presented for the structure of multielectron bubbles observed in liquid helium-4 at low temperatures. The authors estimate bubbles with more than about 20 electrons to be stable against fissioning to single-electron bubbles. Electrons inside multielectron bubbles are found to concentrate in a narrow layer on the liquid helium surface. It is suggested that large bubbles in liquid helium constitute a new system and regime for testing electron density profiles; one which is quite clean from impurities, band structure effects and the background charge, all of which usually complicate the treatment of the electron density profile of metal surfaces. (16 refs.)

108094 Variational ground-state energy of liquid ^{4}He. B.Kumar, R.K.Srivastava (Dept. of Phys., Ranchi Univ., Ranchi, India).
Physica B & C (Netherlands), vol.121B+C, no.3, p.409-19 (Aug. 1983).
A rigorous upper bound on the ground-state energy of liquid ^{4}He is obtained by using a Bijl-type trial wave function, Penrose bounds on the classical pair distribution function and Morse-V_{DD} or LJ pair interactions. The two-body wave function is obtained from the Euler equation associated with the variational problem. The calculation gives a rigorous proof that the expectation energy per atom first decreases with increase of density, has a negative maximum and, then, increases with the density. The upper bound obtained on energy per atom is nearly 32% higher than the experimental value. (40 refs.)

108095 Elliptical multielectron dimples on liquid and solid helium surfaces. V.B.Shikin (Inst. of Solid State Phys., Acad. of Sci., Chernogolovka, USSR), P.Leiderer.
Solid State Commun. (USA), vol.47, no.4, p.269-71 (July 1983).
The structure of multielectron dimples on helium substrates is investigated for conditions deviating from axial symmetry. Main sources for an ellipticity of dimples are an anisotropy of the surface tension, as for the liquid-solid He interface, or anisotropic boundary conditions, as for liquid He between vertical parallel plates. (6 refs.)

108096 Relativistic hydrodynamics of a superfluid. V.V.Lebedev, I.M.Khalatnikov (L.D. Landau Inst. for Theoretical Phys., Acad. of Sci., Moscow, USSR).
Sov. Phys.-JETP (USA), vol.83, no.5, p.923-30 (Nov. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.5, p.1601-14 (Nov. 1982). [received: Sept. 1983]
The authors consider a relativistic generalization of the phenomenology describing a superfluid. Thermodynamic identities are derived for the pressure and energy density. A variational principle is constructed from which the nondissipative two-velocity equations of relativistic hydrodynamics can be derived. The equations are also expressed in Hamiltonian form. An expression for the energy-momentum tensor is found. The dissipative terms in the hydrodynamic equations are discussed. The low-velocity and zero-temperature limits are considered in detail. In the latter limit the equations for a rotating relativistic superfluid are derived and the normal modes of the vortex lattice are discussed. It is shown how to generalize the equations to the presence of a gravitational field. An application of the formalism to neutron stars is discussed. (16 refs.)

108097 Turbulence in superfluid ^{4}He. K.Yamada, J.Yamauchi.
Solid State Phys. (Japan), vol.18, no.5, p.279-304 (May 1983). In Japanese.
The recent development in vortex dynamics and turbulence in superfluid ^{4}He is reviewed. Particularly, the stress is on the critical velocity and the thermal counter flow turbulence. (16 refs.)

108098 Heat excitation of sound waves in liquid helium. V.N.Poroshin, B.A.Danilchenko.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1191-4 (Aug. 1983). In Russian.
Excitation of sound waves in liquid He is investigated for pulsed heating of the source. The investigation of the transient heat exchange of the heater with He bath shows that the excitation of sound waves is connected with He boiling near the heater surface. (9 refs.)

Conditioning effect of dielectric breakdown in liquid helium . See Entry 108875

67.50 FERMI FLUIDS; LIQUID HELIUM-3

108099 First observation of the Knudsen minimum in normal liquid ^{3}He. J.M.Parpia, T.L.Rhodes (Dept. of Phys., Texas A&M Univ., College Station, TX, USA).
Phys. Rev. Lett. (USA), vol.51, no.9, p.805-8 (29 Aug. 1983).
The viscosity of liquid ^{3}He contained in a 45-μm-high chamber has been studied. The slip correction and a clearly defined maximum in the effective viscosity are resolved in this experiment. The magnitude of the slip correction and the position of the maximum in the effective viscosity are found to be in disagreement with recent theoretical work. (12 refs.)

108100 Surface spin waves in ^{3}He-*B*. S.E.Korshunov (L.D. Landau Inst. of Theoretical Phys., Acad. of Sci., USSR).
Sov. Phys.-JETP (USA), vol.83, no.5, p.1034-6 (Nov. 1982). Translation of: *Zh. Eksp. & Teor. Fiz. (USSR)*, vol.83, no.5, p.1788-93 (Nov. 1982). [received: Sept. 1983]
A dispersion equation for surface spin waves in the isotropic superfluid phase of ^{3}He (the *B*-phase) is derived and investigated. It is shown that the spectrum has an end point at small wave vectors k. The velocities of spin waves of various polarizations in a thin ^{3}He-*B* layer are calculated in the limit of large k. (5 refs.)

108101 The low temperature phases of ^{3}He. R.C.Richardson (Materials Sci. Center, Cornell Univ., Ithaca, NY, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.361-4
In the temperature range between 1 mK and 3 mK and in magnetic fields between 0 T and 1 T, there are four distinct phases of liquid ^{3}He and three distinct phases of solid ^{3}He. The liquid becomes a triplet superfluid and the solid becomes a nuclear antiferromagnet. Despite the great differences which exist between a superfluid and an antiferromagnet, there are remarkable similarities between phase diagrams of the two systems. (9 refs.)

Fermi liquid theory of dilute submonolayer ^{3}He on thin ^{4}He II film: dimer bound state and Cooper pairs ....See Entry 108105

67.60 MIXED SYSTEMS; LIQUID HELIUM 3-4 MIXTURES

108102 Experimental results on phonon-quasiparticle interactions in dilute ^{3}He-^{4}He mixtures under pressure. L.P.J.Husson, C.E.D.Ouwerkerk, A.L.Reesink, R.de Bruyn Ouboter (Kamerlingh Onnes Lab., Rijksuniv. Leiden, Leiden, Netherlands).
Physica B & C (Netherlands), vol.122B+C, no.1, p.8-22 (Sept. 1983).
Measurements are presented on the diffusion of phonons in dilute ^{3}He-^{4}He mixtures in the temperature range between 50 mK and 400 mK, at molar ^{3}He concentrations between $X=5.5\times10^{-4}$ and $X=1.73\times10^{-3}$, and at pressures between $p=0.0$ MPa and $p=2.0$ MPa. The detected signals are described by an absorption and scattering parameter α, determined by the effective mean free path, and an absorption rate β. The results for α indicate a drastic increase of the phonon mean free path with pressure, The results for β indicate that the ^{3}He relaxation rate for viscosity τ_η does not depend on the pressure.

108103 Two-fluid effects in the convective instability of ^{3}He-^{4}He superfluid mixtures. V.Steinberg (Dept. of Phys., Univ. of California, Santa Barbara, CA, USA), H.R.Brand.
Phys. Rev. B (USA), vol.28, no.3, p.1618-20 (1 Aug. 1983).
The influence of two-fluid effects on the onset of convection in ^{3}He ^{4}He mixtures is discussed. The differences and similarities between the descriptions of Steinberg and Fetter are pointed out. The connections with recent experiments are also considered. (7 refs.)

Image forces and electron spectrum at the surface of liquid helium ....See Entry 108112

67.70 FILMS

(inc. physical adsorption)

108104 Long range effects on the longitudinal electron localization over a helium film. Yu.P.Monarkha.
Fiz. Nizk. Temp. (USSR), vol.9, no.8, p.789-94 (Aug. 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The behaviour of a peripheral electron over a dipole-electrified film has been theoretically studied. It is shown that, even without allowing for the polarization effects, the infinite dipole plane attracts the peripheral electron if the negative charges are closer to it than the positive ones are. It is concluded that over a helium film covering a metal plate the critical (maximum) surface electron concentration is attained even in the case of zero potential of the plate. It is shown also that in real experimental conditions a very large contribution to the transverse electron localization over the helium film covering the solid substrate is, because of the long range nature of the interaction potentials, provided by image forces of all neighbouring electrons. The effective holding field acting on an individual electron is calculated. (10 refs.)

108105 Fermi liquid theory of dilute submonolayer ^{3}He on thin ^{4}He II film: dimer bound state and Cooper pairs. K.Miyakje (Lab. for Low Temperature Phys., Univ. of Massachusetts, Amherst, MA, USA).
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1794-7 (June 1983).
A degenerate dilute Fermi system, with a shallow dimer bound state, is discussed with attention to the possibility of Fermi superfluidity. (Necessary information on interaction is expressed through the bound state energy of the dimer.) A relevant system may be dilute submonolayer ^{3}He on a thin ^{4}He II film just above the onset of the apparent gas-liquid phase separation of ^{3}He. (14 refs.)

108106 Some phenomenological properties of helium films. H.van Beelen, G.Bannink (Kamerlingh Onnes Lab., Rijksuniv. Leiden, Leiden, Netherlands).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.30-40 (1983).
A brief review of the large variety of experimental investigations on the macroscopic properties of thin helium films is presented. It is shown that a phenomenological two-fluid model gives a satisfactory description of these properties, though at very small helium coverages a superfluid friction force must be introduced already at vanishingly small superfluid transport rates. The evidence that superfluidity in the very thin films is a manifestation of two-dimensional ordering is briefly discussed. (45 refs.)

Superfluidity in a dilute bose gas .... See Entry 108092

Image forces and electron spectrum at the surface of liquid helium ....
....See Entry 108112

67.80 SOLID HELIUM AND RELATED QUANTUM CRYSTALS

108107 X-ray studies of solid *n*-H_2. I.N.Krupskii, A.I.Prokhvatilov, G.I.Shcherbakov.
Fiz. Nizk. Temp. (USSR), vol.9, no.8, p.858-64 (Aug. 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The results of precise X-ray studies of normal hydrogen in the temperature range of 2K to the triple point are reported. Temperature dependences of the lattice parameters, molar volume, linear and volume expansion coefficients of *n*-H_2 are obtained. The increasing contribution to the thermal expansion of the crystal is revealed at decreasing temperature which is due to the presence of a rotational subsystem in *n*-H_2. It is shown that near the melting point the thermal expansion of *n*-H_2 similarly to that of *p*-H_2, is essentially of the anisotropic character. The thermodynamical properties of solid *n*-H_2 are analysed. The results obtained, prove the presence of the isomorphous phase transition in solid $n=H_2$ in the premelting region. (20 refs.)

108108 New high-pressure phase of solid ^{4}He is BCC. D.Levesque, J.-J.Weis (Lab. de Phys. Theorique de Hautes Energies, Univ. Paris-Sud, Orsay, France), M.L.Klein.
Phys. Rev. Lett. (USA), vol.51, no.8, p.670-3 (22 Aug. 1983).
The effect of isobarically heating solid ^{4}He at high density is investigated with use of constant-pressure molecular-dynamics calculations and a realistic interatomic pair potential. At $P \sim 16$ GPa the observed sequence of stable phases with increasing temperature is FCC→BCC→liquid. The presence of a new, thermally stabilized, BCC phase for high-density solid ^{4}He is thus confirmed. (20 refs.)

108109 High frequency NMR in BCC solid ^{3}He. M.E.R.Bernier, G.Guerrier (CENS, Gif-sur-Yvette, France).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.202-18 (1983).
The authors report a comprehensive experimental study of the spin lattice relaxation in bulk BCC solid ^{3}He at high Larmor frequency (200 MHz). The various temperature regimes for T_1 are investigated in connection with the results of low field experiments. At high temperature the modulation of the dipolar interaction by vacancies and atomic exchange motions gives a good account of the experimental data thus providing an answer to a question raised by several experiments: at high magnetic field (6.2T) the correlation function for the modulation of the dipolar interaction by the exchange of ^{3}He atoms remains well described by a Lorentzian function as deduced from low field experiments. At low temperature a plateau is observed and explained by the presence of dislocations in the solid, a model consistent with both low and high field experiments. The influences on T_1 of the ^{3}He-^{4}He phase separation in solid and of the melting of the solid at temperatures lower than the minimum of the melting curve are discussed using this model. (49 refs.)

108110 X-ray diffraction study of thermal vacancies in solid helium-3. S.M.Heald, D.R.Baer, R.O.Simmons (Dept. of Phys., Univ. of Illinois, Urbana-Champaign, IL, USA).
Solid State Commun. (USA), vol.47, no.10, p.807-10 (Sept. 1983).
Thermal vacancy concentrations in solid ^{3}He have been directly measured by X-rays over a wide range of molar volumes in the BCC phase and one molar volume in the HCP phase. Values of the vacancy free energies and free volumes of formation have been obtained, and comparison with NMR and ultrasonic studies yields information about vacancy motion in the two phases of the solid. (14 refs.)

Elliptical multielectron dimples on liquid and solid helium surfaces ....
....See Entry 108095

The low temperature phases of ^{3}He .... See Entry 108101

Statistical mechanics of light elements at high pressure. V. Three-dimensional Thomas-Fermi-Dirac theory .... See Entry 110880

67.90 OTHER TOPICS IN QUANTUM FLUIDS AND SOLIDS (E.G. NEUTRON-STAR MATTER)

108111 Superfluid hydrodynamics in the weak interaction model. N.M.Lavrinenko, S.V.Peletminskii, Yu.V.Slyusarenko.
Fiz. Nizk. Temp. (USSR), vol.9, no.8, p.795-803 (Aug. 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
Equations of dissipative hydrodynamics for a superfluid with $\nu_k - u_k \neq 0$ (ν_k, u_k are the velocities of super and normal components, respectively) are derived. It is shown that the system in this case is described by 14 kinetic coefficients. The low temperature asymptotics of all these coefficients for $\nu_k - u_k \neq 0$ is considered. (7 refs.)

108112 Image forces and electron spectrum at the surface of liquid helium. A.M.Gabovich, L.G.Il'chenko, E.A.Pashitskii (Inst. of Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Surf. Sci. (Netherlands), vol.130, no.2, p.373-94 (Aug. 1983).
On the basis of the longitudinal field Green function, in a three-layer nonsymmetrical system of media with spatial dispersion the image-force potential is calculated for surfaces of the semi-infinite helium bath and a liquid helium film, and also for a surface of the phase-separated ^{3}He-^{4}He mixture. The dependence of the surface electron spectrum on the film thickness and on the pressing electric field strength is analysed. (45 refs.)

Long range effects on the longitudinal electron localization over a helium film
....See Entry 108104

68.00 SURFACES AND INTERFACES; THIN FILMS AND WHISKERS

(for impact phenomena, see 79.; for physics of crystal growth, see 61.50C; for corrosion, oxidation, and surface treatments, see 81.60)

Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191) .... See Entry 105032

68.10 FLUID SURFACES AND INTERFACES WITH FLUIDS

(inc. surface tension, capillarity, wetting and related phenomena)

108113 Measurement of the dynamic surface tension of solutions of surface-activity substances. I.S.Kisil', M.M.Dranchuk, R.T.Bodnar, A.G.Mal'ko (Ivano-Frankovsk Inst. of Oil & Gas, USSR).
Ind. Lab. (USA), vol.48, no.11, p.1109-13 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.48-50 (Nov. 1982).
Special attention is given to the method of maximum pressure in the gas bubble in which the gas bubble is forced out of a calibrated opening into the solution under examination and the maximum pressure required for the formation of the bubble is measured. The maximum pressure method has a number of advantages, such as the possibility of developing automatic devices on the basis of the method, examining solutions at high temperatures, and the satisfactory reproducibility of the measurements taken in the identical conditions; the time range of measurement of the dynamic surface tension varies from 0.5 to 500 sec. The method of maximum pressure in the gas bubble is one of the most accurate methods of determining the surface tension. (7 refs.)

108114 Energetics of solid/liquid interfaces of metals and alloys. N.Eustathopoulos (ENSEEG, Domaine Univ., Saint Martin d'Heres, France).
Int. Met. Rev. (GB), vol.28, no.4, p.189-210 (1983).
The methods for determining the solid/liquid interfacial tension in pure metals and alloys are described and a compilation of experimental results is presented. Information is also given on chemical adsorption and on atomic structure of interfaces, as derived from the compositional and orientation dependence of the interfacial tension. Theoretical models for calculating the thermodynamic properties of interfaces are discussed. The influence of solid/liquid interfaces on the properties of metals and alloys is illustrated with typical examples. (121 refs.)

108115 Study of the surface tension of polymer solutions: theory and experiments in theta solvent conditions. J.M.di Meglio, R.Ober, L.Paz, C.Taupin, P.Pincus (Lab. de Phys. de la Matiere Condensee, Coll. de France, Paris, France), S.Boileau.
J. Phys. (France), vol.44, no.9, p.1035-40 (Sept. 1983).
A study of the surface tension of semi-dilute polymer solutions in theta solvent conditions is presented. Theoretical predictions are given for the two cases when the interface is attractive or repulsive. The Cahn approach for the interfacial tension is used in order to calculate the interfacial tension in the mean field theory of polymer solutions. The measurements were performed on two polymer theta solvent systems: polydimethylsiloxane-bromocyclohexane at 29°C and polystyrene-cyclohexane at 34°C for the attractive and repulsive cases respectively. The well-known ring method was used. The agreement between theory and experiments is good. The theoretical predictions and the results are compared with those obtained in good solvent case. The transition θ solvent-good solvent is studied for the attractive system. (35 refs.)

108116 Wetting of nickel by silver. V.K.Nagesh, J.A.Pask (Dept. of Materials Sci. & Mineral Engng., Univ. of California, Berkeley, CA, USA).
J. Mater. Sci. (GB), vol.18, no.9, p.2665-70 (Sept. 1983).
Sessile drop experiments of molten silver and nickel were performed in air and helium at 970°C. A NiO layer formed at the interface in air; silver formed a 90° contact angle. In helium silver formed a 9° contact angle on nickel. The role of solution reactions in forming these angles is discussed. (7 refs.)

108117 The implications of surface energy in ice adhesion. K.Itagaki (Cold Regions Res. & Engng. Lab., Corps. of Engng., Dept. of the Army, Hanover, NH, USA).
J. Adhes. (GB), vol.16, no.1, p.41-8 (1983).
A simple experiment indicates that the effect of the surface energy of a substrate can be detected through a thin grease layer by spreading water drops. The effect of the surface energy on the adhesive strength of ice can be described qualitatively based on this fact with the use of a schematic diagram. The observations reported may shed some light on the mechanism of bond weakening by hydrophobic coating and the contributions of various parameters to the adhesive strength of ice. (2 refs.)

108118 Wall effects in du Nouy ring tensiometry. Theory and experiment. D.N.Furlong (Div. of Appl. Organic Chem., CSIRO, Melbourne, Australia), P.A.Freeman, I.M.Metcalfe, L.R.White.
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.8, p.1701-19 (Aug. 1983).
A rigorous theory of wall effects in du Nouy ring tensiometry is developed which is no more difficult to compute than the infinite-wall theory of C. Huh and S.G. Mason (1975). The predictions of the theory are compared with experimental measurements on wetting and non-wetting walls. (22 refs.)

108119 Towards a molecular theory of the solid-liquid phase boundary. Structural theory and effective lattice models. Th.Klupsch (Phys.-Tech. Inst., Akad. der Wissenschaften, Jena, Germany).
Phys. Status Solidi b (Germany), vol.118, no.2, p.681-90 (1 Aug. 1983).
From the molecular, structural theory, an unrestricted quadratic Ising model is derived the subcritical region of which enables a semi-quantitative description of the f.c.c. crystalline phase in coexistence with its melt including the interface between them for simple one-component systems with small melting heat at thermal equilibrium, especially for Lennard-Jones systems near the triple point. The Ising Hamiltonian is determined by the free excess energy and not by the internal energy; except for the melting heat, it involves contributions from the entropy difference connected with the higher degree of disorder of liquids compared with the crystalline state. Therefore, a remarkably large Jackson-Temkin factor of about three results, but it does not uniquely determine the interface structure because the effective interaction is not restricted to next neighbouring lattice sites. A new interpretation of the wetting condition in terms of the effective potential is presented. (19 refs.)

108120 Thermodynamic properties of a hard-sphere fluid near a hard wall at low temperatures. G.Navascues, R.Bragado (Inst. de Fisica del Estado Solido, Consejo Superior de Investigaciones, Cientificas, Univ. Autonoma de Madrid, Madrid, Spain).
Phys. Rev. A (USA), vol.28, no.3, p.1848-51 (Sept. 1983).
The effect of the location of the Gibbs dividing surface on the absorption and the correct definition of the spreading pressure of a hard-sphere fluid near a hard wall are discussed. The first four exact virial coefficients of the spreading pressure have been calculated. They are compared with those obtained with the use of Percus-Yevick, hypernetted-chain, scale-particle-theory, and superposition approximations. The first three coefficients of the adsorption are calculated. A simpler alternate integral equation for the density profile is proposed with the use of the superposition approximation. (9 refs.)

108121 Dependence of interfacial tension of plane isotropic liquid-nematic liquid crystal boundary on elastic constants and phase transition parameters. V.B.Magalinskii, A.N.Mikhailov (P. Lumumba Friendship of Nations Univ., USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.239 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.403-4 (March-April 1983). [received: Sept. 1983]
The transition region between an isotropic liquid and a nematic liquid crystal (IL-NLC) is characterized by a very low interfacial tension and a marked discontinuity in the Tsvetkov parameter of the orientation order η. The tensor Maier-Saupe order parameter is equal to $Q_{\alpha\beta}=\eta\rho(N_\alpha N_\beta-\delta_{\alpha\beta}/3)$, where N is the director, ρ is the density. (9 refs.)

108122 Theoretical and experimental investigation on capillary condensation—application of the thermodynamics of finite systems to the consideration of curvature dependence of surface tension. W.Vogelsberger, J.Sonnefeld, G.Rudakoff (Sektion Chem., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Z. Phys. Chem., Leipzig (Germany), vol.264, no.4, p.625-39 (1983). In German.
Application of the thermodynamics of finite systems shows the capillary equilibria to be minima of the Helmholtz free energy of condensation. The equilibrium condition, the well known Kelvin-equation, has to contain a term referring to the change of surface tension with radius of curvature, if a curvature dependent surface tension is used. All tested relations for the curvature dependence of the surface tension shown that the process of emptying takes place at angles of contact larger than zero. From experimental results of numerous partly chemical different porous substances it follows that the use of a curvature dependent surface tension in the model calculations gives a more realistic description of the real pore system than constant surface tension. (19 refs.)

108123 Study of the surface tension minimum of aqueous alcohol solutions and movements at the interface air/solution. G.Petre, M.C.Limbourg-Fontaine, J.C.Legros (Univ. Libre de Bruxelles, Brussels, Belgium).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.199-200
Aqueous long chain alcohols have a surface tension which presents, at equilibrium, a minimum of surface tension as a function of temperature. It is verified that in an interface air-solution submitted to a temperature difference, $\Delta T=T_1-T_2$, movements are induced from hot to cold region when T_1 and T_2 are below the temperature T_{min} corresponding to that minimum of surface tension and the movements are from cold to hot region when T_1 and T_2 are above T_{min}. (3 refs.)

108124 Almost cylindrical isorotating liquid bridges for small Bond numbers. J.M.Vega, J.M.Perales (ETSI, Aeronauticos, Univ. Politecnica de Madrid, Madrid, Spain).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.247-52
In the absence of gravity, a cylindrical-shaped liquid bridge becomes unstable as the slenderness of the bridge Λ exceeds a critical value Λ_c, which depends on the rotational Weber number W. The unstable mode is either axisymmetric (amphora-mode) or non-axisymmetric (C-mode) depending on whether W is smaller or bigger than 1/3. Almost cylindrical bifurcating stationary shapes, with a cylindrical volume, are calculated for $|\Lambda-\Lambda_c|\ll 1$. It is seen that the bifurcation is always subcritical, i.e. the bifurcating non-cylindrical shapes appear for $\Lambda<\Lambda_c$. The effect of a small axial gravity, i.e. a small gravitational Bond number B is also considered. It is seen that $\Lambda_c(0,\Lambda)-\Lambda_c(B,\Lambda)$ is of the order of $B^{2/3}$ for amphora modes, and of the order of B^2 for C-modes. Finally, a comparison is made with numerical and experimental results available in the literature, and some comments on the dynamical behaviour of the liquid bridge are given. (11 refs.)

108125 Conservation laws for liquid bridges. I.Da-Riva (Lab. de Aerodinamica, Univ. Politecnica, Madrid, Spain).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.253-60
Conservation laws for an inviscid liquid bridge set into motion by conservative forces are given in integral form. These laws provide useful information on the overall motion of the bridge in the presence of unexpected or uncontrolled disturbances and could, in addition, be monitored in a computational solution of the problem as an accuracy check. Many of the resulting conservation laws are familiar to fluid dynamicists. Nevertheless, a systematic approach providing an exhaustive list of these laws reveals the existence of new conserved properties hardly deducible in the classical way. Although the present analysis concerns the case of axial and constant gravity it can be applied, with minor refinements, when the gravity field varies with time in both direction and intensity. (7 refs.)

108126 The breaking of axisymmetric non-cylindrical liquid bridges. J.Meseguer, A.Sanz, D.Rivas (Lab. de Aerodinamica, Univ. Politecnica de Madrid, Madrid, Spain).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.261-5
A numerical study of the dynamic behaviour of axisymmetric inviscid liquid bridges near the stability limit of minimum volume has been made by using a one-dimensional slice model. This model has been already used to study the behaviour of cylindrical bridges both analytically and numerically. Although its validity is questionable regarding short bridges, it seems to be appropriate for sufficiently slender bridges. In this study, the interface evolution of non-cylindrical configurations as well as overall data (such as the breaking time, or partial volume of the resulting drops) which can be easily verified experimentally, have been obtained numerically. (9 refs.)

108127 Stability of axisymmetric liquid bridges. I.Martinez (ETSI Aeronauticos, Univ. Politecnica de Madrid, Madrid, Spain).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.267-73
A simple formulation and a compact set of graphic data are presented for the equilibrium shapes and stability limits of axisymmetric liquid bridges. The stability analysis is based on the bifurcation of static configurations and gives the minimum liquid volume a bridge can hold, and the breaking mode. The end supports considered are: equal discs, unequal discs, free edge plates and paraboloidal supports. (6 refs.)

Evaporative convection in minute drops on a plate with temperature gradient .... See Entry 107128
The fluid physics module—new possibilities and applications .... See Entry 107156
The influence on the Marangoni effect of a surface tension minimum as a function of temperature in microgravity conditions .... See Entry 107157
Influence of surface minimum on surface and buoyancy driven flows in Stokes regime .... See Entry 107159
Buoyancy-thermocapillary convection: the role of interfacial deformation .... See Entry 107160
The influence of surface tension on cavitating flow past a curved obstacle .... See Entry 107204
Fluid physics under reduced gravity—an overview .... See Entry 107229
Thermocapillary migration of bubbles in liquids showing relaxation of surface tension .... See Entry 107230
On thermally-driven movement of drops in microgravity conditions .... See Entry 107232
Structural transition at the free surface of the nematic liquid crystals MBBA and EBBA .... See Entry 107527
Implications of the lack of wetting at the monotectic growth front .... See Entry 107581
Particle transport induced by directional solidification .... See Entry 107884
Microstructure and microanalysis of bismuth molybdates .... See Entry 107966
Anisotropy of the dielectric function within a liquid-vapour interface .... See Entry 108319
Surface effects in semiconductors in contact with liquids deduced from conductivity and Hall coefficient measurements .... See Entry 108424
Metallic composite materials and microgravity .... See Entry 109190
Electrostatic curvature contributions to interfacial tension of micellar and microemulsion phases .... See Entry 109815
Revised parameters for modeling the transport of PCB components across an air water interface .... See Entry 110484
Study of the temperature dependence of the rate of oxygen exchange across an air-water interface .... See Entry 110488

68.15 LIQUID THIN FILMS

108128 'Hot' crystallization centers in amorphous layers. V.P.Koverda, V.P.Skripov (Dept. of Physicotech. Problems of Power Generation, Acad. of Sci., USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.106-8 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.185-7 (Jan.-Feb. 1983). [received: Sept. 1983]
For amorphous layers of water at crystallization temperatures the viscosity is 10^8-10^6. If the dimension of the crystalline center is $R\approx 10^{-3}$-10^{-4} cm, then this center can be called 'hot'. Its existence and rapid growth are due to intensive evolution of heat of crystallization, leading to a reduction in the viscosity around the growing center. Crystallization of amorphous layers of water on cold centers with nonstationary nucleation requires a rise in the temperature of the amorphous layer to 160-170K. In contrast with this process, crystallization at hot centers can start at lower temperatures; it requires only local heating of the amorphous layer, which is necessary for the formation of a single hot crystallization center. (6 refs.)

68.20 SOLID SURFACE STRUCTURE

108129 The characterization of the surfaces of tungsten-based dispenser cathodes. C.R.K.Marrian, A.Shih, G.A.Haas (Naval Res. Lab., Washington, DC, USA).
Appl. Surf. Sci. (Netherlands), vol.16, no.1-2, p.1-24 (May-June 1983). (3rd Tri-Service Cathode Workshop, Fort Monmouth, NJ, USA, 23-26 March 1982).
The 'CD', 'M' and scandate cathodes all have a better thermionic emission performance than the 'B' type of impregnated tungsten based dispenser cathode. Modern surface analysis techniques (AES, ISS, SIMS and SLEEP) have been used to examine the surfaces of the four cathode types. The cathode surfaces have been studied in their active state, during reactivation following a sputter cleaning of their surfaces and whilst poisoned by, and reactivating from, an exposure to 10 L O_2. The results are discussed in terms of surface models which would be consistent with the observed data. The

differences in the surfaces of the different cathode types are examined and the value of the various surface analysis techniques discussed. (15 refs.)

108130 Surface study of a Ag electrode on a solid electrolyte used as oxygen sensor. T.Arakawa, A.Saito, J.Shiokawa (Dept. of Appl. Chem., Osaka Univ., Osaka-fu, Japan).
Appl. Surf. Sci. (Netherlands), vol.16, no.3-4, p.365-72 (July-Aug. 1983).
The Ag electrode surface of a solid electrolyte has been studied by X-ray photoelectron spectroscopy and a scanning electron microscope. The XPS has performed in situ observation of the Ag electrode surface when DC current was passed through a system of $P(O_2)$, Ag|ZrO_2-CaO|Ag, $P(O'_2)$. The nature of the Ag-O system on the electrode is dependent on the temperature. It has been observed by XPS that there are three types of Ag-O system at 400°C. Type I with O 1s binding energy of 532.6 eV only appeared at 325°C. Moreover, when the temperature was raised to 400°C, Types II and III (with BEs 531.1 and 529.2 eV) appeared. And a fourth state at ca. 530.1 eV also existed. Type I is the type where the mixing of the 2p orbitals with the d-band of the Ag metal is not so strong. Type II is assigned as a diatomic oxygen-silver complex, i.e. Ag^+-O_2^-. Type III is considered to represent oxygen atoms in an oxide-like layer. However, the O 1s signal disappeared switching off the DC current in both cases. A scanning electron microscope study of the electrode texture helped to understand the change of O 1s signal. (16 refs.)

108131 The surface composition of Pt-Cu alloys: experimental observations and theory of surface segregation. A.D.van Langeveld, V.Ponec (Gorlaeus Labs., State Univ. of Leiden, Leiden, Netherlands).
Appl. Surf. Sci. (Netherlands), vol.16, no.3-4, p.405-23 (July-Aug. 1983).
The surface composition of a number of Pt-Cu alloys varying in their bulk composition from approximately 40 up to 80 at.% Pt has been studied by Auger Electron Spectroscopy. The samples, equilibrated in ultrahigh vacuum at 970K, showed a moderate segregation of Cu to the surface. For the analysis of the Auger spectra the Gallon model (1969) was used. According to this model a layer-by-layer contribution to the intensity of the measured Auger signal was accounted for. The experimental data are rationalized by a two-layer regular solution model, which takes into account the difference in the atomic radii. (39 refs.)

108132 A TEM study of activated FeTi surface. A.Venkert, M.Talianker, M.P.Dariel (Dept. of Materials Engng., Ben-Gurion Univ., Beer Sheva, Israel).
Mater. Lett. (Netherlands), vol.2, no.1, p.45-8 (July 1983).
Transmission electron microscopy was used to study FeTi samples that had undergone activation treatments at low oxygen pressure. Activation treatments resulted in the formation of oxygen-stabilised $Ti_4Fe_2O_x$ precipitates in the surface layers. In addition at 0.1 Pa oxygen pressure TiO is formed, while TiO_2 and Fe_3O_4 are formed both at low and high oxygen pressure treatments. (14 refs.)

108133 Study of high order reconstructions of the Si (100) surface. J.Ihm (Bell Labs., Murray Hill, NJ, USA), D.H.Lee, J.D.Joannopoulos, A.N.Berker.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.705-8 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The structure of the reconstructed Si (100) surface is studied using the tight-binding energy minimization method combined with a renormalization-group calculation. (2×1), $c(2\times2)$, $p(2\times2)$, (4×1), $c(4\times2)$, and $p(4\times2)$ structures are studied and compared. They are classified into two groups which are separated by a large activation barrier. In one group, (2×1), $p(2\times2)$, and $c(4\times2)$ structures are almost degenerate in energy, which can result in diffuse (2×1) LEED patterns. In the other group, a second-order phase transition can occur from the $c(2\times2)$ to the disordered structure at ~800K. Domains of different structures may coexist on the actual surface. (31 refs.)

108134 Structural chemistry of the cleavage faces of compound semiconductors. C.B.Duke (Xerox Webster Res. Center, Webster, NY, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.732-5 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The major features of the reconstructed atomic geometries of the (110) surfaces of zincblende structure compound semiconductors are characterized by two parameters: the relative displacement perpendicular to the surface of the anions and cations in the outermost layer $\Delta_{1,\perp}$ and the angle ω_1 between the plane determined by the chains of these species in the reconstructed surface and the truncated bulk surface. Analysis of the surface structures of nine compound semiconductors reveals a linear correlation between $\Delta_{1,\perp}$ and the bulk cubic lattice constant a_0. A linear correlation between ω_1 and a_0 also is suggested, but is less firmly established. If the sum of either the Pauling covalent radii or the nonlocal pseudopotential core radii are substituted in place of a_0 comparable correlations are achieved. The structures of two previously unexamined surfaces, InAs (110) and AlP (110), are shown to be predicted correctly by these correlations. (30 refs.)

108135 The role of impurity atoms in the formation of defect structure on quartz surfaces under the action of an electrostatic field. S.H.Adamyan, P.A.Bezirganyan.
Izv. Akad. Nauk Arm. SSR Fiz. (USSR), vol.17, no.1, p.26-30 (1982). In Russian.
It has been shown by means of X-radiography that the role played by impurity atoms in the change of a defect structure under the action of an electrostatic field is large. During the piezodeformation of a specimen charged layers are formed near the surface that distort reflecting plates and strongly influence the intensity of scattered X-rays. (6 refs.)

108136 Surface morphologies of magnesium vanadium oxide, $Mg_{2-x}V_{1+x}O_4$. H.Oshima (Nat. Inst. for Res. in Inorganic Materials, Ibaraki, Japan).
J. Am. Ceram. Soc. (USA), vol.66, no.7, p.482-5 (July 1983).
The microscopic appearance of the particle surfaces of magnesium vanadium oxide, $Mg_{2-x}V_{1+x}O_4$, loose powders prepared in various atmospheres at 1200°C was studied. The surface morphology, observed by SEM, was dependent on the V^{4+} content, and three typical features were distinguished at the following x values: $0.75 \lesssim x < 1.00$; rounded crystals with smooth surfaces; $0.55 \lesssim x \lesssim 0.75$; edged crystals with stepped surfaces; $x \lesssim 0.55$; coarse crystals with rough surfaces. (7 refs.)

108137 Structure analysis of the Si(111)7×7 surface by low-energy ion scattering. M.Aono, R.Souda, C.Oshima, Y.Ishizawa (Nat. Inst. for Res. in Inorganic Materials, Ibaraki, Japan).
Phys. Rev. Lett. (USA), vol.51, no.9, p.801-4 (29 Aug. 1983).
A new structural model for the Si(111)7×7 surface called the pyramidal cluster model is proposed on the basis of specialized low-energy ion-scattering experiments. (23 refs.)

108138 Femtosecond-time-resolved surface structural dynamics of optically excited silicon. C.V.Shank, R.Yen, C.Hirlimann (Bell Telephone Labs., Holmdel, NJ, USA).
Phys. Rev. Lett. (USA), vol.51, no.10, p.900-2 (5 Sept. 1983).
The dynamics of the structural changes that take place on a silicon surface following excitation with an intense optical pulse are observed with 90-fs time resolution. The threefold rotational symmetry of the silicon ⟨111⟩ surface becomes rotationally isotropic within a picosecond after excitation consistent with a transition from the crystalline to the liquid molten state. (14 refs.)

108139 Direct imaging of carbon-covered and clean gold (110) surfaces. L.D.Marks (Cavendish Lab., Univ. of Cambridge, Cambridge, England).
Phys. Rev. Lett. (USA), vol.51, no.11, p.1000-2 (12 Sept. 1983).
Results are presented on the atomic structure of gold (110) surfaces obtained by high-resolution electron microscopy. When covered by carbon, the 1×1 surface without surface relaxations is stable. Without carbon, a rough 2×1 reconstruction occurs with the missing-row structure, a 20%±5% outer-atom expansion and a 10% occupancy of atoms displaced outwards by 40%±20% down the channels. Local regions of 1×1 surface also exhibit a 10%±5% expansion of the outermost atoms. (8 refs.)

108140 Study of surface composition of iron-based metallic glasses by means of UV photoemission, angle resolved Auger electron and ion scattering spectroscopy. T.Berghaus, H.Neddermeyer, W.Radlik, V.Rogge (Inst. fur Experimentalphys., Ruhr-Univ., Bochum, Germany).
Phys. Scr. (Sweden), vol.T4, p.194-6 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).
Two different attempts have been made to obtain information on surface concentration, concentration gradients, segregation effects and surface contamination of metallic glasses. (i) Angle-resolved Auger electron spectroscopy and variation of the observation angle was applied to $Fe_{81.5}B_{14.5}Si_4$ and (ii) ion scattering spectroscopy in combination with normal emission UV photoelectron and Auger electron spectroscopy to $Fe_{75}B_{25}$. (8 refs.)

108141 Atomic structure of Si{001}2×1. W.S.Yang, F.Jona (Dept. of Materials Sci. & Engng., State Univ. of New York, Stony Brook, NY, USA), P.M.Marcus.
Phys. Rev. B (USA), vol.28, no.4, p.2049-59 (15 Aug. 1983).
New experiments on reconstructed Si{001}2×1 and their analysis by low-energy electron diffraction (LEED) are reported. A new structural model containing asymmetric and buckled dimers and strains extending to three and four atomic layers is presented, which fits the LEED data substantially better than any other model tested. The new structure involves a dimer length of 2.54 Å, an average contraction of first-layer spacing of 8%, and three asymmetric displacements of the dimer atoms. A detailed discussion of the needed intensity-averaging procedures among eight equivalent domains is presented. Two theoretical structural models for Si{001}2×1 developed by others on the basis of minimization of total energy are shown to fail the LEED test. (29 refs.)

108142 Surface stacking sequence and (7×7) reconstruction at Si(111) surfaces. E.G.McRae (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2305-7 (15 Aug. 1983).
The (7×7) surface is considered to have a triangular checkerboard structure in which the layer stacking sequences *...AaBbA* and *...AaCcA* alternate in neighboring triangular subunits in conformity with ion-backscattering results. The topological requirements of joining double layers at the subunit boundaries lead to the prediction of arrays of dimers and of deep (6.3-Å) holes which are consistent with results of electron diffraction of tunneling microscopy, respectively. (18 refs.)

108143 Is the (110) face of tungsten reconstructed?. J.P.Bourdin (Inst. Univ. de Technol., Univ. d'Angers, Angers, France), G.Treglia, M.C.Desjonqueres, J.P.Ganachaud, D.Spanjaard.
Solid State Commun. (USA), vol.47, no.4, p.279-82 (July 1983).
LEED and photoemission experiments have suggested that the (110) face of W may present a lateral reconstruction in which all atoms of the surface occupy three-fold coordinated sites. The authors present here a theoretical calculation in which the energy is minimized with respect to vertical and lateral displacements. The role played by electronic correlations is discussed. The unreconstructed and unrelaxed surface is found to be the most stable. (12 refs.)

108144 XPS and AES quantitative surface analysis: comparison on oxide powder systems. F.Garbassi (Istituto Guido Donegani SpA, Novara, Italy).
Surf. & Interface Anal. (GB), vol.5, no.4, p.139-46 (Aug. 1983). (International Conference on Quantitative Surface Analysis, Teddington, England, 24-25 Nov. 1981).
XPS and AES quantitative surface analyses on several oxide systems, containing two or three metal elements, are compared. Both single-phase and multi-phase systems have been investigated, representative of a variety of situations regarding surface vs. bulk composition relationships. Metal-to-metal ratios obtained via the two techniques have been compared. A very intimate intermixing of cations, as it happens in single-phase systems (i.e. solid solutions), appears a necessary but not sufficient condition for obtaining good correlation between the results of the two spectroscopies. Slopes of the straight lines correlating XPS and AES data are generally far from the expected value of 1, suggesting the existence of strong matrix effects for at least one of the two techniques. (29 refs.)

108145 On the phase transition between the (7×7) and (1×1) structures of silicon (111) surfaces studied by reflection electron microscopy. Y.Tanishiro, K.Takayanagi, K.Yagi (Phys. Dept., Tokyo Inst. of Technol., Tokyo, Japan).
Ultramicroscopy (Netherlands), vol.11, no.2-3, p.95-102 (1983). (Surface Imaging and Analysis with High Spatial Resolution, Wickenburg Inn, AZ, USA, 12-15 Jan. 1983).
The phase transition process between the (7×7) and (1×1) structures of the clean silicon (111) surface has been studied by means of reflection electron microscopy (REM). The first-order phase transition was suggested from the observation of preferential nucleation of the new phases along the steps for the ⟨110⟩ electron incidence. Movements of the phase boundaries on the terraces during the transition and their terrace-width-dependence were studied. Changes of the step shape and a sudden stop of the shape fluctuation during the transition on cooling are found to be due to the formation of out-of-phase boundaries in the (7×7) structure. Image contrast in REM observations of the $\langle 11\bar{2}\rangle$ incidence suggests the second-order type of phase transition. On the basis of these observations the phase transition process is discussed. Electron energy loss spectroscopic study of the phase transition is also reported. (17 refs.)

108146 Analysis of surface structural defects using LEED and RHEED. M.G.Lagally (Dept. of Metall. & Mineral Engng., Univ. of Wisconsin, Madison, WI, USA).
Ultramicroscopy (Netherlands), vol.11, no.2-3, p.103-4 (1983). (Surface Imaging and Analysis with High Spatial Resolution, Wickenburg Inn, AZ, USA, 12-15 Jan. 1983).
Diffraction techniques that are sensitive to the surface can, in principle, be used to study the surface structural defects. Low-energy electron diffraction (LEED) and reflection high-energy electron diffraction (RHEED) are two techniques that can be used in this way. By measuring the angular distribution of intensity of diffracted beams, different types of surface effects can be distinguished and quantified. Recent progress in the use of LEED to analyze steps, finite-size overlayer domains, surface strain, and mosaic effects is reviewed. In particular, overlayer studies present challenging and interesting problems, because they can involve the combination of finite-size effects in the oberlayer with the scattering from a coherent substrate. Examples of defect analysis on several surfaces are given. Recently renewed interest has been shown in the use of RHEED for surface defect studies. The capabilities for defect studies of conventional RHEED, as found in crystal surface studies or epitaxial growth experiments, are described and compared to those of LEED. (26 refs.)

108147 Surface studies with (clean) supported metal particles and clusters. H.R.Poppa (Dept. of Materials Sci., Stanford Univ., Stanford, CA, USA).
Ultramicroscopy (Netherlands), vol.11, no.2-3, p.105-16 (1983). (Surface Imaging and Analysis with High Spatial Resolution, Wickenburg Inn, AZ, USA, 12-15 Jan. 1983).
Small particles are ideal for combined studies with surface analytical and electron microscopy/diffraction methods. In this way crystallography, microstructure, morphology, physical stability, and electronic structure can be correlated directly with chemical reactivity. Various integrated experimental approaches for conducting model studies with UHV-evaporated particles have been successfully developed; they entail the use of TPD, AES, XPS, and work function measurements on one hand and standard TEM/TED, in-situ TEM/TED, and in-situ STED/TEM techniques on the other hand. The essential features of four particular experimental approaches are discussed and a selection of representative results is presented to illustrate the potential usefulness of such studies in the field of catalysis. (39 refs.)

108148 High energy transmission electron diffraction and imaging studies of the silicon (111) 7×7 surface structure. J.C.H.Spence (Dept. of Phys., Arizona State Univ., Tempe, AZ, USA).
Ultramicroscopy (Netherlands), vol.11, no.2-3, p.117-24 (1983). (Surface Imaging and Analysis with High Spatial Resolution, Wickenburg Inn, AZ, USA, 12-15 Jan. 1983).
Kilovolt electron scattering experiments in the transmission geometry offer certain advantages for surface structure analysis over more traditional techniques. These include the absence of electron exchange effects, the ability to analyze submicron regions, their compatibility with imaging (for the study of chemically important inhomogeneities) and the usefulness of the kinematic approximation for surface superlattice reflections. An experimental 100 kV transmission electron diffraction pattern from the silicon [111] 7×7 structure is analyzed and compared with the diffracted intensities expected from two recent models for the 7×7 adlayer. Shuffle and glide termination effects are discussed. Thousand-beam dynamical calculations of atomic resolution transmission electron images of the surface superlattice are used to show the high sensitivity of these to charge transfer effects, and the imaging conditions needed to maximize this sensitivity are determined. (19 refs.)

108149 STEM imaging and analysis of surfaces. J.M.Cowley, Z.-C.Kang (Dept. of Phys., Arizona State Univ., Tempe, AZ, USA).
Ultramicroscopy (Netherlands), vol.11, no.2-3, p.131-40 (1983). (Surface Imaging and Analysis with High Spatial Resolution, Wickenburg Inn, AZ, USA, 12-15 Jan. 1983).
Scanning reflection electron microscopy (SREM) can provide various types of image contrast depending on the smoothness and crystallinity of the surface. For flat single surfaces SREM gives the same range of phase contrast and diffraction contrast effects as in REM but suffer to some extent from limited depth of focus and noisy images. As with STEM, the main advantage of SREM arises from the possibility of obtaining microdiffraction patterns and some microanalysis from any small region of the image. Applications to the study of surface reactions include the investigation of the reaction of thin evaporated gold layers with magnesium oxide smoke crystals. The gold is initially in the form of very small crystals but reacts with the MgO when heated in vacuum at more than 500°C forming a series of compounds in thin films or small crystallites on the MgO surface. Microdiffraction patterns from surface layers of crystals may be affected by surface refraction effects or by surface channelling phenomena but in the current case are attributed to the presence of one or two atomic layers of a reaction product. (22 refs.)

108150 Reflection electron microscopy (REM) of vicinal surfaces of FCC metals. Tung Hsu (Dept. of Phys., Arizona State Univ., Tempe, AZ, US).
Ultramicroscopy (Netherlands), vol.11, no.2-3, p.167-72 (1983). (Surface Imaging and Analysis with High Spatial Resolution, Wickenburg Inn, AZ, USA, 12-15 Jan. 1983).
REM has been applied to study the low index facets and their vicinal regions on Au and Pt spheres solidified from the melt. Areas of regularly spaced steps have caused splitting of diffraction spots, and the splitting in the diffraction pattern agrees with the periodicity of steps as measured in the REM image. Resolution limits for REM images are discussed and compared to the 9 Å resolution experimentally achieved. (13 refs.)

10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces .... See Entry 105017

Surface Imaging and Analysis with High Spatial Resolution .... See Entry 105024

Chemographic images of silicon surfaces .... See Entry 105389

Ion microscopy using electron-desorbed ions .... See Entry 105421

Surface imaging by scanning tunnelling microscopy .... See Entry 105440

Application of orthogonal experimental design to LEED crystallography .... See Entry 107494

Equivalent beam averaging (EBA) of I-V spectra for LEED analysis .... See Entry 107496

UHV-SEM studies of surface processes: recent progress .... See Entry 107501

On the measurement of surface step heights by low-loss imaging in STEM .... See Entry 107502

Surface morphology and growth mechanisms of Argyrodite-type Cu_6PS_5Hal crystals .... See Entry 107575

Dislocations in $Pb_{1-y}Sn_ySe$ .... See Entry 107697

Surface damage and crystallization in amorphous alloys by helium ion bombardment .... See Entry 107783

Surface damage of Cu/Ni alloys by low energy noble gas ion bombardment .... See Entry 107784

The development of surface morphological features on crystalline materials by 30 keV Ar^+ ion bombardment .... See Entry 107785

The surface dislocation and its relationship to the boundary-integral equation .... See Entry 107812

The effect of the grain structure of Al_2O_3 substrate on the solid state reaction with a layer of NiO: a comparative backscattering spectrometry study. I .... See Entry 108075

Absorption of carbon from residual gases during Ti implantation of alloys .... See Entry 108153

Bonding geometries of Cl on Si{111} and Ge{111} .... See Entry 108159

Surface roughness and influence on the properties of the selectivity of MoO_2 .... See Entry 108179

Characterization of the Fe/MgO interface .... See Entry 108204

Instabilities of (110) III-V compounds grown by molecular beam epitaxy .... See Entry 108219

Imaging of atomic steps on ultrathin Au films by TEM .... See Entry 108239

Si(111)2×1 surface reconstructions calculated by the density-functional method .... See Entry 108497

Work function measurements and their relation to modern surface analysis techniques .... See Entry 108521

Scanning tunneling microscopy of semiconductor surfaces .... See Entry 108524

A study of positron annihilation in the bulk and on the surface of Pd-Si and Pd-Si-Cu amorphous alloys .... See Entry 109036

Application of synchrotron radiation to EXAFS and SEXAFS .... See Entry 109049

Auger characterization of new and aged dispenser cathode surfaces .... See Entry 109062

Quantitative Auger-electron analysis of nonstoichiometric lead telluride .... See Entry 109063

Surface preparation for quantitative Auger electron spectroscopy: mechanical polishing and inert gas ion sputtering .... See Entry 109067

Sputtering of CoSi(100) and $CoSi_2(100)$ single crystal surfaces .... See Entry 109077

Atomic beam scattering from single crystal surfaces .... See Entry 109089

Dependence of surface composition of Zr-Ni intermetallic compounds on bulk composition and treatment .... See Entry 109092

X-ray photoelectron spectroscopy study of the surface composition of CoO-MgO solid solutions .... See Entry 109112

Surface quantitative analysis of Cr-O systems by XPS .... See Entry 109113

Structural irregularities in solid $(Pb_{1-x}Sn_x)_{1-y}Te_y$ solutions after annealing in a temperature gradient .... See Entry 109371

Regularities in the formation of the shape of scratches on tungsten monocrystals .... See Entry 109496

Deformation by scratches and frictional properties of MgO crystals .... See Entry 109532

XPS and XAES studies of transient enhancement of Cu^I at CuO surfaces during vacuum outgassing .... See Entry 109538

Titanium oxycarbide on TiC (100) surface .... See Entry 109541

Surface reactions and excitations .... See Entry 109807

Pulsed-laser atom-probe FIM study of solid surfaces .... See Entry 109836

68.25 MECHANICAL AND ACOUSTICAL PROPERTIES OF SOLID SURFACES AND INTERFACES

(for tribology, see 62.20P and 81.40P)

Light scattering from vibrational modes in GaAs-$Ga_{1-x}Al_xAs$ superlattices and related alloys .... See Entry 108954

Plastic deformation and wear process at a surface during unlubricated sliding .... See Entry 109518

Deformation by scratches and frictional properties of MgO crystals .... See Entry 109532

68.30 DYNAMICS OF SOLID SURFACES AND INTERFACE VIBRATIONS

108151 Thermal boundary resistance at the interface between a crystal and a disordered solid. J.Jackle (Fakultat fur Phys., Univ. Konstanz, Konstanz, Germany).
Z. Phys. B (Germany), vol.52, no.2, p.133-7 (1983).
The thermal boundary resistance at the interface between a crystalline and disordered solid with large scattering mismatch but negligible acoustic mismatch is calculated. Under the assumption that phonon scattering in the disordered material is predominantly elastic and strongly frequency dependent, the thermal boundary resistance derives from the spectral redistribution of the heat current by inelastic processes in the vicinity of the interface. (13 refs.)

108152 Measurement of the Rayleigh surface-phonon dispersion curve for NaCl(001) from high-resolution He time-of-flight spectroscopy and from kinematical focusing angles. G.Benedek, G.Brusdeylins, R.Bruce Doak, J.G.Skofronick, J.P.Toennies (Max-Planck-Inst. fur Stromungsforschung, Gottingen, Germany).
Phys. Rev. B (USA), vol.28, no.4, p.2104-13 (15 Aug. 1983).
Angular distributions and time-of-flight spectra have been measured for the collisions of 20-meV He atoms with a NaCl(001) surface in the ⟨100⟩ direction. Structures in the angular distribution and in the time-of-flight spectra due to elastic and inelastic scattering are measured and used to extract (1) a corrugation parameter of the rigid-atom surface potential $\zeta_0=0.34$ Å, (2) three bound-state energies of the He-surface potential, and (3) a surface-phonon Rayleigh dispersion curve out to the edge of the Brillouin zone. Furthermore, the authors were able to demonstrate that by rotating the crystal about the surface normal it is possible to unambiguously identify kinematical focusing features in the angular distributions. These features were then used to determine a surface-phonon dispersion curve in good agreement with that obtained from the time-of-flight experiments. (35 refs.)

Influence of helium I layer formation on the copper-helium-4 Kapitza resistance at helium II bath temperatures .... See Entry 108088

End-on and side-on bonding of ketones to surfaces: acetone on the Ru(001) and Pt(111) surfaces .... See Entry 108172

Ab initio cluster study of the interaction of fluorine and chlorine with the Si(111) surface .... See Entry 108180

Structural determination of Cl chemisorption on Si{111} and Ge{111} by total-energy minimization .... See Entry 108183

Monohydride and dihydride formation at Si(100) 2×1: a high resolution electron energy loss spectroscopy study .... See Entry 108186

Inelastic changes during the formation of multilayers of C_2H_6 on Ag(110) .... See Entry 108187

Surface polaritons in nonlinear media .... See Entry 108309

Simple theory for surface-plasmon-polariton resonance on sinusoidal metal surface: application to SERS .... See Entry 108943

Inelastic scattering of He atoms from a Cu(110) surface .... See Entry 109086

Inelastic atom scattering from layers of atoms and molecules on Cu(110) .... See Entry 109087

Inelastic electron tunneling spectroscopic studies of adsorption of simulated epoxy resin .... See Entry 109797

68.45 SOLID-FLUID INTERFACE PROCESSES

(see also 82.65 Sorption and accommodation coefficients)

108153 Absorption of carbon from residual gases during Ti implantation of alloys. I.L.Singer (Chem. Div., Naval Res. Lab., Washington, DC, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.457-9 (1 Sept. 1983).
Secondary ion mass spectrometry (SIMS) has been used to analyze the surface composition of several steel and Ni-plated substrates implanted with Ti ions (5×10^{17} Ti/cm^2 at 190 keV). SIMS shows clearly the carbonaceous subsurface layer previously reported in Auger and nuclear backscattering analyses of Ti-implanted Fe-based alloys. Moreover, substrates implanted in a vacuum which was backfilled with isotopic ^{13}CO gas showed 20 to 50× higher mass 13/mass 12 ratios for surface concentrations and integrated subsurface doses than substrates implanted in normal vacuum atmospheres at pressures near 10^{-6} Torr. Auger analysis confirmed the subsurface C profile and found no O(<1 at.%) below the oxide layer. The experiments provide direct evidence that C atoms can be absorbed from residual gas molecules in a vacuum chamber near room temperatures during implantation of carbide-forming ions. A second possible source of C atoms is also discussed. (8 refs.)

108154 The effect of metal composition on the adsorption of zinc di-isopropyldithiophosphate. B.Dacre, C.H.Bovington (Royal Military Coll. of Sci., Shrivenham, England).
ASLE Trans. (USA), vol.26, no.3, p.333-43 (July 1983).
Rates of adsorption of zinc di-isopropyldithiophosphate from n-hexadecane on to iron and steel (13 percent Cr) disks have been measured using ^{65}Zn and ^{14}C radiolabelling. Concentration, stirring, and temperature dependence have been examined. A selective rinsing technique has been used to investigate chemisorption which occurs extensively on iron but not at all on the steel. On iron, adsorption occurs with some release of zinc at all temperatures investigated. On the steel, no zinc is lost from the adsorbed layer. Absence of stirring effects indicates that rates are surface rather than diffusion controlled. Results have been compared with those of previous workers. (11 refs.)

108155 A Lennard-Jones calculation of Xe adsorption on reconstructed Ir(100) and Pt(100) surfaces. J.Kuppers, U.Seip (Inst. fur Phys. Chem., Univ. Munchen, Munchen, Germany).
Appl. Surf. Sci. (Netherlands), vol.16, no.3-4, p.313-21 (July-Aug. 1983).
Xenon adsorption energy profiles have been calculated for various reconstructed overlayers at Ir(100) and Pt(110) surfaces on the basis of a Lennard-Jones 6-12 pair potential operating between adsorbed Xe and the surface metal atoms. Agreement with experimental data is observed with a buckled hexagonal overlayer at Ir(100) and a missing row structure at Pt(110). (7 refs.)

108156 Study of kinetic adsorption of H_2S, at very low pressure on face (110) of copper. Phu Sy Uy, J.Bardolle, M.Bujor (Univ. d'Orleans, Orleans, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.20, p.1571-4 (6 June 1983). In French.
Very low pressure adsorption of H_2S on the clean and oxygen covered Cu (110) face has been followed by Auger electron spectroscopy and surface potential variation measurements. (6 refs.)

108157 Partial phase diagram of the two-dimensional Ni(111)-S system from LEED and Auger electron spectroscopy. R.Ramanathan, J.M.Blakely (Dept. of Materials Sci. & Engng., Cornell Univ., Ithaca, NY, USA).
Mater. Lett. (Netherlands), vol.2, no.1, p.12-19 (July 1983).
Using low-energy electron diffraction (LEED) and Auger electron spectroscopy (AES) the ordered phases in the two-dimensional Ni(111)-S system have been examined. The results are presented in terms of a 'temperature versus coverage' phase diagram. At relatively low coverages a well-ordered Ni(111) p(2×2)S structure was observed. This undergoes a reversible transformation as temperature is cycled. In an intermediate narrow coverage range, a two-phase structure was observed for the first time in this system. This structure consists of Ni(111) p(2×2)S and a complex structure similar to the one reported by other investigators. The temperatures of these reversible structural transformations were determined. At high coverages only a complex LEED pattern was observed. The structure producing this pattern undergoes a reversible transformation at high temperatures (i.e. $\gtrsim$570K). (25 refs.)

108158 Theory of sorption of gases on polymers. II. Effects of inter-chain secondary bonds. M.Pyda (Inst. of Phys. & Chem., Acad. of Agriculture, Poznan, Poland), M.Kurzynski.
Chem. Phys. (Netherlands), vol.79, no.2, p.219-24 (1 Sept. 1983).
For pt.I see ibid., vol. 67, p.7 (1982). A simple phenomenological model of the influence of sorption on the subsystem of secondary bonds of a polymer is proposed. Two mechanisms are considered: the competition between creation of sorbate-sorbent bonds and inter-chain bonds, and the dependence of the volume accessible for condensation of sorbate molecules on the number of secondary bonds. The model is analyzed numerically and the effects of plasticization and swelling are discussed. An alternative interpretation of the double-sigmoid sorption isotherms of higher alcohol vapours on cellulose is proposed. (3 refs.)

108159 Bonding geometries of Cl on Si{111} and Ge{111}. G.B.Bachelet, M.Schluter (Bell Labs., Murray Hill, NJ, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.726-8 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Determines the chemisorption geometry of Cl-Si{111} and Cl-Ge{111} by total energy minimization. The calculations are done within the local-density-functional framework using normconserving pseudopotentials. Among the three bonding sites investigated, Cl is found to be most stable in the onefold atop position on both Si{100} and Ge{111}. The calculations confirm the site geometries obtained in recent surface extended X-ray absorption fine structure (SEXAFS) measurements on annealed surfaces. The calculated substrate-Cl bond lengths are in quantitative agreement with the SEXAFS results. The authors also predict vibrational frequencies for the Cl-substrate modes which, because of the highly ionic character of the bond, should be easily observable by infrared or energy loss spectroscopy. (17 refs.)

108160 Sb and Al chemisorption on GaAs(110). Zhang Kai-Ming, Xu Yong-Nian (Modern Phys. Inst., Fudan Univ., Shanghai, China).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.729-31 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
In the present paper the chemisorption of Al and Sb on the GaAs(110) surface is studied theoretically. In the case of higher coverage, the authors designed a cluster model with Al_4 sitting upon the GaAs(110) surface. The computer renormalization technique is used, and some pseudo-*s*-orbitals are adopted to fit the molecular orbitals of cluster Al_4 by the least square method. The charge self-consistent extended Huckel method is used with a cluster model simulating the substrate GaAs(110). The calculated results show that differences do exist between column III and V elements on GaAs(110). The covalent character for the Sb-GaAs bond is quite obvious, whereas the Al overlayer cluster interacts only weakly with the substrate, so that covalent bonds can be formed only in the case of lower coverage. (19 refs.)

108161 Oxygen and hydrogen adsorption on GaAs (110). F.Bartels, L.Surkamp, H.J.Clemens, W.Monch (Lab. fur Festkorperphys., Univ. Duisburg, Duisburg, Germany).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.756-62 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The interaction of molecular, 'unexcited' oxygen and of atomic hydrogen with clean, cleaved GaAs surfaces was studied by Auger-electron and low-energy electron energy-loss spectroscopy as well as by a Kelvin probe. Up to $\approx 3\times10^5$ L of O_2 the coverage slightly increases only up to $\theta=0.05$-0.1, depending on the 'quality' of the cleave. This chemisorption, which is attributed to cleavage-induced imperfections, is further correlated with the annihilation of the 20 eV energy-loss, usually characterized as an excitonic Ga(3*d*) core level-to-dangling bond states transition. The main chemisorption is observed after exposures above 3×10^5 L and yields $\theta=0.8$ after 10^{10} L of O_2. Two successive stages can be distinguished. The first one saturates at $\theta=0.4$-0.5 after 3×10^6 L of O_2. Larger exposures further increase the coverage and cause two new losses to grow, an O(2*p*) related one at 7 eV and an As(3*d*) related one shifted by 2.5 eV to larger binding energies. Illumination of the surface with the light of a Xe-arc lamp dramatically stimulated the oxygen uptake. Under the present experimental conditions, the initial sticking coefficient at *RT* is increased by a factor of 100, and the coverage reaches $\theta=1.5$ after 10^{10} L of O_2. The chemisorption of hydrogen causes the work function to increase on *n*-type and to decrease on *p*-type substrates, by this indicating the formation of depletion layers on both substrates. After exposures of up to 5 L the chemisorption-induced surface states of acceptor- and donor-type, respectively, pin the Fermi level at approximately $E_{vs}+0.85$ eV and $E_{vs}+0.63$ eV for *n*- and *p*-doped samples, respectively. Above exposures of 3 L the 20 eV energy-loss peak is observed to decay, and it has vanished after 3×10^4 L of hydrogen. This result clearly demonstrates that hydrogen atoms do not initially bond to the surface Ga atoms. In the exposure range from 50 to 3×10^4 L the intensity ratio of the surface sensitive As(31 eV) and Ga(55 eV) AES peaks decreases by approximately 20% while the Ga(55 eV) signal itself remains unchanged with respect to the primary peak. This result corresponds to a chemisorption-induced loss of approximately 75% of the As atoms in the topmost layer. (49 refs.)

108162 UV photoemission study of low temperature oxygen adsorption on GaAs(110). D.J.Frankel, J.R.Anderson, G.J.Lapeyre (Dept. of Phys., Montana State Univ., Bozeman, MT, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.763-6 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The adsorption of oxygen on the (110) cleaved surface of GaAs is studied by first physisorbing molecular O_2 on the surface at a temperature of approximately 45K and then warming the surface to 300K. The transformation from a state with molecular O_2 physisorbed on the surface to one with chemisorbed atomic oxygen is studied with ultraviolet photoemission spectroscopy (UPS) using a helium resonance lamp as a source. The physisorbed state shows a set of emission peaks with spacings equal to the gas phase values. The sample temperature is not cold enough to obtain multiple layers of condensed oxygen. As the temperature of the sample is then increased from $T=45$ to 300K, the UPS spectrum changes dramatically; by $T=60$K the molecular O_2 peaks have disappeared and by 170K the spectra have taken on a form characteristic of chemisorbed atomic oxygen. Evidence is found for one or more intermediate states during the transformation of the physisorbed molecular O_2 to chemisorbed atomic oxygen. (16 refs.)

108163 Enhanced oxygen adsorption on palladium silicide at room temperature. R.Butz, H.Wagner (Inst. fur Grenzflachenforschung und Vakuumphys., KFA Julich, Julich, Germany).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.816-18 (July-Sept. 1983).
Following Pd deposition on Si(111), Pd_2Si formation was observed at room temperature up to a Pd coverage of about 10 Å. Exposure to oxygen revealed an estimated four times larger oxygen uptake on the thin Pd_2Si layers with respect to pure Si. Thicker Pd_2Si layers formed upon heating of unreacted Pd layers showed the same enhanced oxygen adsorption. The Si(*LVV*) Auger line shape does not indicate SiO_2 formation but rather maintains the form characteristic for Pd_2Si. (10 refs.)

108164 Specimens in the MnO-Fe_2O_3-H_2O system. M.M.Kosyakina, N.G.Roslyakova, S.I.Kol'tsov (Lensovet Leningrad Technol. Inst., Leningrad, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1112-15 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1316-19 (Aug. 1982).
The interaction of ferrogel and divalent manganese salt solutions is studied. Chemisorption of divalent manganese ions by the ferrogel at room temperature results in the formation of highly porous manganese hydroferrites. The

nature of the solid substances obtained was established by thermographic analysis, X-ray diffraction, and IR spectroscopy. (6 refs.)

108165 Adsorption and electrophysical properties of doped gallium arsenide. I.A.Kirovskaya, N.N.Belousova, G.M.Zeleva (Omsk Polytech. Inst., Omsk, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1174-6 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1383-4 (Aug. 1982).
The effect of group VI elements as doping agents on the adsorption and electrophysical properties of GaAs was demonstrated. The experimental installation included a vacuum block (with piezoelectric crystal weights) and an electrophysical block, permitting simultaneous measurement of adsorption, surface conductivity σ_s, and contact potential difference on single-crystal specimens of gallium arsenide. These specimens consisted of epitaxial films with and without S, Se, and Te doping, which were grown by a gas-transport method on a germanium substrate with subsequent etching and were coated on the piezoelectric crystal. The adsorbates were hydrogen and oxygen. The temperature interval was 300 to 423K. (7 refs.)

108166 Properties of real surfaces of thin films of cadmium selenide. V.A.Smyntyna (I.I. Mechnikov Odessa State Univ., Odessa, Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.9, p.1263-6 (Sept. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.9, p.1479-82 (Sept. 1982). [received: Sept. 1983]
Two types of basic active center are observed on the surfaces of cadmium selenide films—selenium vacancies and excess cadmium atoms. The adsorptive power of the samples at 473K is determined only by the type and concentration of the surface adsorption centers. At room temperature the absorptive power depends on the concentration of free electrons in the bulk of the crystallites and on the height of the potential barrier on their surfaces. In both cases the basic form of oxygen chemisorption is governed by the nature of the basic absorption center. (6 refs.)

108167 Interaction of saturated hydrocarbons with transition-metal films: molecular orbital calculations. R.C.Baetzold (Res. Labs., Eastman Kodak Co., Rochester, NY, USA).
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4271-6 (29 June 1983).
Tight-binding-type calculations have been performed to treat the chemisorption and the C-H bond activation of saturated hydrocarbons (CH_4 and C_2H_6) on transition-metal films. The films contain two to five layers of metal atoms, each with a valence s, p, d component of orbitals. A metal-hydrogen-carbon attractive interaction exists, as manifested by a partial population of the $\sigma^*_{C\text{-}H}$ antibonding hydrocarbon molecular orbitals providing an acceptor function for the molecule. This effect is characterized by a small net electron transfer to hydrocarbon and a decrease in the C-H overlap population. The chemisorption energy of a given hydrocarbon, CH_4 or C_2H_6, decreases as the d occupation of the metal film increases in traversing a periodic row from left to right. This effect may be traced to the fact that the separation between $\sigma^*_{C\text{-}H}$ energy levels of hydrocarbon and metal film Fermi energy increases with increasing d occupation. (27 refs.)

108168 The influence of adsorbate interactions of kinetics and equilibrium CO on Ru (001). I. Adsorption kinetics. H.Pfnur, D.Menzel (Dept. of Phys., Tech. Univ. Munchen, Munchen, Germany).
J. Chem. Phys. (USA), vol.79, no.5, p.2400-10 (1 Sept. 1983).
After careful calibration, the work function change induced by CO adsorption on Ru(001) has been used to measure the sticking coefficient s as functions of sample temperature (between 100 and 400K) and coverage with the gas temperature always at about 295K. The main results are: At $\theta=0$, the sticking coefficient is independent of sample temperature between 100 and 400K, at $s_0=0.7$ for $0<\theta<0.2$. s drops proportional to $(1\text{-}\theta)$ for $T_s>200K$, and more gradually below 200K; at 100K, s drops slowly up to $\theta=0.5$. Above $\theta=0.23$ a sharp decrease of s sets in for $T_s>120K$; a second plateau becomes obvious around $\theta \sim 0.35$ for $T_s<360K$. Close to saturation, s drops to below 10^{-2}. These results are discussed in terms of a percursor model with strong effects of the chemisorbed layer on the properties of the precursor. A critical evaluation of the formal precursor states involved suggests that classical precursor states exist only at appreciable coverage and are defined by the lateral and vertical interactions, while at low coverage the collisional dynamics are determined for sticking of molecules. (25 refs.)

108169 A one-dimensional model for phonon-induced desorption. S.Efrima (Dept. of Chem., Ben Gurion Univ. of Negev, Beer Sheva, Israel), C.Jedrzejek, K.F.Freed, E.Hood, H.Metiu.
J. Chem. Phys. (USA), vol.79, no.5, p.2436-53 (1 Sept. 1983).
The authors derive the kinetic equations for a one-dimensional model of phonon-induced desorption. They start with a generalized master equation and discuss approximations that reduce it to a master equation of the Pauli type. This describes desorption as a stochastic process in which the energy of the chemisorptive bond has random variations caused by the thermal fluctuations of the lattice atoms. Desorption occurs when the bond energy exceeds a certain value, placing the adsorbed particle in a continuum state of the surface-particle potential. The calculation of the rates of energy transfer includes multiphonon processes and allows transitions between all the bound levels of the adsorbed particle. Numerical calculations are presented in a subsequent paper. (25 refs.)

108170 Thermal desorption with the Smoluchowski equation. S.Shindo (Dept. of Phys., Tokyo Gakugei Univ., Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2637-8 (Aug. 1983).
The radiation boundary condition is derived for the Smoluchowski equation based on the Fokker-Planck equation. This is applied to the calculation of the desorption rate for the large friction coefficient. The friction dependence of the desorption rate is discussed. (8 refs.)

108171 Adsorption of hard spheres via the non-uniform Percus-Yevick equation. S.Sokolowski (Dept. of Theoretical Chem., Inst. of Chem., Marie Curie Sklodowska Univ., Lublin, Poland).
Mol. Phys. (GB), vol.49, no.6, p.1481-8 (20 Aug. 1983).
The author studies the adsorption of hard spheres on solids interacting according to potentials whose Boltzmann functions contain a δ-function. The nonuniform Percus-Yevick equation is solved by using the method introduced by Lado (1968) to study two dimensional fluids. (17 refs.)

108172 End-on and side-on bonding of ketones to surfaces: acetone on the Ru(001) and Pt(111) surfaces. N.R.Avery, W.H.Weinberg, A.B.Anton, B.H.Toby (Div. of Chemistry, California Inst. of Technol., Pasadena, CA, USA).
Phys. Rev. Lett. (USA), vol.51, no.8, p.682-5 (22 Aug. 1983).
High-resolution electron-energy-loss spectroscopy has verified the existence of two fundamentally different types of adsorbed acetone, η^1-bonded acetone on Pt(111) and η^2-bonded acetone on Ru(001). On a Ru(001) surface, the Lewis acidity of which has been increased by the presence of oxygen adatoms, the η^1 and η^2 forms of acetone coexist. The η^1-bonded acetone desorbs molecularly, whereas η^2-bonded acetone is a precursor to dissociation on the surface. (31 refs.)

108173 Efficient scheme for calculation of low-energy electron-diffraction intensities in the presence of large superlattices, with application to the structural analysis of benzene adsorbed on Rh(111). M.A.Van Hove, R.Lin, G.A.Somorjai (Dept. of Chem., Univ. of California, Berkeley, CA, USA).
Phys. Rev. Lett. (USA), vol.51, no.9, p.778-81 (29 Aug. 1983).
A powerful calculational low-energy electron-diffraction scheme is introduced for super lattices with unit cells of any size: beam-set neglect. It is applied in the first structural analysis from low-energy electron-diffraction intensities of a large molecule, benzene, adsorbed on a single-crystal metal surface, Rh(111). In a $({}_{13}^{31})$ lattice, benzene is found to lie flat on the surface, centered over HCP-type hollow sites. A planar, possibly distorted C_6 ring is found with Rh-C bond lengths of 2.35 ± 0.05 Å. (12 refs.)

108174 Experimental evidence of a roughening transition in adsorbed xenon multilayers. R.Miranda, E.V.Albano, S.Daiser, G.Ertl, K.Wandelt (Inst. fur Phys. Chem., Univ. Munchen, Munchen, Germany).
Phys. Rev. Lett. (USA), vol.51, no.9, p.782-5 (29 Aug. 1983).
In this letter evidence is provided for a roughening transition in adsorbed xenon multilayers on palladium. The layer-distinctive Xe $5p$ photoemission is used to measure adsorption isotherms as well as the relative equilibrium population of individual Xe layers. Below the roughening temperature T_R xenon adsorbs layer by layer. Above T_R simultaneous population of different layers takes place. (17 refs.)

108175 Evidence for Ising and Potts transitions in the ϵ-ζ transformation of two-dimensional O_2. R.Marx, B.Christoffer (Lab. fur Tieftemperaturphys., Univ. Duisburg, Duisburg, Germany).
Phys. Rev. Lett. (USA), vol.51, no.9, p.790-3 (29 Aug. 1983).
Two-dimensional O_2 physisorbed on graphite shows a structural and magnetic phase transition from the paramagnetic to the antiferromagnetic state. A high-resolution specific-heat measurement is presented which reveals that there are two successive phase transitions: first a three-state Potts transition, producing a distorted lattice being still paramagnetic, and second an elastically driven Ising transition from the paramagnetic to the antiferromagnetic state. (13 refs.)

108176 Anisotropic phase transition on uniaxial surfaces. W.Kinzel (Inst. fur Festkorperforschung, Julich GmbH, Julich, Germany).
Phys. Rev. Lett. (USA), vol.51, no.11, p.996-9 (12 Sept. 1983).
A centered rectangular lattice-gas model for the chemisorption of H on Fe (110) is studied by transfer-matrix scaling. The results indicate a new type of phase transition to a uniaxial modulated '(3×1)' phase with anisotropic critical behavior. (21 refs.)

108177 Wetting and thick-thin film transitions in a model of argon at a solid CO_2 substrate. R.Evans, P.Tarazona (H.H. Wills Phys. Lab., Univ. of Bristol, Bristol, England).
Phys. Rev. A (USA), vol.28, no.3, p.1864-8 (Sept. 1983).
Using a simple free-energy functional, the authors determined the location of the transition from partial to complete wetting and the thick-thin-film transition line for a mode of gaseous argon at a solid carbon dioxide substrate. The wetting transition temperature is significantly higher than that calculated by Ebner and Saam (1977) for the same model and the thick-thin transition line lies much closer to the bulk gas-liquid coexistence curve. The authors results suggest that thick-film formation will only occur for high temperatures and this is why such films have not been observed in computer simulations and in other recent studies of this model. The authors show that long-ranged transverse (parallel to the surface) pairwise correlations occur at the edge of the thick and thin films which coexist on the transition line. The range of these correlations becomes infinite at the surface critical temperature and, for the thick film, at the wetting transition temperature. (22 refs.)

108178 Determination of molecular orientation of monolayer adsorbates by optical second-harmonic generation. T.F.Heinz, H.W.K.Tom, Y.R.Shen (Dept. of Phys., Univ. of California, Berkeley, CA, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1883-5 (Sept. 1983).
Optical second-harmonic generation has been used to deduce the average arrangement and orientation of *p*-nitrobenzoic acid molecules adsorbed at air-silica and ethanol-silica interfaces. An adsorption isotherm for the liquid-solid interface has also been obtained. (13 refs.)

108179 Surface roughness and influence on the properties of the selectivity of MoO_2. H.Ezbakhe, A.Donnadieu (Lab. de Spectroscopie II, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
Phys. Status Solidi a (Germany), vol.78, no.2, p.607-14 (16 Aug. 1983). In French.
It is shown how the variation of the texture of metallic substrates influences the properties of the selectivity of molybdenum oxide (MoO_2, called 'black' molybdenum) thin films with a constant thickness. The obtained results are analysed as function of wavelengths and roughness parameters (amplitude and spatial frequency), measured before and after deposition of the thin film. (16 refs.)

108180 Ab initio cluster study of the interaction of fluorine and chlorine with the Si(111) surface. M.Seel, P.S.Bagus (IBM Res. Lab., San Jose, CA, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2023-38 (15 Aug. 1983).
The interaction of atomic fluorine and chlorine with the Si(111) surface has been studied by using clusters of Si atoms to stimulate the substrate. The largest cluster contains ten Si atoms, representing the first four layers of the Si surface. An F or Cl atom is added to three high-asymmetry adsorption sites. In the on-top site, the halogen adatom is directly above a surface Si atom. The open and eclipsed sites are both threefold with the adatom at the center of a triangle of first-layer atoms. In the open site, the adatom is directly above a fourth-layer Si while in the eclipsed site it is above a second-layer Si. Ab initio Hartree-Fock wave functions have been calculated, and the energy of the system is studied as a function of the vertical distance of the adatom from the surface (first) Si layer. Equilibrium bond distances, vibrational energies of the adatoms, and binding energies for adsorption are calculated. Bonding mechanisms and properties for the different sites are compared. For the on-top site, the binding energy D_e is 3.2 eV (1.6 eV) for F (Cl), and the equilibrium distance from the surface r_e is 1.7 Å (2.2 Å). For F at the open site, two attractive minima are found: $R_e=1.3$ and -1.4 Å; D_e is found to be ~ 0.5 eV for both positions, the barrier height for penetration is ~ 1 eV. For Cl at this open site, D_e is 0.4 eV and r_e is 1.9 Å. The barrier height is 13 eV. At the eclipsed site, D_e is 0.5 eV (0.2 eV) for F (Cl) with r_e being 1.7 Å (2.2 Å). The calculated D_es for Cl indicate that the most stable chemisorption site for Cl on Si(111) is the onefold on-top site. The vibrational energies for the motion of Cl normal to the surface are found to be substantially different for sites with different surface coordination and should be experimentally accessible in electron-energy-loss spectroscopy. The difference of calculated core-ionization energies for F at the on-top site and at the open site are compared with observed X-ray photoelectron spectroscopy data. The results provide a model for understanding reactions relevant in plasma etching. (51 refs.)

108181 Resonant heating in photodesorption via laser-adsorbate coupling. Z.W.Gortel, H.J.Kreuzer (Dept. of Phys., Dalhousie Univ., Halifax, Nova Scotia, Canada), P.Piercy, R.Teshima.
Phys. Rev. B (USA), vol.28, no.4, p.Z119-24 (15 Aug. 1983).
Based on the master equation for photodesorption of molecules by resonant laser-molecular vibrational coupling and on the equation of heat conduction, the authors calculate the heating of the solid through transfer of laser energy resonantly absorbed in the internal vibration of the adsorbed molecule. For the system CH_3F on NaCl they find that for large laser intensity resonant heating can raise the surface temperature by some 30% for realistic surface-potential parameters. The desorption time, being mainly laser induced and not thermal, changes only by at most a factor of 2-3 as a result of resonant heating. (12 refs.)

108182 Direct structural study of Cl on Si{111} and Ge{111} surfaces: new conclusions. P.H.Citrin, J.E.Rowe, P.Eisenberger (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2299-301 (15 Aug. 1983).
Surface extended X-ray-absorption fine-structure measurements show that the lowest-energy adsorption site for Cl on annealed Si{111}-(7×7), annealed Ge{111}-(2×8), and quenched Si{111}-($\sqrt{19}\times\sqrt{19}$) surfaces is the onefold-atop site. This is in contrast to earlier photoemission studies which suggested different sites for Cl on Si{111} vs. Ge{111}. The observed electronic differences between these two systems are shown to be due to matrix element effects. The measured geometries for both are in excellent agreement with recent parameter-free total-energy calculations. (22 refs.)

108183 Structural determination of Cl chemisorption on Si{111} and Ge{111} by total-energy minimization. G.B.Bachelet, M.Schluter (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2302-4 (15 Aug. 1983).
The atomic geometry of Cl-Si{111} and Cl-Ge{111} has been determined by total-energy minimization. The calculations are done within the total-density-functional framework with the use of norm-conserving pseudopotentials. Cl is found to be most stable in the onefold-atop position on Si{111} and, in contrast to earlier belief, also on Ge{111}. This result agrees with recent surface extended X-ray-absorption fine-structure (SEXAFS) measurements on annealed surfaces. The calculated substrate-Cl bond lengths are in quantitative agreement with the SEXAFS results, and vibrational frequencies are predicted. (22 refs.)

108184 On existence of quantum diffusion of 2-D electrons at the surface. V.E.Kravtsov, I.V.Lerner (Inst. of Spectroscopy, Acad. of Sci., Troitsk, USSR).
Solid State Commun. (USA), vol.47, no.4, p.297-301 (July 1983).
A quantum diffusion of 2-D electrons at a metal substrate has been shown to arise because of surface-bulk interaction via hybridization provided that the surface Fermi momentum has been smaller than the bulk one. The diffusion coefficient D has been found to depend nonmonotonously on sample dimensions L. An initial decrease in D has turned into an increase for sufficiently large L. The minimum in D has nonanalytically depended on the hybridization constant: $D_{\min}\sim g^{4/3}$. The effects predicted have resulted from the instability of the zero-component nonlinear σ-model with respect to inclusion of certain symmetry—breaking terms which have proved to increase under RG transformations. (14 refs.)

108185 Investigation of the initial stages of oxidation of microcrystalline silicon by means of X-ray photoelectron spectroscopy. J.K.Gimzewski, S.Veprek (Inst. of Inorganic Chem., Univ. of Zurich, Zurich, Switzerland).
Solid State Commun. (USA), vol.47, no.9, p.747-51 (Sept. 1983).
XPS Si2*p* spectra of microcrystalline silicon (μc-Si), prepared by plasma chemical transport are reported and the initial stages of oxidation are studied. In comparison with single crystal Si(111) surfaces, μc-Si samples are remarkably resistant to surface oxidation. A short exposure to air results in negligible oxygen adsorption (intensity ratio of 01*s* to Si2*p* peaks is less than 0.018 after more than 3×10^{11} Langmuirs exposure to air). Intensive oxidation treatment is required to produce an oxide layer and evidence supporting a preferential grain boundary oxidation mechanism is presented. The surface plasmon structure observed in the Si2*p* spectrum provides complementary information on the remarkably low oxidation rate of the crystallite surfaces as compared to the grain boundaries. (28 refs.)

108186 Monohydride and dihydride formation at Si(100) 2×1: a high resolution electron energy loss spectroscopy study. F.Stucki, J.A.Schaefer, J.R.Anderson, G.J.Lapeyre, W.Gopel (Phys. Dept., Montana State Univ., Bozeman, MT, USA).
Solid State Commun. (USA), vol.47, no.10, p.795-801 (Sept. 1983).
Results from EELS and LEED investigations on the interaction of atomic hydrogen with the Si(100) 2×1 surface give direct evidence for the formation of two distinct surface phases: a monohydride Si(100) 2×1:H and a dihydride Si(100) 1×1::2H phase. Temperature and exposure time determine which of the two phases appears. An analysis of normal vibrational modes leads to an identification of hydrogen adsorption complexes in both phases. (23 refs.)

108187 Inelastic changes during the formation of multilayers of C_2H_6 on Ag(110). B.F.Mason, B.R.Williams (Nat. Res. Council Canada, Ottawa, Canada).
Surf. Sci. (Netherlands), vol.130, no.2, p.L329-36 (Aug. 1983).
Adsorption of C_2H_6 on Ag(110) has been studied using inelastic He atom scattering. Changes in the inelastic spectrum have been observed for the first time during adsorption up to three monolayers. No changes occurred as a fourth layer was added. The spectrum moves to lesser energy values. The ratio of the energy gain and loss events varies from layer to layer (at constant surface temperature). The (00) peak also reflects some changes in intensity during adsorption. (8 refs.)

108188 The effect of chain reactions on the diffusion of adsorbates. D.R.Bowman (James Franck Inst., Univ. of Chicago, Chicago, IL, USA).
Surf. Sci. (Netherlands), vol.130, no.2, p.348-60 (Aug. 1983).
A chain reaction mechanism is developed that can dramatically increase the predicted diffusion coefficient as a function of coverage for thermally activated submonolayer coverages of adsorbates weakly chemisorbed on surfaces. The key idea is that when a diffusing adatom encounters another adatom it will tend to forward scatter it (due to the channeling effect of the periodic potential of the substrate lattice), thus increasing the effective mean free path. The enhancement effect can be quite dramatic at large adsorbate coverages. The formalism is essentially that of a Markoffian random walk on a lattice which allows for 'billiard ball' type collisions. A general formalism for calculating the chemical diffusion tensor for an unspecified lattice is developed. The diffusion tensor is then related to the effective diffusion coefficient measured by the field emission fluctuation method. The special case of the two-dimensional rhombic lattice with two adsorbate species is worked out and shown to agree qualitatively with theoretical predictions of the coverage dependence of the diffusion coefficient with the experimental data for hydrogen and deuterium on W(110). (9 refs.)

108189 Theoretical studies on the standard but misleading adsorption isotherm. I. True adsorption isotherm. F.A.Shebl, M.Abd El-Khalik, F.M.Helmy (Dept. of Chem., Ain Shams Univ., Abbasia, Cairo, Egypt).
Surf. Technol. (Switzerland), vol.19, no.4, p.321-34 (Aug. 1983).
When an adsorbent contains micropores or specific adsorption sites, the adsorption isotherm is misleading. The monolayer capacity V_m is higher than the true monolayer capacity V_{mt} for a microporous solid and is lower than V_{mt} for a surface which is partly lyophobic. It is proposed that an amount x should be added or subtracted from the monolayer capacity determined using the Braunauer-Emmett-Teller method to calculate V_{mt}. The amount x is calculated from the n_R-n_s plot. A general equation is derived to calculate the value x and the true monolayer capacity as well as to draw the true adsorption isotherm just before capillary condensation. The equations derived are applied to two silica gels, one containing micropores and the other containing mesopores. Excellent agreement between theoretical and experimental results is obtained. (16 refs.)

108190 Adsorption of NO on a Rh-10% Pt (111) surface: non-uniform spatial distribution. P.H.Holloway (Dept. of Materials Sci. & Engng., Univ. of Florida, Gainesville, FL, USA), F.L.Williams.
Surf. & Interface Anal. (GB), vol.5, no.4, p.147-9 (Aug. 1983). (International Conference on Quantitative Surface Analysis, Teddington, England, 24-25 Nov. 1981).
Most studies of chemisorption now use single crystals in order to distinguish the effects of crystallite orientation upon absorption and to have a 'large, uniform' surface for measurement. Also, many of the analytical techniques require surface areas 1 mm in diameter for measurements. Most investigators implicitly assume that a single crystal will provide a uniform surface over these dimensions. This is not always true as is shown in this case for NO absorption on Rh-10% Pt (111) crystals. Therefore, the purpose of this communication is to show that high spatial resolution surface analysis can be very useful in studying surface/gas reactions, even on single crystal surfaces. (7 refs.)

108191 Paramagnetic relaxation of protons of water adsorbed on the aerosil surface. Yu.V.Shulepov, A.G.Bratunets, R.F.Shulepova.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1226-9 (Aug. 1983). In Russian.
The temperature dependence of the spin-lattice relaxation time of protons of water adsorbed on the A-175 aerosil surface is measured and calculated in terms of the surface diffusion model using the spin-temperature theory. The mean length of the proton jump and the movement activation energy are $b=1.64$ Å and $E_a=16.93$ kcal/mol, respectively. From comparison of the calculated and measured spin-lattice relaxation times of water protons in the presence of Mn(II) ions (concentration 1.14×10^{13} ion/cm^{-2}) a conclusion is made that the paramagnetic ion concentration becomes effectively lower due to the formation of submacroscopic globules of the $MnCl_2$, $Mn(OH)_2$, etc. type during the drying of the sample to achieve necessary humidity. (14 refs.)

108192 Electron- and photon-stimulated desorption benefits and pitfalls. T.E.Madey, D.L.Doering, E.Bertel, R.Stockbauer (Surface Sci. Div., NBS, Washington, DC, USA).
Ultramicroscopy (Netherlands), vol.11, no.2-3, p.187-97 (1983). (Surface Imaging and Analysis with High Spatial Resolution, Wickenburg Inn, AZ, USA, 12-15 Jan. 1983).
Electron beam irradiation of solids often results in damage-producing events along with information-producing events. The authors explore mechanisms of beam damage in solids, as well as examples of the benefits of electron- (and photon-) stimulated processes to study molecules at surfaces. Information about the geometrical structure of adsorbed species can be obtained from measurements of the angular distribution of ions released by electron- or photon-stimulated desorption. The directions of ion emission are directly related to the orientations of the surface bonds which are ruptured by the excitation. The method of electron-stimulated desorption ion angular distributions (ESDIAD) has proven particularly useful in characterizing local molecular structure at surfaces in the absence of long-range order; recent measurements of bonding configurations stabilized by impurities or by lateral interactions are discussed. Photon-stimulated desorption (PSD) studies using synchrotron radiation are providing new insights into fundamental electronic excitation processes at surfaces. Mechanisms for the excitation and desorption of ions are examined, and examples include ion desorption from adsorbed monolayers, as well as ion formation and desorption processes in condensed molecular films. (45 refs.)

10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces .... See Entry 105017

A ^{252}Cf fission fragment-induced desorption mass spectrometer: design, operation and performance .... See Entry 105412

ENDOR study of VO^{2+} adsorbed on Y zeolite .... See Entry 106473

Eight-vertex model of two-dimensional domain walls .... See Entry 107866

Single-crystal-polycrystalline-aggregate phase transition due to internal intercrystallite adsorption of impurities .... See Entry 107929

Surface study of a Ag electrode on a solid electrolyte used as oxygen sensor .... See Entry 108130

Direct imaging of carbon-covered and clean gold (110) surfaces .... See Entry 108139

Interface formation at PbTe(100) surfaces: Ge, Al, and In overlayers .... See Entry 108492

Schottky barrier formation and the initial metal-atom bonding state: InP(110)-Al vs GaAs(110)-Al .... See Entry 108495

Correlation effects in doped organic semiconductors .... See Entry 108502

Electronic structure of a cobalt monolayer on Cu(100) .... See Entry 108506

Work function change of hydrogen chemisorbed Si (100) surface .... See Entry 108522

Characterization of GaAs:O-Ge and ZnSe:O-Ge heterointerfaces grown on oxygen-exposed GaAs and ZnSe substrates .... See Entry 108531

Deuterium NMR of molecules adsorbed on active alumina .... See Entry 108798

Knight shift of H adatoms on $Cu_{1-x}Ni_x$ alloy .... See Entry 108810

NMR study of the orientational ordering of monolayers of $^{15}N_2$ on graphite .... See Entry 108833

The influence of dipole molecules adsorption on the fine-porous membranes polarizability .... See Entry 108913

Surface-enhanced Raman scattering of polymethine dyes on silver colloidal particles .... See Entry 108935

Surface-enhanced resonance Raman spectroscopy of adsorbates on semiconductor electrode surfaces: tris(bipyridine)ruthenium(II) adsorbed on silver-modified n-GaAs (100) .... See Entry 108940

Surface-enhanced Raman spectroscopy of platinum. II. Enhanced light scattering of chlorine adsorbed on platinum .... See Entry 108941

GaAs surface oxidation-related photoluminescence transients .... See Entry 109016

Electron correlation and hole localization in photon-stimulated ion desorption from solid N_2, CO, and C_2H_2 .... See Entry 109058

Interatomic Auger analysis of the oxidation of thin Ba films. II. Applications to impregnated cathodes .... See Entry 109061

Energy loss spectroscopy of oxygen chemisorption on tin ..... See Entry 109070

Elementary surface excitations and electron energy loss spectroscopy .... See Entry 109074

The diffraction of molecular hydrogen from copper surfaces .... See Entry 109084

Inelastic atom scattering from layers of atoms and molecules on Cu(110) .... See Entry 109087

Direct-inelastic and trapping-desorption scattering of N_2 and CH_4 from Pt(111) .... See Entry 109088

XPS studies on xanthate adsorption on galena surfaces .... See Entry 109091

Transition from adiabatic to sudden core-electron excitation: N_2 on Ni(100) .... See Entry 109102

Photo-electron emission microscopy of work function changes .... See Entry 109114

Field evaporation of silicon and field desorption of hydrogen from silicon surfaces .... See Entry 109116

Hydrogen in carbon foils made by DC glow discharge in ethylene .... See Entry 109154

A Monte Carlo study of Si(111) surface oxidation .... See Entry 109542

Surface films and rate of dissolution .... See Entry 109593

The adsorption of methanol on Ag(111) and its reaction with preadsorbed oxygen .... See Entry 109795

X-ray photoemission spectroscopy of potassium promoted Fe and Pt surfaces after H_2 reduction and CO/H_2 reaction .... See Entry 109796

Inelastic electron tunneling spectroscopic studies of adsorption of simulated epoxy resin .... See Entry 109797

Chemisorption of oxygen at Ag(110) surfaces and its role in adsorbate activation. [Photoelectron spectra observations] .... See Entry 109801

Error simulation experiments. The virial equation in the absorption of isobutene on Aerosil .... See Entry 109802

Characterization of the surfaces of MgO-ZnO solid solutions by CO and H_2 adsorption at room temperature .... See Entry 109803

Hydrogen sorption performance of pure magnesium during continued cycling .... See Entry 109923

Direct visualization of unstained nucleic acids on a metal substrate .... See Entry 109966

68.48 SOLID-SOLID INTERFACES

(inc. bicrystals; for grain boundaries, see 61.70N)

•**108193 Interface analysis by spectroscopic ellipsometry of $Ga_{1-x}Al_xAs$-GaAs heterojunctions grown by metal organic vapor phase epitaxy.** M.Erman, P.M.Frijlink (Lab. d'Electronique et de Phys. Appl., Limeil Brevannes, France).
Appl. Phys. Lett. (USA), vol.43, no.3, p.285-7 (1 Aug. 1983).
Metal organic vapor phase epitaxy (MOVPE) grown $Ga_{1-x}Al_xAs$-GaAs heterostructures have been analyzed by spectroscopic ellipsometry in the 1.6-5.4-eV region. The authors show that this technique is capable of a nondestructive analysis of the interface region. The method can distinguish between a physical interface (roughness, alloy clustering) and a chemical one (gradual changes in Al concentration). The results show that extremely sharp interfaces (of the order of one monolayer) can be grown by MOVPE. (12 refs.)

108194 Si-SiO_2 interface structures on Si (100), (111), and (110) surfaces. T.Hattori, T.Suzuki (Dept. of Electrical Engng., Musashi Inst. of Technol., Tokyo, Japan).
Appl. Phys. Lett. (USA), vol.43, no.5, p.470-2 (1 Sept. 1983).
The distributions of intermediate oxides (SiO_x, $0<x<2$) in ultrathin oxide films formed on (100), (111), and (110) surfaces were investigated by using the nondestructive measurements of Si 2*p* photoelectron spectra. The experimental observations can be understood as follows: (1) the abrupt interfaces are formed for three crystal orientations; (2) the interface formed at 1000°C on (100), (111), and (110) surface consists mainly of SiO, Si_2O, and the mixture of SiO and Si_2O, respectively; (3) Si_2O_3 is distributed in the oxide films for three crystal orientations. (8 refs.)

108195 Interfacial transition region between silicon and ultrathin plasma Si oxide. E.D.Atanassova (Inst. of Solid State Phys., Bulgarian Acad. of Sci., Sofia, Bulgaria), A.V.Shopov.
Appl. Surf. Sci. (Netherlands), vol.16, no.3-4, p.395-404 (July-Aug. 1983).
A depth profiling of ultrathin plasma Si oxide on Si is presented, based upon a combination of results obtained by Auger electron spectroscopy and low-energy electron loss spectroscopy with argon ion sputtering. The parameters of the interfacial transition region in dependence on oxide thickness and technology conditions are studied. It is concluded that the more interface is an attribute of a more perfect oxide. (39 refs.)

108196 Diffusion permeability of single interphase boundaries in the Cu-Mo system. B.S.Bokshtein, I.V.Videnskii, L.M.Klinger (Inst. of Steel & Alloys, Moscow, USSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.587-91 (1982). [received: Aug. 1983]
Diffusion along single interphase boundaries in bicrystals with a known crystallographic orientation was examined. Cu-Mo bicrystals grown by zone recrystallisation were used in the experiments. The results obtained are preliminary but allow several conclusions. 1. The difference in $D_b.\delta$ values the product of diffusivity and boundary width for interphase boundaries with different misorientation angles can be attributed to the different degree of atomic ordering. 2. For grain boundaries the activation energy of diffusion along a boundary with a higher diffusion permeability is lower, whereas for interphase boundaries the situation is just the opposite: the activation energy is higher, and D_0 grows even more rapidly. 3. The high D_0 value for the 15° interface (about 10^2 m^2/s) suggests that in these boundaries a relay type mechanism may work: a jump of one atom initiates jumps of other atoms displacing a chain of atoms. (12 refs.)

108197 Direct observation of lattice arrangement in MBE grown GaAs-AlGaAs superlattices. H.Okamoto, M.Seki, Y.Horikoshi (Musashino Electrical Communication Labs., Nippon Telegraph & Telephone Public Corp., Tokyo, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.6, p.L367-9 (June 1983).
Observation is made of a cross section including the growth direction of an MBE grown GaAs-$Al_{0.28}Ga_{0.72}As$ superlattice structure by a transmission electron microscope with a resolution of 1.4 Å. Relevant atoms are observed to be regularly aligned even across the heterointerface. There is no alloy clustering observed in the ternary alloy layer. Dislocations are clearly observed as a local disorder in lattice alignment for the first time in the MBE grown layer. (6 refs.)

108198 Chemical reaction at the annealed Si/Yb interface. G.Rossi, J.Nogami, J.J.Yeh, I.Lindau (Stanford Univ., Stanford, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.530-2 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The authors present the first evidence of formation of mixed valent compounds at the Si(111)/Yb interface upon annealing. Two stable and uniform compositions were found, these being related to the known bulk silicides YbSi and $YbSi_2$. The mixed valence behavior is seen in the presence of the strong $4f^{13}$ (Yb^{3+}) signal and in the shift of the $4f^{14}$ (Yb^{2+}) signal to the Fermi level. (11 refs.)

108199 Interface properties of *n*-ZnSe-*p*-Ge heterojunctions grown by organometallic chemical vapor deposition. J.G.Werthen, W.Stutius (Xerox Palo Alto Res. Center, Palo Alto, CA, USA), F.A.Ponce.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.656-60 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Aluminum-doped, *n*-type ZnSe layers ranging in thickness from several thousand angstroms to several microns were grown epitaxially on differently oriented *p*-type Ge substrates by a low temperature, low pressure organometallic chemical vapor deposition process. The surface morphology and photoluminescence spectra reveal differences between the ZnSe films grown on (100)Ge substrates and those grown on (111)Ge substrates. Photoluminescence spectra of the former films show strong band gap luminescence, whereas the latter films are characterized by a reduced band gap luminescence intensity and an enhanced intensity in the self-activated region. The lattice structure of the ZnSe-Ge interface has been studied by high resolution transmission electron microscopy, and the electrical characteristics of the corresponding *n*-ZnSe-*p*-Ge heterojunctions have been measured. Heterojunctions formed on (100) oriented substrates show good diode behavior with dark saturation currents of 1×10^{-11} A/cm^2. Heterojunctions formed on (111) substrates are characterized by poor diode behavior with dark saturation currents of the order of 4×10^{-8} A/cm^2. The difference in the electrical transport properties is attributed to the distinctly different defect structure at the ZnSe-Ge heterojunction interface. (18 refs.)

108200 Some observations on Ge:GaAs(001) and GaAs:Ge(001) interfaces and films. J.H.Neave, P.K.Larsen, B.A.Joyce, J.P.Gowers, J.F.van der Veen (Philips Res. Labs., Redhill, England).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.668-74 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Ge:GaAs(001) and GaAs:Ge(001) interfaces and thin films have been prepared by molecular beam epitaxy (MBE) and studied in situ by reflection electron diffraction (RHEED), angle-resolved photoemission spectroscopy (ARPES), and core level photoemission. The film structures have also been examined by transmission electron microscopy (TEM). Ge films grown on GaAs(001) substrates have a $c(2\times2)$ surface symmetry and are free of extended defects and domain structures. ARPES measurements of Ge(001)-$c(2\times2)$ surfaces in the photon energy range 20-50 eV show the presence of two surface states and dispersing bulk states. Valence bands along the ΓX symmetry direction are derived on the basis of a free-electronlike final state. The quality of the Ge-GaAs(001) interface, however, is determined by the GaAs substrate reconstruction. Ge deposition on an intrinsic (2×4) reconstructed surface produces an abrupt interface, but when a $c(4\times4)$ chemisorption phase is used the distribution of arsenic across the interface region is diffuse. TEM examination of GaAs films on Ge(001) substrates has confirmed the presence of a domain structure in which the domains are distinguished by reversal of the polar axis. (37 refs.)

108201 Structural studies of InGaAs/GaAs and GaAsP/GaP strained-layer superlattices by ion channeling. S.T.Picraux, R.M.Biefeld, L.R.Dawson, G.C.Obourn (Sandia Nat. Labs., Albuquerque, NM, USA), W.K.Chu.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.687 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Summary form only given. Investigates the application of the ion channeling technique to study the periodic layer structure of strained-layer superlattices. The objective is to develop a depth-sensitive probe of the strain in these modulated layer structures. The authors report ion channeling studies of the InGaAs/GaAs and the GaAsP/GaP strained-layer superlattices. The $In_{0.2}Ga_{0.8}As$/GaAs alternating layers were grown by MBE with a thickness per layer pair of 20 nm. The $GaAs_{0.16}P_{0.84}$/GaP layers were grown by MOCVD with a thickness per pair of 31 nm. (2 refs.)

108202 Nucleation and strain relaxation at the InAs/GaAs (100) heterojunction. W.J.Schaffer (Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA), M.D.Lind, S.P.Kowalczyk, R.W.Grant.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.688-95 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The techniques of molecular beam epitaxy have been used to investigate the nucleation and growth of InAs heteroepitaxial thin films lattice mismatched to GaAs(100) substrates. The authors' previous observations have been that optimum structural and electrical properties are obtained only if the heteroepitaxial nucleation sequence is carried out under experimental conditions leading to the indium stabilized (4×2) InAs(100) surface reconstruction. In this work, reflection electron diffraction, Auger electron spectroscopy and X-ray diffraction have been used to determine the InAs(100) surface phase diagram. The InAs/GaAs(100) heterojunction grown by MBE is abrupt and smooth surfaces are obtained only under indium stabilized nucleation conditions. A residual compressive strain at the crystalline interface occurs which is somewhat relieved by a tetragonal distortion in the direction normal to the film plane. Results of investigations by reflection electron diffraction show that the nucleation of InAs/GaAs(100) occurs via island formation and coalescence, and that the initial in-plane lattice constant observed for InAs at 520°C is 5.9 Å. The unstrained lattice constant is obtained only after ~2000 Å of growth under indium stabilized conditions. If the InAs bond length in the vicinity of the interface is estimated from the experimental data, the agreement between the authors' previously measured (via XPS) value for the heterojunction

valence-band discontinuity and the calculation based on Harrison's (1977) model (LCAO) is improved. (26 refs.)

108203 Crystalline perfection of heteroepitaxial structures of $Al_{0.3}Ga_{0.7}P_yAs_{1-y}$-GaAs grown from the liquid phase. V.S.Krasil'nikov, V.N.Shcherbakov, E.V.Borodova (Gor'kii Physicotech. Res. Inst., N.I. Lobachevskii Gor'kii State Univ., Gor'kii, USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1521-5 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1772-6 (Nov. 1982).
The crystalline perfection of epitaxial layers of $Al_{0.3}Ga_{0.7}P_yAs_{1-y}$ and surface layers of GaAs substrates on which they are grown deteriorates when there is an increase in the misfit between the unit-cell parameters of the layer and substrate. The type of dislocation structure of the heteroboundaries in the $Al_{0.3}Ga_{0.7}P_yAs_{1-y}$-GaAs (001) system is determined both by the value and by the sign of the elastic stresses acting in the epitaxial layers. Predominance of thermal stresses is accompanied by induction of misfit dislocations oriented along one of the ⟨110⟩ directions. Predominant action of misfit stresses causes the formation of rectangular networks of misfit dislocations along both ⟨110⟩ directions, or leads to the formation of disordered dislocation networks. (12 refs.)

108204 Characterization of the Fe/MgO interface. R.Hubert, J.Darville, J.M.Gilles (Dept. de Phys., Facultes Univ. Notre-Dame de la Paix, Namur, Belgium).
Phys. Scr. (Sweden), vol.T4, p.179-82 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).
An iron film of 12 Å thickness is deposited onto a cleaved MgO (001) face and annealed up to 400°C in ultra high vacuum. Using Auger electron spectroscopy and low energy electron diffraction, it is shown that interdiffusion occurs across the interface around 300°C leading to an ordered solid solution. The behaviour of various contaminations is also studied. (10 refs.)

108205 Influence of substrate deformations on interface structures. I. Theory. J.Woltersdorf, E.Pippel (Inst. fur Festkorperphys. & Elektronenmikroskopie, Akad. der Wissenschaften, Halle (Saale),, Germany).
Phys. Status Solidi a (Germany), vol.78, no.2, p.475-83 (16 Aug. 1983).
The bicrystal deformations due to epitaxial stresses are calculated exactly within the framework of the linear theory of elasticity, but a zeroth and a first approximation sufficient for application are also presented. Besides the radius of curvature and the position of the neutral plane, the critical thickness for the occurrence of misfit dislocations and the dependence on the substrate relaxations—caused by the bicrystal bending—is given as a third parameter which can also be determined experimentally. (22 refs.)

108206 Coherence of the phase boundary and deformation in the epitaxial system Ge/GaAs. I.F.Mikhailov, M.Ya.Fuks, L.P.Koval', O.G.Alaverdova, Yu.A.Tkhorik, N.N.Soldatenko, L.A.Matveeva, L.S.Khazan (Polytechnic Inst., Khar'kov, Ukrainian SSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.215-17 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.368-71 (March-April 1983). [received: Sept. 1983]
The dislocation structure and residual deformation of a film and substrate are studied by X-ray diffractometry and topography. The residual stresses are due to mismatch between the periods of the film and substrate lattices. The thermal stresses in the system are very small. The phase boundary remains coherent up to a film thickness of about 5 μ, 30 times greater than the critical thickness calculated by the method of van der Merve. The deformation of the substrate layer adjoining the phase boundary is three times greater than that calculated from the 'bimetallic' model of the theory of elasticity, showing that there is a nonlinear stress distribution over the depth of the substrate. (11 refs.)

108207 Multilayered metal films with artificial superstructure. T.Shinjo.
Solid State Phys. (Japan), vol.18, no.5, p.271-7 (May 1983). In Japanese.
By alternate deposition of two elements, multilayered films with artificial superstructure are prepared. Examples are briefly reviewed. (30 refs.)

10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces .... See Entry 105017

The nature of grain boundary sliding and the superplastic flow .... See Entry 107717

Pulsed ion beam interface melting of PtCr and CrTa alloys on Si structures .... See Entry 107789

Auger depth profiling studies of interdiffusion and chemical trapping at metal-InP interfaces .... See Entry 108072

Formation and properties of the copper silicon (111) interface .... See Entry 108215

Structure of the Al-GaP(110) and Al-InP(110) interfaces .... See Entry 108218

Investigation of the chemical bonding of Cr and Ti to silicon nitride .... See Entry 108242

DLTS determination of the Mo acceptor level in Mo-$GaAs_{0.6}P_{0.4}$ Schottky diodes .... See Entry 108508

On the mechanism of self-lubrication in metal-polymer electrical contacts .... See Entry 108548

Surface roughness scattering at the Si-SiO_2 interface .... See Entry 108562

68.55 THIN FILM GROWTH, STRUCTURE, AND EPITAXY

(for techniques of crystal growth and film deposition, see 81.10 and 81.15)

108208 Low compensation vapor phase epitaxial gallium arsenide. P.C.Colter (Universal Energy Systems Inc., Dayton, OH, USA), D.C.Look, D.C.Reynolds.
Appl. Phys. Lett. (USA), vol.43, no.3, p.282-4 (1 Aug. 1983).
Vapor phase epitaxial arsenide (GaAs) layers, with lower compensation ratios than any reported heretofore, have been reproducibly grown by the $Ga/H_2/AsCl_3$ method. One of these samples has been studied extensively by electrical measurements and shows an acceptor concentration of $(2.0\pm0.7)\times10^{13}$ cm^{-3}, and a compensation rate of $N_A/N_D=0.06\pm0.02$. These numbers are supported by magnetophotothermal spectroscopy and photoluminescence measurements. The preparation involves growth on [211A] substrates, and a pregrowth bakeout of the Ga source, which results in a significantly lower Zn acceptor concentration in the layer. These reuslts have important implications for various compensation mechanisms which have been proposed for GaAs. (11 refs.)

108209 Measurement of compositional inhomogeneity of liquid phase epitaxial InGaPAs. P.E.Brunemeier, T.J.Roth, N.Holonyak,Jr., G.E.Stillman (Electrical Engng. Res. Lab., Univ. of Illinois, Urbana, IL, USA).
Appl. Phys. Lett. (USA), vol.43, no.4, p.373-5 (15 Aug. 1983).
Precision X-ray measurements have been performed on the compositional inhomogeneity that occurs during the initial part of the liquid phase epitaxial (LPE) growth of InGaPAs on InP substrates from step-cooled solutions. Double crystal X-ray diffraction and absorption data are presented on epitaxial layers grown short term (30 ms) and long term (1-2 min). These data are used to determine the difference in alloy composition of the two growth methods. This study indicates that long-term LPE growth of quaternary alloys is inhomogeneous, while short-term growth can be made uniform. (15 refs.)

108210 High-resistivity ($>10^5$ Ω.cm) InP layers by liquid phase epitaxy. E.A.Razek, L.M.Zinkiewicz, H.D.Law (TRW/Technol. Res. Center, El Segundo, CA, USA).
Appl. Phys. Lett. (USA), vol.43, no.4, p.378-80 (15 Aug. 1983).
Experimental conditions suitable for the liquid phase epitaxial growth of InP epilayers with resistivities $>10^5$ Ω cm have been investigated. It has been found that the resistivities of Fe-doped InP layers are, in fact, less than the resistivity of an undoped InP control sample. Furthermore, the resistivity decreases monotonically as more Fe dopant is added to the melt. When Co is used as a dopant, the same growth conditions used for the Fe-doped InP produce InP epilayers with $\rho>10^5$ Ω cm. High-resistivity InP layers have been reproducibly grown with 1.0 and 0.6 at.% of Co added to the melt. The high-resistivity InP epilayers have been grown at various temperatures between 715 and 630°C. (12 refs.)

108211 A study of meniscus lines on the surface of LPE-GaAs. Zhou Bojun, Wu Rangyuan (Inst. of Semiconductors, Acad. Sinica, Beijing, China).
Chin. J. Semicond. (China), vol.4, no.4, p.395-8, 414 (July 1983). In Chinese.
The meniscus lines on LPE-GaAs surface are affected by the speed, temperature and direction of the wafer leaving the growth liquid, by the As partial pressure of the gas flow and by the gap between the surface of the epitaxial layer and the frame bottom of the liquid bath. Based on these phenomena, the concept of 'semi-circumferential line instant local meltingback' is postulated, which can interpret the cause of forming meniscus lines. (3 refs.)

108212 Influence of source composition on the properties of flash-evaporated thin films in the Cu-In-Se system. H.Neumann, B.Schumann, E.Nowak, A.Tempel, G.Kuhn (Sektion Phys., Karl-Marx-Univ., Leipzig, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.895-900 (1983).
Using $CuIn_2Se_{3.5}$ as source material epitaxial layers are obtained on (111)A- and (100)-oriented GaAs substrates by flash evaporation in the substrate temperature range $T_{sub}=720-870K$. The composition of the films is between $CuInSe_2$ and $CuIn_2Se_{3.5}$. The structural properties of the films are similar to those for $CuInSe_2$ epitaxial layers and refer to a chalcopyrite-like structure. The films are always p-type conducting but different acceptor states are found in dependence on the substrate temperature. (18 refs.)

108213 Mismatch and electron mobility in MBE $Ga_xIn_{1-x}As$ epitaxial layers on InP substrates. J.Massies (Lab. Phys. du Solide et Energie Solaire, CNRS, Valbonne, France), M.Sauvage-Simkin.
Appl. Phys. A (Germany), vol.A32, no.1, p.27-30 (Sept. 1983).
Composition inhomogeneity in nearly matched epilayers of the ternary semiconductor alloy $Ga_xIn_{1-x}As$ (x close to 0.47), grown by molecular beam epitaxy (MBE) on (001) InP substrates is correlated to variation of the lattice mismatch by X-ray imaging and local diffractometry. Misfit dislocations are shown to develop in areas of large misfit (above 2×10^{-3}) and are at the origin of a severe degradation of the electron mobility: an increase by a factor of about 4 in the intrinsic misfit (2.3×10^{-3} compared to 0.6×10^{-3}) results in a 35% reduction of the 77K electron mobility. (17 refs.)

108214 Internal stress in evaporated tellurium films. K.Okuyama (Dept. of Electronic Engng., Faculty of Engng., Yamagata Univ., Yonezawa, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.6, p.934-7 (June 1983).
The internal stress and electrical resistivity were measured during and after deposition for tellurium films evaporated on a glass substrate. Both tensile and compressive stresses were observed depending on the substrate temperature during deposition. For the films deposited at room temperature, a tensile stress was generated accompanied by a drastic decrease in the resistivity. In contrast, a compressive stress was initially developed in the films deposited at 100°C and then the stress changed into the tensile one as the deposition progressed. The experimental results were interpreted in terms of the phase change mechanism and the lattice expansion and grain boundary annealing mechanisms, respectively. (10 refs.)

108215 Formation and properties of the copper silicon (111) interface. F.Ringeisen, J.Derrien (ISEA-Univ. de Haute-Alsace, Mulhouse, France), E.Daugy, J.M.Layet, P.Mathiez, F.Salvan.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.546-52 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The initial stages of the Cu growth on top of a 7×7 Si(111) surface were monitored with LEED, AES, UPS, and XPS techniques. Results suggest that at room temperature the Cu growth proceeds by a laminar fashion. An intermixing between Si and Cu takes place giving rise to a diffuse interface extending to several first monolayers. This fact is testified by the splitting of the Si *LVV* transition in AES spectra, by the deviation of the AES and XPS Cu and Si signal plot versus coverage from a perfect layer by layer growth plot, and by a strong diffuse background intensity in the LEED diagram. Moreover, at this coverage range, a slight narrowing and a shift (0.7 eV±0.2 eV) of the 3*d* Cu peak towards higher binding energy as compared with the bulk metal are observed in valence band photoemission spectra. With increasing coverage, a metal rich phase is found displaying an ordered 1×1 Cu(111) planelike structure. No Si enrichment at the topmost metallic layer is observed by XPS. Core level spectroscopy gives similar results showing a noticeable energy shift (0.6 eV±0.2 eV) for the Cu 2*p* line. A depth profile confirms the interface structure which is rather metastable at room temperature. At high temperature ($T>400$°C), an ordered Cu induced pattern is found at $\theta\sim1$ monolayer. The diagram resembles a 5×5 superstructure. With increasing coverage, 3D crystallites are growing on top of the first ordered layer. The interface is stable at high temperature. (40 refs.)

108216 Epitaxial growth of Ag films on Ge(001). J.R.Lince, J.G.Nelson, R.S.Williams (Dept. of Chem. & Biochem., Univ. of California, Los Angeles, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.553-7 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The deposition of thin films of Ag on clean Ge(001) substrates has been investigated using low energy electron diffraction, Auger electron spectroscopy, and scanning electron microscopy. Ag was deposited from an effusion source onto Ge at both 325 and 600K substrate temperatures. Deposition on high temperature substrates resulted in the formation of Ag islands with no

apparent crystalline order, whereas films deposited at temperatures near 325K onto clean Ge(001) 2×1 surfaces were oriented. The deposition of the equivalent of one Ag(001) monolayer on the Ge surfaces resulted in a Ge(001) 1×1-like LEED pattern. As deposition was continued (up to 500 monolayers), a pattern evolved which is consistent with two (011) 1×1 Ag domains oriented at 90° to one another. This behavior is interpreted in terms of a predominantly Stranski-Krastanov growth mechanism for the initial deposition of Ag onto near room temperature Ge(001) substrates. Annealing of a sample with a thin, ordered film revealed the original Ge(001) 2×1 LEED pattern, which demonstrated that the chemical interaction between Ge and Ag is very weak. (28 refs.)

108217 Palladium on GaAs: a reactive interface. P.Oelhafen, J.L.Freeouf, T.S.Kuan, T.N.Jackson, P.E.Batson (IBM Res., Yorktown Heights, NY, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.588-92 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The authors have studied the formation and properties of ≈15 nm films of Pd on GaAs(100) and (110) substrates as a function of annealing temperature. Ultraviolet and X-ray photoelectron spectra (UPS and XPS) have established several distinctive phases; coupled with scanning electron microscopy studies, agglomeration has been observed at elevated temperatures. Transmission electron diffraction studies permit more detailed phase identification at specific temperatures. Electrical studies permit characterization of both interface properties and bulk transport properties of the reacted layer. In contrast to previous work, the authors find no Pd-As binary phases. After high temperature anneals (T_a>350°C), only PdGa is observed; these films are not continuous, but form [often epitaxial on (100) substrates—with (110)PdGa$\|$ (100)GaAs and $[\bar{1}1\bar{1}]\|[011]$GaAs] islands. After low temperature (≈250°C) anneals of Pd films on (110) substrates, small crystallites of PdGa are imbedded in the dominant matrix of a ternary single crystal phase. Energy dispersive X-rav analysis and XPS core level intensities suggest that this phase has the nominal composition of Pd_2GaAs. Metallic Ga is inferred after room temperature deposition from He II UPS studies of the Ga 3*d* core level. (26 refs.)

108218 Structure of the Al-GaP(110) and Al-InP(110) interfaces. A.Kahn, C.R.Bonapace (Dept. of Electrical Engng. & Computer Sci., Princeton Univ., Princeton, NJ, USA), C.B.Duke, A.Paton.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.613-17 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The Al-GaP(110) and Al-InP(110) interfaces are characterized with low energy electron diffraction and Auger electron spectroscopy. Both interfaces are reactive, i.e. the replacement of the cation by Al is thermodynamically favorable. However, Al evaporated on the room temperature substrates has a high surface mobility and forms metallic islands which leave the atomic structure of the uncovered semiconductor areas unperturbed. Limited Al-substrate reaction can be detected at room temperature. Moderate annealing triggers a large scale Al-cation replacement reaction and leads to the formation of AlP layers. The crystalline quality of the AlP layers is good for Al on GaP (0.01% lattice mismatch between AlP and InP) and poor for Al on InP (7% lattice mismatch between AlP and InP). The atomic geometry of AlP(110) is analyzed with multiple scattering LEED computation. A best fit structure is obtained which is consistent with the correlation recently obtained between atomic structure and atomic size on (110) semiconductor compound surfaces. (20 refs.)

108219 Instabilities of (110) III-V compounds grown by molecular beam epitaxy. W.I.Wang (Microelectronics Res. & Dev. Center, Rockwell Internat., Thousand Oaks, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.630-6 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The author has grown GaAs and AlGaAs on (110)-oriented GaAs substrates by molecular beam epitaxy (MBE). The epitaxial growth was studied in situ by reflection high energy electron diffraction. Hall measurements, low temperature photoluminescence, and scanning electron microscopy were used to characterize the epitaxial layers. Significant instabilities were found for this orientation under the growth conditions employed. The experimental results are discussed with bonding considerations of the (110) surfaces. (12 refs.)

108220 Damped oscillations in reflection high energy electron diffraction during GaAs MBE. J.M.Van Hove, C.S.Lent, P.R.Pukite, P.I.Cohen (Dept. of Electrical Engng., Univ. of Minnesota, Minneapolis, MN, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.741-6 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Oscillations in the time evolution of electron diffraction during MBE growth of GaAs are shown to be related to periodic variations in the step distributions on GaAs surfaces during epitaxial growth. Unintentionally doped GaAs surfaces were first prepared by MBE. Then the Ga flux is interrupted until an instrument limited diffraction pattern was obtained. During this process the angular width of the specular beam was measured versus time. When the Ga flux is reapplied there are intensity oscillations that are weak near the Bragg angle. At the Bragg angle, where the diffraction is insensitive to surface steps, the length of the specular RHEED streak does not change. At angles between the Bragg angles, where steps lengthen the streaks, there are periodic variations in the streak length. The authors interpret the results in terms of a model in which a partially completed surface has a step distribution with smaller average terrace lengths than a completed surface. (12 refs.)

108221 MBE growth and characterization of single crystal silicon oxides on (111) and (100) silicon. T.J.Maloney (Varian Associates Inc., Palo Alto, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.773-7 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Silicon molecular beam epitaxy has been used to prepare thin (500 Å) films of single crystal silicon oxide material, having from 25%-30% oxygen content, on (111) and (100)Si wafers. The films, called SiO_z herein, were grown by evaporating silicon in the presence of oxygen at a wafer temperature around 675°C. Single crystal films of pure silicon on top of (111) SiO_z films have also been grown. The oxide material may be single crystal Si_2O on (111)Si, but the ease of growing SiO_z films on (100)Si indicates that perhaps oxygen incorporates in some other way. Auger data resembled AES data for amorphous SIPOS, while capacitance-voltage measurements possibly indicated a band gap step. This form of SiO_z could be very significant if it can be used as a wide band gap semiconductor, compatible with silicon, and suitable as a wide band gap emitter for heterojunction bipolar transistors and ICs. (14 refs.)

108222 Time and temperature dependences of phosphorus evolution from InP. L.G.Van Uitert, P.K.Gallagher, S.Singh, G.J.Zydzik (Bell Labs., Murray Hill, NJ, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.825-6 (July-Sept. 1983).
Indium phosphide decomposes evolving phosphorus at temperatures below 360°C in vacuum. Hence, heating in this range during processing epitaxial InGaAs films on InP substrates may lead to surface contamination of the active layer by phosphorus. This contamination can be minimized at elevated temperatures by initially depositing a passivating layer over the exposed parts of the substrate and/or active film well below the decomposition range of the substrate (e.g., at 250°C) and then sintering the film directly or while continuing deposition at a higher temperature. The vapor pressure of phosphorus evolved from InP increases by an order of magnitude for each 45°C increase in temperature. (3 refs.)

108223 Structural transformations in polycrystalline cadmium selenide films. V.S.Grinevich, V.E.Polishchuk, V.V.Serdyuk, V.A.Smyntyna (I.I. Mechnikov Odessa State Univ., Odessa, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1064-8 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1262-6 (Aug. 1982).
Recrystallisation with the formation of the hexagonal CdSe modification occurs upon thermal ageing, which increases the anisotropicity of a cadmium selenide semiconductor film characterised by compression of the crystallite unit cell. Relaxation of the original structural defects occurs during natural ageing with restoration of the cell parameters to literature values in the course of an increase in the interplanar distances. (14 refs.)

108224 Structural organisation of amorphocrystalline films of lead tin telluride during annealing in vacuo and in oxygen. A.P.Gorchakov, Yu.A.Zarif'yants, O.I.Tananaeva (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1075-7 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1275-7 (Aug. 1982).
The use of X-ray diffraction analysis and IR spectroscopy has established that there is a dependence of structural and compositional changes of films obtained by rapid evaporation on a cold support, on the environment during low-temperature annealing. The shift and change in form of the absorption-band edge of films subjected to these treatments have been investigated. (7 refs.)

108225 Phase composition and electrophysical properties of EuS- and Sm-based films. L.S.Palatnik, V.E.Marincheva, M.N.Naboka, V.N.Tupikina, L.A.Mineeva, M.L.Mal'tseva (V.I. Lenin Kharkov Polytech. Inst., Kharkov, Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.11, p.1534-7 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1788-91 (Nov. 1982).
The elemental and phase compositions of thin condensed layers of the quasi-binary system EuS-Sm have been studied by chemical, spectral and X-ray analyses and electrophysical measurements. The films of a variable composition in the system EuS-Sm also contain the phases SmS, SmO and $Sm(OH)_3$ in addition to $Eu_{1-x}Sm_xS$ solid solutions. The semiconductor-metal phase transition has been noted in the system EuS-Sm. (7 refs.)

108226 Influence of supercooling on the compositional homogeneity of $InAs_{1-x}Sb_x$ solid solutions in the case of liquid-phase epitaxy. R.Kh.Akchurin, S.R.Borisov, V.B.Ufimtsev (M.V. Lomonosov Moscow Inst. of Fine Chem. Technol., Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.9, p.1256-8 (Sept. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.9, p.1471-4 (Sept. 1982). [received: Sept. 1983]
Epitaxial accumulation under isothermal conditions from supercooled solution melts makes it possible to obtain homogeneous epitaxial layers of $InAs_{1-x}Sb_x$ with x=0.65-0.67, the extent of which reaches 4-12 μm in the direction of growth. The thickness of the constant composition region is strongly influenced by the magnitude of the initial supercooling: on increasing this to values close to that of critical supercooling (ΔT=18K), the thickness of the region decreases, apparently due to the start of homogeneous nucleation in the solution melt. (5 refs.)

108227 On the formation of electroless amorphous layers. I. Phenomenological description of NiP deposited on Cu and Fe substrates. A.Szasz, J.Kojnok, L.Kertesz (Inst. for Solid State Phys., Eotvos Univ., Budapest, Hungary), Z.Hegedus.
J. Non-Cryst. Solids (Netherlands), vol.57, no.2, p.213-24 (1 Sept. 1983).
The formation of amorphous NiP coating by electroless deposition on to copper and iron substrates has been followed by soft X-ray emission spectroscopy (SXES), X-ray diffraction (XRD) and transmission electron microscopy (TEM). Three different stages of formation can be distinguished. The first period is nucleation in an essentially two-dimensional layer where the formation of nuclei depends on the number and properties of the active sites on the underlying substrate layer. There is a three-dimensional spherical growth in the second stage. The concentration of phosphorus increased in the interspherical area. A relatively slow two-dimensional growth is characteristic of the third stage giving rise to a bright outer surface of the coating. (22 refs.)

108228 Prediction of kinetically controlled surface roughening: a Monte Carlo computer-simulation study. J.Singh, A.Madhukar (Dept. of Materials Sci. & Phys., Univ. of Southern California, Los Angeles, CA, USA).
Phys. Rev. Lett. (USA), vol.51, no.9, p.794-7 (29 Aug. 1983).
The existence of a surface roughening under far-from-equilibrium conditions is demonstrated. Roughening is critically controlled by surface kinetic processes, such as the atomic migration rate. Monte Carlo simulations are presented for a model of molecular-beam epitaxial growth of tetrahedrally bonded compound semiconductors. It is proposed that the roughening reported for GaAs/AlAs(100) growth, if intrinsic, corresponds to the kinetic surface roughening predicted here rather than that predicted by Burton, Cabrera, and Frank (1951) for surface-vapor equilibrium. (17 refs.)

108229 Application of the 'negative decoration' phenomenon of thin film growth in surface studies. P.B.Barna, G.Barcza (Res. Inst. for Tech. Phys., Hungarian Acad. of Sci., Budapest, Hungary).
Phys. Scr. (Sweden), vol.T4, p.197-8 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).
The results of experiments on the epitaxial growth of two dimensional islands of $AuAl_2$ grown at gold deposition on the (111) crystal faces of as deposited Al films are reviewed. Formulation of holes and scalloping of islands have been found on crystal faces exposed to various doses of oxygen before gold deposition. These holes, i.e. uncovered areas of Al crystals faces, decorate the islands of adsorbates or oxide developed during oxygen exposure. This 'negative decoration' phenomenon of thin film growth presents a new method suitable for studying the distribution and shape of the products of surface chemical interactions. (10 refs.)

108230 Atomic composition of RF-sputtered alumina coatings determined by XPS method. T.Mantyla, R.Jarvinen, P.Kettunen, P.Huttunen, M.Pessa (Tampere Univ. of Technol., Tampere, Finland).

Phys. Scr. (Sweden), vol.T4, p.199-200 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).

The O/Al ratios of RF-sputtered alumina coatings were analyzed by the XPS (ESCA) method. The coatings were prepared from an Al_2O_3 target by two commercial deposition devices. The effects of the following deposition parameters on the chemical composition of the coatings were studied: sputtering voltage from 1.3 to 1.9 kV, bias voltage from 0 to -100 V, excess oxygen partial pressure from 0 to 4%, and total pressures from 0.6 to 2.0 Pa. The sputtering gas was argon. The measured values of the O/Al ratio varied from 1.33 to 1.50 in the alumina coatings. The compositions were very close to stoichiometry when excess oxygen of 1% and bias voltage of -100 V were applied. However, a deviation in the O/Al ratio was found when the deposition was carried out at a high excess oxygen concentration of 4% which yielded a very oxygen deficient coating with the O/Al ratio of only 1.01. The sputtering voltage and the total pressure had no observable effects on the chemical composition. (4 refs.)

108231 Study of the crystalline structure of HgTe thin layers. I.Spanulescu (Faculty of Phys., Univ. of Bucharest, Bucharest, Rumania), M.I.Abd El-Ati, I.Dima.

Rev. Roum. Phys. (Rumania), vol.28, no.6, p.529-32 (1983).

The method of obtaining HgTe thin films with a small deviation from stoichiometry is presented. The crystalline structure of the obtained samples was studied and the exact value of the crystalline lattice parameter was computed. (20 refs.)

108232 Structure and bonding of hydrocarbon plasma generated carbon films: an electron energy loss study. J.Fink, T.Muller-Heinzerling, J.Pfluger (Inst. fur Angewandte Kernphys. I, Kernforschungszentrum Karlsruhe, Karlsruhe, Germany), A.Bubenzer, P.Koidl, G.Crecelius.

Solid State Commun. (USA), vol.47, no.9, p.687-91 (Sept. 1983).

Electron energy loss spectroscopy has been used to study the structure and the bonding in hard amorphous carbon films (a-C:H) prepared by plasma decomposition of benzene. EXAFS spectra indicate an amorphous and not a microcrystalline structure for a-C:H films. The near-edge structure of the carbon K-absorption edge reveals a considerable amount of π bonding in the a-C:H films. The optical constants were derived by a Kramers-Kronig analysis of the loss functions for energies less than 40 eV. From the sum rule for ϵ_2, the authors derive that 1/3 of the carbon atoms are trigonally bonded and 273 of the carbon atoms are tetrahedrally bonded. (14 refs.)

108233 LEED analysis of solid phase epitaxy of Si. V.V.Korobtsov, V.G.Zavodinskii, A.V.Zotov (Inst. of Automation & Control Processes, Acad. of Sci., Vladivostok, USSR).

Surf. Sci. (Netherlands), vol.130, no.2, p.L325-8 (Aug. 1983).

The LEED technique has been used to study the solid phase epitaxial growth of silicon. The crystalline quality of the film surface, the growth rate and the activation energy have been determined. A comparison of these results with those obtained by other authors has been made. (12 refs.)

108234 Nature of group Ib metal films deposited on polymer surfaces photooxidised with far-ultraviolet (185 nm) radiation. R.Srinivasan, V.B.Jipson, M.J.Poirier (IBM Thomas J. Watson Res. Centre, Yorktown Heights, NY, USA).

Surf. Sci. (Netherlands), vol.130, no.2, p.L344-58 (Aug. 1983).

Solid samples of three polymers (polymethyl methacrylate, polycarbonate and polyimide), whose surfaces were photooxidised with far-ultraviolet (185 nm) radiation in air, were used as substrates for the deposition of gold, silver, and copper films in vacuo. The electrical conductivities of the films were studied in situ as a function of the film thickness (0-15 nm). At a thickness of 10 nm, silver films showed 10^4 greater conductivities when deposited on the treated surfaces of all three polymers. Gold films showed no detectable differences between treated and untreated surfaces. Copper behaved similar to gold on PMMA but showed somewhat greater sensitivity (<20 at 5.4 nm thickness) on photooxidised polyimide. Transmission electron microphotographs of silver films on treated and untreated surfaces showed that photooxidation of the polymer caused the metal to be deposited with better coverage of the surface, i.e. with fewer voids. A partial explanation for the observations would be that photooxidation increases the number of nucleating sites for the metal on the polymer surface. In some way, this must be specific to silver because the effect does not extend to either a more reactive element such as copper or a less reactive element such as gold. (12 refs.)

108235 Superlattices formed by electrodeposition of silver on iodine-pretreated Pt(111); studies by LEED, Auger spectroscopy and electrochemistry. J.L.Stickney, S.D.Rosasco, D.Song, M.P.Soriaga, A.T.Hubbard (Dept. of Chem., Univ. of California, Santa Barbara, CA, USA).

Surf. Sci. (Netherlands), vol.130, no.2, p.326-47 (Aug. 1983).

Reported are studies by LEED and Auger spectroscopy of silver layers electrodeposited on well-characterised Pt(111) surfaces from aqueous solution. Prior to electrodeposition, the Pt(111) surface was treated with I_2 vapour to form the Pt(111) $(\sqrt{7}\times\sqrt{7})R19.1°$-I superlattice which protected the Pt and Ag surfaces from attack by the electrolyte and residual gases. Electrodeposition of silver occurred in four distinct ranges of electrode potential. Ordered layers having (3×3) and (18×18) (coincidence lattice) LEED patterns were formed at all coverages from the onset of deposition to the highest coverages studied, about twenty equivalent atomic layers. Formation of ordered Ag layers has therefore been demonstrated, at least for deposits of limited thickness. Auger spectra revealed that for deposits of a few atomic layers. The iodine layer remained unattached to the surface during multiple cycles of electrodeposition and dissolution of silver from iodine-free solution. Each peak of the voltammetric current-potential scan produced a change in the LEED pattern. (40 refs.)

108236 The structure of amorphous boron films. L.S.Palatnik, A.A.Koz'ma, A.A.Nechitailo (Polytech. Inst., Khar'kov, Ukrainian SSR).

Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.73-7 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR),* vol.28, no.1, p.136-42 (Jan.-Feb. 1983). [received: Sept. 1983]

X-ray diffractometry is used to study the short-range order substructure of the atomic positions in amorphous films of boron (B^a) condensed in a vacuum of 10^{-7} torr. On the basis of an analysis of the atomic radial distribution curves in amorphous boron and in its crystalline modifications, the authors suggest a model for the substructure of B^a. In amorphous boron the ^{12}B icosahedra are distorted on account of the absence of at least 10% of the atoms from their vertices and the presence of about the same number of B* atoms in the interstices between the distorted icosahedra. These point defects (vacancies V and interstitial atoms B*) are nonuniformly distributed in B^a and form V-B* pairs, analogous to Frenkel pairs in crystals, but in concentrations which are greater by several orders of magnitude. This nonuniform distribution can be represented in the form of a periodic function with a period equal to twice the distance between the distorted icosahedra ^{11}B. At low substrate temperatures, $T_s=50°C$, the distorted icosahedra are arranged in a disorderly fashion. At higher temperatures, $T_s=425\text{-}550°C$, microordering occurs. There is partial recombination of the V-B* pairs, the distortion of the icosahedra is reduced, and short-range order appears in their arrangement, approaching the short-range order in the arrangement of ^{12}B icosahedra in the metastable modification B_{50}. (13 refs.)

108237 Influence of an epitaxial substrate on the growth rate of ammonium iodide crystals. I.M.Gaidamako, E.B.Treivus, I.E.Kamentsev (State Univ., Leningrad, USSR).

Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.117-18 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR),* vol.28, no.1, p.200-2 (Jan.-Feb. 1983). [received: Sept. 1983]

KI crystals epitaxially grown on a joint between concreted muscovite and biotite are asymmetrical. This is evidence that the substrate influences the growth rates of the crystals which are grown on it. The authors investigate this influence in the case of NH_4I crystals. An epitaxial substrate not only exerts an orientating influence on crystals growing upon it and determines the probability of nucleation of these crystals, but also may influence the growth rates of the faces. (7 refs.)

108238 Interpreting light scattering patterns by means of optical diffraction. V.A.Gudkov, I.G.Chistyakov (Inst. of Crystallography, Acad. of Sci., USSR).

Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.211-14 (March-April 1983). Translation of: *Kristallografiya (USSR),* vol.28, no.2, p.363-7 (March-April 1983). [received: Sept. 1983]

A method is suggested for determining the supermolecular structure of polymer films, based on optical Fourier transformation of the patterns of scattering of light. Each one is reduced a hundredfold and Fraunhofer diffraction is effected with the reduced negative image. It is shown that the result of an optical Fourier transformation of the pattern of scattered light is the self-convolution function of the macrostructure, in which the form of the elements of the macrostructure and the character of their relative arrangement is reflected. The proposed method is used to investigate the macrostructure of a polythene film. (8 refs.)

108239 Imaging of atomic steps on ultrathin Au films by TEM. M.Klaua, H.Bethge (Inst. fur Festkorperphys. und Elektronenmikroskopie, Akad. der Wissenschaften, Halle/Saale, Germany).

Ultramicroscopy (Netherlands), vol.11, no.2-3, p.125-9 (1983). (Surface Imaging and Analysis with High Spatial Resolution, Wickenburg Inn, AZ, USA, 12-15 Jan. 1983).

Monatomic steps were studied on ultrathin Au films of 1 to 30 monolayer thickness by TEM. Au(111) and Au(100) films were prepared by evaporation of Au onto Ag growth faces in vacuum, following the evaporation of a C film as supporting replica. Au film and C replica were dissolved electrolytically from the Ag substrate. Goniometer tilting was used for setting optimum step contrasts in the microscope. Maximum contrast changes per monolayer are obtained by excitation of a systematic row with nearest (111) or (200) reflections. The thickness dependence of the contrast changes is opposite in bright-field and dark-field micrographs, respectively. Monatomic steps are imaged simultaneously on both sides of the Au film, the Au-vacuum surface and the former Au-Ag interface. Measured intensity changes are discussed in comparison with theoretical extinction curves. Step imaging is applied to the investigation of growth modes of Au films depending on substrate temperature. (7 refs.)

108240 Characteristics of recrystallised polysilicon on SiO_2 produced by dual electron beam processing. J.R.Davis, R.A.McMahon, H.Ahmed (Engng. Dept., Cambridge Univ., Cambridge, England).

Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.563-8

Describes the production of large areas of precisely oriented, defect-free, single crystal silicon films on SiO_2 by dual electron beam heating of deposited polysilicon using lateral epitaxy. Defects which occur in the film far from the seeding window are characterised, and the dependence of the area of the defect-free region on the processing conditions is discussed. (6 refs.)

108241 Linear zone-melt recrystallized Si films using incoherent light. A.Kamgar, G.A.Rozgonyi, R.Knoell (Bell Labs., Murray Hill, NJ, USA).

Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.569-74

Incoherent tungsten radiation has been used to recrystallize polysilicon films deposited on SiO_2, grown on 75 mm diameter wafers. These films have been analyzed by a variety of techniques such as optical microscopy, Auger spectroscopy and TEM cross sectioning. These films are large (>50 mm dia.) single crystals, and contain fewer defects and impurities than similar films recrystallized in graphite strip heater ovens. They do, however, contain the subgrain boundaries found previously, even when high purity MBE polysilicon is used. In vertical TEM cross-sectioning, in addition to the subgrain boundaries, the authors have seen crystallized particles of 50-200 Å size in the Si film at both the upper and lower SiO_2 boundaries. Although these particles could be related to formation of the subgrain boundaries, no definite correlation has been made. (11 refs.)

Dislocations in $Pb_{1-y}Sn_ySe$ ....See Entry 107697

Two kinds of stacking faults in InSb liquid phase epitaxial layers ....See Entry 107719

Sn ion doping during GaAs MBE with field ion gun ....See Entry 107723

Pulsed UV laser irradiation of ZnS films on Si and GaAs ....See Entry 107759

Metastable Fe(Pd) alloys formed by pulsed electron beam melting ....See Entry 107769

Pulsed proton beam annealing of Co-Si thin film systems .....See Entry 107788

Instability of 'slow' solid-liquid interface relaxation before the hetero-LPE of III-V compounds ....See Entry 107874

Features of structural changes accompanying the metal-semiconductor phase transition in an oxidized vanadium foil ....See Entry 107908

Solubility of silicon carbide in tin and gallium ....See Entry 107943

Mismatch in the thermal expansion coefficients in $Ga_{1-x}Al_xP$-GaP heterostructures ....See Entry 107993

Thermal Soret diffusion in the liquid phase epitaxial growth of binary III-V compounds ....See Entry 107995

The effect of the grain structure of Al_2O_3 substrate on the solid state reaction with a layer of NiO: a comparative backscattering spectrometry study. I ....See Entry 108075

'Hot' crystallization centers in amorphous layers ....See Entry 108128

STEM imaging and analysis of surfaces ....See Entry 108149

Properties of real surfaces of thin films of cadmium selenide ....See Entry 108166

Interface analysis by spectroscopic ellipsometry of $Ga_{1-x}Al_xAs$-GaAs heterojunctions grown by metal organic vapor phase epitaxy .... See Entry 108193

Direct observation of lattice arrangement in MBE grown GaAs-AlGaAs superlattices .... See Entry 108197

Some observations on Ge:GaAs(001) and GaAs:Ge(001) interfaces and films .... See Entry 108200

Nucleation and strain relaxation at the InAs/GaAs (100) heterojunction .... See Entry 108202

Crystalline perfection of heteroepitaxial structures of $Al_{0.3}Ga_{0.7}P_yAs_{1-y}$-GaAs grown from the liquid phase .... See Entry 108203

Investigation of the chemical bonding of Cr and Ti to silicon nitride .... See Entry 108242

X-ray determination of the surface compression force in the ion-doped layer in silicon .... See Entry 108245

Deformation of epitaxial structures on the basis of GaAs in the process of their production .... See Entry 108246

The anomalous strain resistor effect in $Bi_{2-x}Sb_xTe_3$ polycrystalline films .... See Entry 108247

Influence of impurities on the growth of tin whiskers .... See Entry 108250

An optical characterization of defect levels induced by MBE growth of GaAs .... See Entry 108335

The dependence of Al Schottky barrier height on surface conditions of GaAs and AlAs grown by molecular beam epitaxy .... See Entry 108511

On the dependence of Schottky barrier height and interface states upon initial semiconductor surface parameters in GaAs {001}/Al junctions .... See Entry 108515

Properties and ion implantation of $Al_xGa_{1-x}N$ epitaxial single crystal films prepared by low pressure metalorganic chemical vapor deposition .... See Entry 108579

Epitaxial layers of iron-doped gallium arsenide .... See Entry 108580

Electrical characteristics and device applications of zone-melting-recrystallized Si films on SiO_2 .... See Entry 108582

Effect of some preparation conditions upon properties of sputtered Nb_3Ge films .... See Entry 108588

Magnetic properties and structure of cobalt-platinum thin films .... See Entry 108742

Effect of growth temperature on the photoluminescent spectra of undoped AlGaAs grown by metalorganic-chemical vapour deposition .. See Entry 108989

Semiconductor electrodes. LII. Photoelectron spectroscopic determination of the structure of thin platinum silicide layers formed on Si (100) and Si (111) for use as electrodes .... See Entry 109097

Quantitative analysis of titanium nitride thin film by means of X-ray photoelectron spectroscopy .... See Entry 109101

A new method for the fabrication of submicron thick gallium arsenide membranes .... See Entry 109145

Crystallization of silicon films on glass: a comparison of methods .... See Entry 109147

Low energy (≤100 eV) sputtering of thin molybdenum nitride films .... See Entry 109151

Laterally seeded regrowth of silicon over SiO_2 through strip electron beam irradiation .... See Entry 109152

High-quality ZnSe thin films grown by molecular beam epitaxy .... See Entry 109153

Hydrogen in carbon foils made by DC glow discharge in ethylene .... See Entry 109154

Phase composition and structure of thin praseodymium and dysprosium sulphide films .... See Entry 109156

Chemical conversion of surface and film formation techniques used together with vacuum deposition and ion implantation .... See Entry 109157

Hydrogenated amorphous silicon produced by laser induced chemical vapor deposition of silane .... See Entry 109158

Photodeposition of aluminum oxide and aluminum thin films .... See Entry 109159

Self-regulation of epitaxial growth of gallium arsenide in a chloride system .... See Entry 109163

High conductive carbon films obtained by plasma CVD .... See Entry 109164

Heteroepitaxial growth of CdTe on GaAs by laser assisted deposition .... See Entry 109166

Preparation and oxidation of a thin Ba film .... See Entry 109167

Properties of plasma-deposited films using ethylene and fluoroethylenes as starting monomers .... See Entry 109168

Production of layers of $A^{IV}B^{VI}$ compounds with specific parameters by quasi-closed-volume methods .... See Entry 109169

Liquid phase growth of epitaxial Ni and Co silicides .... See Entry 109170

High-efficiency GaP pure green light-emitting diodes of 555 nm fabricated by new liquid phase epitaxy method .... See Entry 109171

Chemical deposition of SiO_2 on InP .... See Entry 109172

Growth of epitaxial $Cd_xHg_{1-x}Te$ layers from mercury solutions of Cd and Te .... See Entry 109173

Choice of solvent for liquid-phase epitaxy of $Ga_xIn_{1-x}As_yP_{1-y}$ solid solutions .... See Entry 109174

Production of high-strength nickel coatings by pulse electrolysis .... See Entry 109175

Lateral epitaxial growth of thick polysilicon films on oxidized 3-inch wafers .... See Entry 109177

Effect of concentration gradient on phase stability .... See Entry 109237

Cleaning chemistry of GaAs(100) and InSb(100) substrates for molecular beam epitaxy .... See Entry 109544

Estimation of depth profiles of boron in silicon on ion beam etched sloping cuts by means of neutron induced autoradiography .... See Entry 109831

Transparent conducting tin oxide films for application in heterojunction solar cells .... See Entry 109900

68.60 PHYSICAL PROPERTIES OF THIN FILMS, NONELECTRONIC

108242 Investigation of the chemical bonding of Cr and Ti to silicon nitride. T.W.Orent, R.A.Wagner (Honeywell Corporate Technol. Center, Bloomington, MN, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.844-9 (July-Sept. 1983).
The adhesion characteristics of RF-sputtered Cr/Cu and Ti/Cu films to polished silicon nitride substrates were studied. As-deposited samples showed lower rupture strengths than Cr/Cu on unpolished alumina, but Ti samples that had been annealed above 500°C and Cr films on substrates that had been prefired inair had higher rupture strengths than Cr/Al_2O_3. The compositions of the metal/substrate interfacial regions were studied by Auger depth profiling and by X-ray photoelectron spectroscopy, and the results were correlated with the adhesion measurements. Chromium did not react extensively with the substrate during deposition, but it did react with the silicon oxynitride surface layer formed during prefiring. On the other hand, Ti reduced the silicon nitride during deposition to produce TiN and free Si. Above 500°C the free silicon reacted with additional Ti at the Ti/TiN interface to form a silicide. (15 refs.)

108243 Method of studying viscoelastic properties of porous polymer films. V.E.Savchenko (Ivanovo Sci.-Res. & Experimental-Engng. Inst. of Machine Design, USSR).
J. Eng. Phys. (USA), vol.43, no.5, p.1250-3 (Nov. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.5, p.784-7 (Nov. 1982). [received: Sept. 1983]
A method is proposed for studying the viscoelasticity of polymer films with the aid of a quartz resonator. Results are reported pertaining to thin copper films. (7 refs.)

108244 Determination of stresses in Si-SiO_2 and mechanically affected Si by EPR. W.Gehlhoff, K.H.Segsa (Zentrum fur Wissenschaftlichen Geratebau, Akad. der Wissenschaften, Berlin, Germany).
Phys. Status Solidi b (Germany), vol.118, no.2, p.703-12 (1 Aug. 1983).
The influence of stresses generated by roughening or oxidation of silicon samples on the EPR spectra of Fe^0 in silicon is investigated. Starting from previous calculations it is possible to explain the changes in the angular dependence of the spectra, and to determine the stress components in the SiO_2 film and in the Si surface affected by roughening. The stress values determined by the EPR analysis are compared with the results obtained by other methods. (32 refs.)

108245 X-ray determination of the surface compression force in the ion-doped layer in silicon. P.V.Petrashe, I.L.Shulpina (VNII Nauchpribor, Leningrad, USSR).
Phys. Status Solidi a (Germany), vol.78, no.2, p.K105-8 (16 Aug. 1983).
Carries out a quantitative analysis of the X-ray section topographs from the ion-doped silicon samples. The authors are concerned mainly with four types of point defects, namely vacancies with the surface density N_v, interstitial Si atoms with density N_i, interstitial B atoms with density N_{Bi}, and the substitutions of the Si atoms by B atoms with density N_{Bs}. (13 refs.)

108246 Deformation of epitaxial structures on the basis of GaAs in the process of their production. O.K.Gorodnichenko, V.A.Presnov, N.D.Vasilenko.
Phys. Status Solidi a (Germany), vol.78, no.2, p.K171-3 (16 Aug. 1983).
Investigates the mechanical properties of epitaxial $Al_xGa_{1-x}As$-GaAs, Ge-GaAs heterostructures, and GaAs homostructures being subjected to tension. The tests were carried out at a constant loading rate in the IMASh 20-75 apparatus with a modified chamber permitting to perform liquid-phase epitaxy in it. The layers were grown on flat polished samples of semiconducting GaAs having the shape of dumb-bells. (4 refs.)

108247 The anomalous strain resistor effect in $Bi_{2-x}Sb_xTe_3$ polycrystalline films. S.A.Azimov, Sh.B.Atakulov, T.Azimov, A.N.Shamsiddinov (State Pedagogical Inst., Fergana, USSR).
Solid State Commun. (USA), vol.47, no.4, p.275-8 (July 1983).
The structure, electrophysical and deformational properties of $(Bi,Sb)_2Te_3$ polycrystalline films with anomalous strain-sensitivity ($K \sim 10^4$) were investigated. The presence of empty interleaves between conductive regions crossing current lines was established. An account of the peculiarities of temperature dependence of electrophysical parameters allowed the authors to come to a conclusion that charge carrier transfer in films occurred by tunneling across interleaves. The high films' strain-sensitivity was stipulated by modulation of thickness of empty interleaves (correspondingly to transparency of tunnel barrier) at uniaxial deformation. (13 refs.)

108248 Features of longitudinal flow of cellulose acetate films in active media. A.K.Evseev, Yu.N.Panov, S.Ya.Frenkel'.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.8, p.1638-42 (Aug. 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The behaviour of cellulose acetate films preliminary oriented in ethanol during uniaxial stretching in water-phenol mixture has been studied for the regime of constant stress and constant force in the 40-60° temperature range. The analysis of the flow curves permits one to explain the observed regularities in terms of 'negative longitudinal viscosity'. The internal source of this viscosity is apparently the mesophase formed in material. A direct rheological method of measuring 'negative longitudinal viscosity' is proposed. (5 refs.)

Thermal expansion of thin gold films .... See Entry 107992

Impurity redistribution studies on laser-formed silicides .... See Entry 108063

Coherence of the phase boundary and deformation in the epitaxial system Ge/GaAs .... See Entry 108206

Determination of the dispersion and the measurement of the thickness of epitaxial garnet films .... See Entry 108902

Submicron conductor array fabricated from a recrystallized eutectic thin film .... See Entry 109604

68.70 WHISKERS AND DENDRITES: GROWTH, STRUCTURE, AND NONELECTRONIC PROPERTIES

108249 Whisker growth and cone formation on metal surfaces under ion bombardment. G.K.Wehner (Electrical Engng. Dept., Univ. of Minnesota, Minneapolis, MN, USA).
Appl. Phys. Lett. (USA), vol.43, no.4, p.366-7 (15 Aug. 1983).
The author was able to show experimentally that the seed metals which can cause cone development on ion bombarded metal targets need not to have a lower sputtering yield as widely believed but a higher melting point. By lowering the bombarding ion energy to near sputtering threshold values (<100 eV) one observes the growth of genuine single crystal whiskers which

point in all directions not related to the direction of ion incidence. The author is now convinced that (intentional or unintentional) seed cones are the result of an interplay among whisker growth, surface movement of atoms, and the effects of sputtering. (3 refs.)

108250 Influence of impurities on the growth of tin whiskers. R.Kawanaka (Kitaitami Works, Mitsubishi Electric Corp., Hyogo, Japan), K.Fujiwara, S.Nango, T.Hasegawa.
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.6, p.917-22 (June 1983).
Observations by micro Auger electron spectroscopy and X-ray micro analysis have been made on tin films electroplated on substrates of brass or zinc-coated copper, and on whiskers grown on the films. Direct experimental evidence has shown the existence of zinc and oxygen atoms on the surfaces both of the whiskers and the films. Copper atoms have also been detected in the whiskers and the films. A mechanism for the whisker growth is proposed, based on these experimental results. After electroplating, zinc atoms migrate onto the tin surface and bind there with oxygen atoms. At this stage, the nuclei of whiskers are formed, and the whiskers begin to grow with the aid of the internal stresses caused by the recrystallization of tin grains and/or the formation of intermetallic compounds of tin with copper. (23 refs.)

108251 Growth of whisker crystals of silver azide and lead azide. F.I.Ivanov, L.B.Zuev, M.A.Lukin, V.D.Mal'tsev (Siberian Metall. Inst., USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.113-14 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.194-5 (Jan.-Feb. 1983). [received: Sept. 1983]
Discusses ways of obtaining acicular (whisker) crystals (AC) of lead and silver azides, very perfect from the viewpoint of various physicochemical properties, and consider the mechanism of their growth. Silver and lead azides attract attention not only as initiator explosives but also as model compounds with clearly marked semiconducting properties, suitable for the study of the mechanisms of topochemical reactions. In view of the fact that silver azide AgN_3 and lead azide PbN_6 are incongruent compounds, to obtain AC the authors used evaporation of solvent and crystallization by chemical reaction with oppositely directed diffusion of the substances. (10 refs.)

A study on the morphological changes due to reduction of WO_3 to α-W ....
....See Entry 107641

68.90 OTHER TOPICS IN THE STRUCTURE AND NONELECTRONIC PROPERTIES OF SURFACES AND THIN FILMS

108252 On two methods of calculation of the force of sticking of an elastic sphere to a rigid plane. V.M.Muller, B.V.Derjaguin, Yu.P.Toporov (Dept. of Surface Phenomena, Acad. of Sci., Moscow, USSR).
Colloids & Surf. (Netherlands), vol.7, no.3, p.251-9 (Aug. 1983).
Two methods for calculating the force of the adhesion of an elastic sphere with a rigid plane are considered, under conditions where the surface profile of the deformed sphere under the effect of a normal load and surface forces is very similar to that described by Hertz theory. The first method is based on the calculation of the first derivative of the total energy of the adhesive interaction; the second method is based on summing up the interactions outside the zone of direct contact of the deformable sphere with the right plane. The origin of discrepancy in the results obtained by the two aforesaid methods are indicated. The maximum adhesion forces proves to be equal to the force of interaction of the undeformed sphere with the substrate for the two approaches and within the approximation employed independent of the method of calculation. (21 refs.)

A new probe of the optical properties of surfaces ....See Entry 105379

Processing/microstructure relationships in surface melting ....See Entry 107890

70.00 CONDENSED MATTER: ELECTRONIC STRUCTURE, ELECTRICAL, MAGNETIC, AND OPTICAL PROPERTIES

(see also 81.40R Electrical and magnetic properties related to materials treatment, 81.40T Optical properties related to materials treatment)

108253 Approximate Green function for a semi-infinite solid with varying properties. R.Englman (Soreq Nuclear Res. Centre, Israel Atomic Energy Comm., Yavne, Israel).
J. Phys. A (GB), vol.16, no.13, p.2939-42 (11 Sept. 1983).
An expression is derived for the spatially dependent Green function or response function in a solid occupying a half-space and having generally varying properties. The expression is valid in the same range as the WKB approximation, namely for slowly varying properties. Some generalisation is indicated and the time-dependent Green function or the resolvent is obtained as a Fourier transform. (11 refs.)

71.00 ELECTRON STATES

(see also 63. Lattice dynamics, 73. Surfaces, interfaces, and thin films)

71.10 GENERAL THEORIES AND COMPUTATIONAL TECHNIQUES

108254 APW approach to the momentum matrix element calculation. I.I.Gegusin, V.N.Datsyuk (Inst. of Phys., Rostov State Univ., Rostov, USSR).
Phys. Status Solidi b (Germany), vol.118, no.2, p.K121-4 (1 Aug. 1983).
The direct interband transitions model is often used for the description of the optical properties of solids. This model requires the calculation of the momentum matrix elements $\vec{p}_{if}(\vec{k})$ (MME) between the initial and final Bloch states. The authors report new formulae for the MME calculation. Their version includes no summation over the magnetic quantum number and therefore leads to much faster computations. They briefly describe the main stages of the formula derivation. (8 refs.)

108255 Quasi-particle motion in a dichotomous stochastic potential: comparison of a decoupling approach with the dynamic CPA. U.Behn (Sektion Phys., Karl-Marx-Univ. Leipzig, Leipzig, Germany).
Phys. Status Solidi b (Germany), vol.118, no.2, p.K151-3 (1 Aug. 1983).
The motion of a tight-binding quasi-particle in a dichotomous stochastic time dependent potential is considered. The author shows that the decoupling approach, although interpolating between band limit (BL, $U=0$) and atomic limit (AL, bandwidth $2\Delta=0$) fails to reproduce the static limit (SL, $\alpha=0$) in contrast to the dynamical CPA which interpolates between the above limit cases correctly. For α not too small, however, in both approaches the density of states (DOS) shows the same qualitative behaviour and the solutions of the self-consistency condition in the dynamic approximation for the Hubbard model differ only slightly. (6 refs.)

108256 Electronic states for incommensurate lattice potentials. D.Weaire, J.P.Kermode (Dept. of Phys., Univ. Coll., Dublin, Ireland).
Phys. Status Solidi b (Germany), vol.118, no.2, p.K163-6 (1 Aug. 1983).
Dy and Ma (J. Phys. C, vol.15, p.6971, 1982) have recently presented a number of results for the electronic states of a one-dimensional Hamiltonian of the following form, where q is an irrational multiple of π: $H_{n,n}=V_0 \cos(qn)$, $H_{n,n+1}=H_{n+1,n}=1$, and $H_{n,m}=0$ otherwise. The authors point out that all of the detailed structure which Dy and Ma found in the local density of states may be simply interpreted. The authors shall concentrate on the case $q=3$, and preceed to approximate this by $2\pi(21/44)$, corresponding to the familiar estimate $\pi\approx 22/7$. This defines a periodic Hamiltonian with a primitive cell consisting of 44 lattice sites n. The authors find its band structure by use of Bloch's theorem and standard numerical methods. (2 refs.)

Defects in the sine-Gordon model: statics ....See Entry 108313

Thermodynamics of a spin 1/2 Anderson impurity in the $U\rightarrow\infty$ limit ....
....See Entry 108330

71.20 ELECTRONIC DENSITY OF STATES DETERMINATIONS

(inc. energy states of liquid semiconductors; see also 65.40 Lattice and electronic heat capacity)

108257 Exact electronic spectra and inverse localization lengths in one-dimensional random sysems. I. Random alloy, liquid metal and liquid alloy. T.M.Nieuwenhuizen (Inst. for Theoretical Phys., Univ. of Utrecht, Utrecht, Netherlands).
Physica A (Netherlands), vol.120A, no.1-2, p.468-514 (1983).
Analytic continuations into the complex energy plane of Dyson-Schmidt type of equations for the calculation of the density of states are constructed for a random alloy model, a liquid metal and for a liquid alloy. In all these models the characteristic function follows from the solution of this equation. Its imaginary part yields the accumulated density of states and its real part is a measure for the inverse of the localization length of the eigenfunctions. (28 refs.)

108258 Effects of order on the electronic structure of Ni_3Fe. S.Lipinski (Inst. of Molecular Phys., Polish Acad. of Sci., Poznan, Poland).
Phys. Status Solidi b (Germany), vol.118, no.2, p.861-9 (1 Aug. 1983).
The electronic densities of states for partially ordered Ni_3Fe are calculated within the framework of the Hartree-Fock and coherent potential approximations. The four-sublattices Hubbard model with an ansatz simplifying the hopping part of the Hamiltonian is used. (14 refs.)

108259 Partial LCAO densities of states for ScN, TiN, ZrN and ScP. R.Eibler, M.Dorrer, A.Neckel (Inst. fur Physikalische Chem., Univ. Wien, Wien, Austria).
Theor. Chim. Acta (Germany), vol.63, no.2, p.133-41 (1983).
Densities of states (DOS) and partial densities of states were calculated from self-consistent APW band structure calculations for four transition metal compounds (ScN, TiN, ZrN and ScP) using a recently published improved LCAO interpolation scheme. The total DOS and the LCAO non local partial metal *s*, *p* and *d* and non-metal *s* and *p* DOS of these compounds are presented and compared with non local LCAO partial DOS from earlier calculations as well as with local partial DOS obtained directly from the APW or LAPW wave functions. A LCAO charge analysis for all valence states and for the individual valence bands is also given. (10 refs.)

Experimental evidence for a structure-induced mininum of the density of states at the Fermi energy in amorphous alloys ....See Entry 108265

Electronic band structure, Fermi surface and optical properties of hexagonal yttrium ....See Entry 108269

Weak itinerant ferromagnets: Ni_3Al ....See Entry 108270

Application of special-directions method to the optical properties of copper and silver ....See Entry 108277

On the solution of the periodic Anderson model ....See Entry 108352

Density of states and charge distribution in hydrogenated amorphous silicon ....
....See Entry 108355

Composition and temperature dependence of the density of states at the Fermi level in vanadium-based A-15 compound systems [NMR study] ....
....See Entry 108826

71.25 NONLOCALIZED SINGLE-PARTICLE ELECTRONIC STATES

108260 Fermi levels in electrolytes and the absolute scale of redox potentials. H.Gerischer, W.Ekardt (Fritz-Haber-Inst., Max-Planck-Gesellschaft, Berlin, Germany).
Appl. Phys. Lett. (USA), vol.43, no.4, p.393-5 (15 Aug. 1983).
Based on the correlation between the work function and the Fermi level of electrons in a single phase, Fermi levels in electrolytes are defined. With the vacuum level above the electrolyte as the reference state, an absolute scale of redox potentials can be derived. It is outlined how such data can be obtained experimentally. (12 refs.)

On the translation mode of the kink lattice of a quasi-one-dimensional Peierls-Frohlich system with a nearly half-filled band ....See Entry 107843

Analytical solutions to the movement of the Fermi energy in a distribution of states ....See Entry 108342

Electronic states in solution and charge transfer ....See Entry 108358

71.25C Techniques of band-structure calculation (general theory, applications of group theory, analytic continuation, etc)

108261 Band structure calculations in N-ary alloys. A.A.Mbaye (Lab. de Phys. du Solide et Energie Solaire, CNRS, Valbonne, France), F.Aymerich.
J. Phys. (France), vol.44, no.9, p.1085-93 (Sept. 1983).
A method for simple calculations of the electronic structure of complex crystalline alloys is presented. This method is twostepwise: within the virtual crystal approximation (VCA) a general interpolation scheme is achieved for the determination of the physical properties of the alloy in terms of those of its pure constituents and the intrinsic (VCA) bowing effects of their related simplest (pseudobinary) alloys. The second step of this method is an extension of the Dielectric Method to account for disorder effects in the general alloy, including a **k** dependent parameterization of the extrinsic bowing effects. Applied to the III-V compound-based materials, the general expressions of lattice parameter and higher symmetry points optical transitions as functions of compositions are derived for these isovalent and quaternary alloys. (26 refs.)

APW approach to the momentum matrix element calculation .... See Entry 108254

Application of special-directions method to the optical properties of copper and silver .... See Entry 108277

Electronic structure of anisotropic semiconductors: optical properties and behaviour under hydrostatic pressure .... See Entry 108280

Semirelativistic SCF-SW-Xα calculations of uranium compounds. Electronic structure and chemical bond .... See Entry 108287

The problem of the electron energy bands interconnection in abrupt semiconductor heterojunctions .... See Entry 108489

71.25H Measurement of Fermi surface parameters

(inc. dHvA, magnetoacoustic, position annihilation, and cyclotron resonance studies, etc.)

108262 The de Haas-van Alphen effect and anisotropy of the magnetic susceptibility in Zn-Ag and Zn-Ga dilute alloys. Y.Saito (Faculty of Sci., Toyama Univ., Toyama, Japan), K.Mori, Y.Yosida.
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2820-6 (Aug. 1983).
The authors report the results of measurements of the de Haas-van Alphen effect and the anisotropy of the magnetic susceptibility associated with the needle Fermi surface in the 3rd-band of pure zinc, dilute Zn-Ag and Zn-Ga alloys. The cross-sectional area of the needles increases for silver impurity, and decreases for gallium impurity. A large maximum in the temperature dependence of the anisotropy of the magnetic susceptibility is observed in pure zinc, Zn-Ag and Zn-Ga alloys. The temperature indicating its maximum increases in Zn-Ag and decreases in Zn-Ga alloys. These results of the magnetic susceptibility and the changes in the cross-sectional area of the needs with alloying can be reasonably accounted by temperature and impurity dependence of axial ratios.

Electronic structure and tetragonality of martensite .... See Entry 107600

Molybdenum hole octahedron and hole ellopsoid cyclotron effective mass calculation .... See Entry 108263

Electronic band structure, Fermi surface and optical properties of hexagonal yttrium .... See Entry 108269

Weak itinerant ferromagnets: Ni_3Al .... See Entry 108270

de Haas-van Alphen effect study of electronic structures of niobium-based molybdenum alloys .... See Entry 108272

On quantum localization of conduction electrons under magnetic breakdown conditions .... See Entry 108326

High temperature oscillations of magnetoresistance in bismuth and semimetallic BiSb alloys .... See Entry 108452

Temperature dependence of Knight shift in Cd-Mg alloys .... See Entry 108805

Positron study of Nb-Mo alloys .... See Entry 109037

71.25J Effective mass and g-factors

108263 Molybdenum hole octahedron and hole ellopsoid cyclotron effective mass calculation. M.Surma, G.Musial (Inst. of Phys., A. Mickiewicz Univ., Poznan, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.2, p.207-14 (Aug. 1983).
The cyclotron effective mass of carriers on the hole-ellipsoid and hole-octahedron Fermi surface of molybdenum is calculated. Calculations are performed on the assumption of the well known equation $m^*(k_z)=(\hbar^2/2\pi)(\partial S(k_z)/\partial\epsilon)$. The authors write the latter in the form with $\partial S(k_z)/\partial\epsilon=[\partial S(k_z)/\partial k_z](\partial\epsilon/\partial k_z)^{-1}$ and calculate $m^*(k_z)$ directly from the data of $\partial S(k_z)/\partial k_z$ for the hole-ellipsoid and also for the hole-octahedron. The cyclotron effective mass of the hole on the ellopsoid and octahedron is confirmed by experimental results. (6 refs.)

Degenerate four-wave mixing due to intervalance band transition in *p*-type mercury cadmium telluride .... See Entry 106825

Energy spectrum of Bi_2Te_2Se .... See Entry 108282

Charge density and orientation dependence of the effective mass in electron inversion layers on the principal surfaces of Si .... See Entry 108505

Self-consistent evaluation of nonuniform superlattice parameters by the harmonic method .... See Entry 108540

Cyclotron resonance in the conduction band of GaP in very high magnetic fields .... See Entry 108789

71.25L Electron energy states in liquid metals

108264 Electronic states in liquid metals and amorphous solids: a functional approach. L.Dagens (CEA, Centre d'Etudes de Limeil, Villeneuve St. Georges, France).
J. Phys. F (GB), vol.13, no.9, p.1833-46 (Sept. 1983).
The powerful functional formulation used in quantum field theory and statistical physics is extended to deal with electronic properties of liquid metals and disordered semiconductors. The averaged one-electron Green operator is extended to a functional $G|\eta|$ of a position-dependent ionic number density η_R. Functional equations are derived for the purely random case and for the correlated-ion case, within a generalised Kirkwood superposition approximation (GKSA), which treats exactly the ionic correlations of n ions up to $n=\nu$ ($\nu=2$ is the ordinary KSA; $\nu=3$ involves the exact two-ion and three-ion distribution functions, etc). The functional equation for the site-site scattering operator is reduced formally to ordinary integral equations by introducing vertex operators. An approximation is derived which extends the effective medium approximation (EMA) beyond the KSA. The functional formulation provides various exact identities which are used to derive internal consistency relations for approximations such as the EMA and to formulate a general identity related to the non-overlapping condition. (15 refs.)

71.25M Electron energy states in amorphous and glassy solids

108265 Experimental evidence for a structure-induced mininum of the density of states at the Fermi energy in amorphous alloys. P.Haussler, F.Baumann (Phys. Inst., Univ. Karlsruhe, Karlsruhe, Germany), J.Krieg, G.Indlekofer, P.Oelhafen, H.-J.Guntherodt.
Phys. Rev. Lett. (USA), vol.51, no.8, p.714-17 (22 Aug. 1983).
First photoemission spectra are reported for the valence bands and core levels of quench-condensed Au_xSn_{100-x} ($0\leq x\leq 100$) films in the amorphous and the crystalline state. It is found that (1) the valence-band spectra for the $20\leq x\leq 80$ region, measured just after condensation, exhibit a decrease in intensity towards the Fermi energy E_F which can be understood in terms of a minimum in the density of states near E_F and (2) the minimum near E_F is most pronounced at an alloy concentration where the highest stability for the amorphous phase has been found. (13 refs.)

108266 Theory of the interaction between electrons and the two-level system in amorphous metals. I. Noncommutative model Hamiltonian and scaling of first order. K.Vladar (Central Res. Inst. for Phys., Budapest, Hungary), A.Zawadowski.
Phys. Rev. B (USA), vol.28, no.3, p.1564-81 (1 Aug. 1983).
The general form of the interaction between tunneling two-level systems (TLS) and conduction electrons is discussed for metallic glasses. The particular form of the Hamiltonian is given in the case where only a single atom tunnels between two positions. There are two couplings correspopding to the two basic scattering processes. In the first one, the tunneling atom does not change position; the second process is the conduction-electron-assisted tunneling process. The two coupling parameters are estimated. The difference in the angular dependence of these couplings on the directions of the incoming and of the outgoing electrons is responsible for the appearance of logarithmic corrections in the scattering amplitude. Scaling equations are derived for the couplings in terms of changing the bandwidth cutoff. It is shown that the scaling equations lead to especially strong coupling in two conduction-electron scattering channels which are linear combinations of the *s*-, *p*-, and *d*-like spherical wave functions. The Hamiltonian scales to a spin $S={}^1/_2$ antiferromagnetic Kondo Hamiltonian, which indicates the formation of a 'bound state', where the motions of the tunneling atom and of the conduction-electron screening cloud around the TLS are strongly correlated; thus the Friedel oscillations follow the tunneling atom. The crossover temperature, below which the correlation becomes especially strong, is determined in the leading logarithmic approximation. (36 refs.)

108267 Theory of the interaction between electrons and the two-level system in amorphous metals. II. Second-order scaling equations. K.Vladar (Central Res. Inst. for Phys., Budapest, Hungary), A.Zawadowski.
Phys. Rev. B (USA), vol.28, no.3, p.1582-95 (1 Aug. 1983).
For pt.I see ibid., vol.28, no.3, p.1564 (1983). A general Hamiltonian for the interaction between conduction electrons and the two-level system is considered. Renormalization-group equations of second order are constructed with the use of the multiplicative renormalization-group technique. The mass renormalization is treated in detail to determine the effect of screening by conduction electrons on the energy splitting E. The crossover temperature $T_K=D(v^xv^z)^{1/2}(v^x/4v^z)^{1/4A}$, where $A=v^z$, between the weak and strong coupling regions is determined, and it is reduced by 2 orders of magnitude compared to the expression obtained in first-order scaling. The scaled values of the couplings are calculated analytically. In the crossover region the off-diagonal couplings are $v^x\sim v^y\sim{}^1/_8$. The crossover temperature can be found in the region of physical interest ($T_K>1K$) if the initial diagonal coupling $v^z>0.2$. In this case, the energy splitting calculated is reduced by more than 2 orders of magnitude. That reduction results in a large enhancement in the distribution of the energy splitting at the low-energy side. The position of the lower end of the scaling region is discussed where scaling in terms of temperature is hindered by the energy splitting. (19 refs.)

108268 Theory of the interaction between electrons and the two-level system in amorphous metals. III. Experimentally observable quantities. K.Vladar (Central Res. Inst. for Phys., Budapest, Hungary), A.Zawadowski.
Phys. Rev. B (USA), vol.28, no.3, p.1596-612 (1 Aug. 1983).
For pt.II see ibid., vol.28, no.3, p.1582 (1983). In the two immediately preceding papers a theory of interaction between electrons and two-level systems (TLS) has been developed. According to that theory, the electron scattering on the TLS is resonant scattering below a characteristic crossover temperature T_k. This resonant scattering contributes to the lifetime T_1 of the TLS due to a Korringa-type mechanism. The relaxation time T_1 has been calculated by using the renormalized enhanced-coupling constants. Making use of the different ultrasound experimental data, the authors have given the effective coupling strengths for different alloys. The average coupling is small in PdCuSi and NiP alloys to form a resonant state. For PdZr and NbZr alloys, however, the averaged coupling strengths are too small—only by less than a factor of 2—to have a resonant state. Thus in these alloys a portion of the TLS may have sufficiently large coupling to have resonant scattering if a distribution for the coupling is assumed. The electrical resistivity, as a function of temperature, is calculated. At the crossover temperature a logarithmic temperature dependence with a negative coefficient is found for one decade of the temperature. At lower temperature a crossover between the logarithmic and Fermi-liquid-type behaviors is suggested. It has been suggested that an enhanced density of state may be due to the renormalization (reduction) of the energy splitting of the TLS. That enhancement is necessary to explain the amplitude of the resistivity maximum at $T=0$ if only a small portion of the TLS has sufficiently large coupling to form the resonant state. Finally, the inelastic inverse scattering lifetime τ_{in} for conduction electrons is calculated. (42 refs.)

Electronic states in liquid metals and amorphous solids: a functional approach .... See Entry 108264

Density of states and charge distribution in hydrogenated amorphous silicon .... See Entry 108355

Investigations of the effect of nonexponential distribution of gap states of photoconductivity .... See Entry 108474

Photoemission studies of $Pd_{80-x}Si_{20}Co_x$ amorphous alloys .... See Entry 109104

71.25P Band structure of crystalline metals

108269 Electronic band structure, Fermi surface and optical properties of hexagonal yttrium. N.I.Kulikov, E.T.Kulatov.
Fiz. Nizk. Temp. (USSR), vol.9, no.8, p.823-31 (Aug. 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
By using a linearized KKR method the band structure of HCP yttrium was calculated. Self-consistency for the crystal potential was made in the framework of the local density approximation for the density functional formalism (Hedin-Lundkvist potential). Density of states, joint density of states and cross-sections of the Fermi surface were calculated and comparison with the experimental data was performed. The coincidence between theory and experiment is satisfactory. The results of computation are used for the interpretation of optical measurements. In addition, the explanation for unavailable magnetic order and superconductivity in this metal is given. (21 refs.)

108270 Weak itinerant ferromagnets: Ni_3Al. J.J.M.Buiting, J.Kubler, F.M.Mueller (Res. Inst. for Materials, Nijmegen, Netherlands).
J. Phys. F (GB), vol.13, no.9, p.L179-83 (Sept. 1983).
The electronic band structure of Ni_3Al has been calculated using the ASW method, and a high-precision density of states has been derived. Comparison with existing specific-heat measurements data suggests that Ni_3Al remains in the fluctuation regime even in the ferromagnetic state. The authors present calculations of the extremal cross-sectional areas of the Fermi surface and the corresponding orbital masses to stimulate further experiments. (15 refs.)

108271 Electron-electron interaction in 3d metals which b.c.c. structure. F.Sacchetti (Istituto di Fisica, Univ. di Perugia, Perugia, Italy).
J. Phys. F (GB), vol.13, no.9, p.1801-6 (Sept. 1983).
The calculation of the electronic states lifetime and of the enhancement factor of the electronic specific heat related to the electron-electron interaction is presented in the case of the 3d metals V, Cr, Mn and Fe with b.c.c. structure. The average lifetime of the electronic states has been found to be simply related to the interstitial electron density while no simple behaviour has been found for the enhancement factor. (22 refs.)

108272 de Haas-van Alphen effect study of electronic structures of niobium-based molybdenum alloys. H.Aoki, K.Ogawa (Nat. Res. Inst. for Metals, Tokyo, Japan).
J. Phys. F (GB), vol.13, no.9, p.1821-31 (Sept. 1983).
The electronic structures of dilute niobium-based molybdenum alloys have been studied by using the de Haas-van Alphen effect. The rate of increase of the Dingle temperature (ΔT_D*) on alloying is found to be fairly small compared with that of noble-metal alloys and to be anisotropic over the Fermi surfaces that is, 3K (at.% Mo)$^{-1}$ for ν oscillations arising from the ellipsoids, and 7K (at.% Mo)$^{-1}$ for α and η oscillations arising from the jungle gym. The change in frequency of the ν_{3456} oscillation is about $^2/_3$ that predicted by the rigid band model. Applying the partial-wave analysis to these experimental facts, the following results are obtained. (i) The d wave phase shift dominates over s, p and f wave phase shifts in this alloy system and the anisotropy in ΔT_D* results from the anisotropy in the amount of d component of the wavefunction over the Fermi surfaces. (ii) The non-rigid band-like behaviour of the ν_{3456} oscillation arises from the same origin as ΔT_D*. (iii) The significantly small ΔT_D* found in the present experiment is related to a small electron group velocity on the Fermi surfaces in niobium. (34 refs.)

108273 A theory of the electronic structure in metallic spin-glass alloys: Ag_cMn_{1-c}. M.C.Munoz, B.L.Gyorffy (H.H. Wills Phys. Lab., Univ. of Bristol, Bristol, England), K.Verhuyck.
J. Phys. F (GB), vol.13, no.9, p.1847-67 (Sept. 1983).
The authors present a first-principles description of the electronic structure in metallic spin-glass alloys. The method is illustrated by explicit calculations for the Ag_cMn_{1-c} system. In this case it consists of a Korringa-Kohn-Rostoker coherent potential approximation (KKR CPA) calculation for a three-component alloy. Namely, the lattice sites are taken to be occupied by Ag atoms with probability c, Mn atoms with local moments pointing 'up', $Mn\uparrow$, with probability $^1/_2(1-c)$ and Mn atoms with the opposite orientation, $Mn\downarrow$, with the same probability $^1/_2(1-c)$. They find that the Mn impurity band is exchange split, as in spin-polarised band theory with aligned spins, and the resulting gain in energy supports the moments. In this sense their theory is a generalisation of the Anderson model of impurity moment formation to finite concentrations. They study the density of states, Bloch spectral functions and the Fermi surface. (50 refs.)

108274 The electronic structure of non-stoichiometric Pd-rich Pd-Ag hydrides. W.M.Temmerman (Sci. & Engng., Res. Council, Daresbury Lab., Daresbury, England), A.J.Pindor.
J. Phys. F (GB), vol.13, no.9, p.1869-84 (Sept. 1983).
The authors analyse in detail the KKR CPA calculations of Pindor et al. (1983) on the electronic structure of a series of non-stoichiometric Pd-rich Pd-Ag hydrides. The authors find the hydrogen-metal bonding band split off the bottom of the metal d bands for all H concentrations. They study the electronic structure at high symmetry points and along the ΓL direction, and in particular they find two $L_{2'}$ states. They comment on the relationship of their results to the stability of hydride formation. (17 refs.)

108275 Self-energy contributions to the band structure of alkali metals: application to potassium. M.Schreiber, H.Bross (Sektion Phys., Univ. Munchen, Munchen, Germany).
J. Phys. F (GB), vol.13, no.9, p.1895-914 (Sept. 1983).
Starting from the realistic wavefunctions of Faust et al. (1976) the authors have calculated the electron self-energy Σ and corresponding corrections to the band energies of potassium in Hedin's GW approximation. The inverse dielectric function (DEF) was evaluated in the plasmon pole approximation (PPA) using a biquadratic dispersion law. The dynamical effects, i.e. the energy dependence of Σ in the quasiparticle equation, were taken into account fully self-consistently, showing significant shifts with respect to the usual first-order calculations. They found the expected reduction of self-energy contributions as compared with the static approximation from which they started. Moreover, the core polarisation could be included in a consistent way, yielding better agreement with experimental data. (40 refs.)

108276 Filling of the 3d band of the manganese in $GdAl_{2-x}Mn_x$ for $x<0.2$. A.Slebarski, K.Kaczmarska, E.Kwapulinska (Inst. of Phys., Silesian Univ., Katowice, Poland).
J. Magn. & Magn. Mater. (Netherlands), vol.38, no.1, p.51-6 (Aug. 1983).
X-ray, magnetic, electrical sensitivity and ESR studies of $GdAl_{2-x}Mn_x$ compounds were performed. The transition temperatures, effective mass, thermal broadening of resonance linewidth and g-factors were obtained. For low concentration of $GdMn_2$ in $GdAl_2$ up to 20%, Mn is nonmagnetic. Increasing of the effective mass and the thermal broadening linewidth ESR with increasing x can be explained by the presence of d-electrons. (13 refs.)

108277 Application of special-directions method to the optical properties of copper and silver. A.K.Ahuja, S.Auluck, S.K.Joshi (Dept. of Phys., Univ. of Roorkee, Roorkee, India).
Phys. Status Solidi b (Germany), vol.118, no.2, p.575-86 (1 Aug. 1983).
Using the interpolation scheme (with four OPWs) the density of states $N(E)$, joint density of states JDOS(E), and the frequency dependent dielectric function $\epsilon_2(\omega)$ for copper (non-relativistic) and silver (relativistic) are calculated. The summation over the k-vectors lying in the first Brillouin zone are performed using the special directions (SD) method. The effect of increasing the number of SDs is investigated. The optical matrix elements are evaluated by a method given by Smith (1979). The effect of including a relaxation time τ on $\epsilon_2(\omega)$ is studied. Also a calculation of $\epsilon_2(\omega)$ for copper including 16 OPWs in the interpolation scheme is given and found that the agreement with experimental results is improved at the higher energies by increasing the number of OPWs in the interpolation scheme. (27 refs.)

108278 Angle-resolved photoemission and band structure of copper. R.Courths, B.Cord, H.Wern, S.Hufner (Fachbereich Phys., Univ. of Saarland, Saarbrucken, Germany).
Phys. Scr. (Sweden), vol.T4, p.144-7 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).
The triangulation method, the appearance angle method and for the first time the surface emission method have been used for the determination of the electronic band structure of copper along the [001], [110] and [111] direction from ARPES spectra taken on the (110) and (111) faces. The experimentally derived bands are compared with first-principles calculations. For the bands up to energies of 20 eV above the Fermi energies it is found that Burdick's band calculation is in good agreement with experiment. Together with published normal emission data an almost complete experimental band structure below the Fermi energy is derived which clearly shows the spin-orbit splitting of the d-bands. (19 refs.)

108279 Method for band structure determination from angle-dispersed photoemission data: application to Ni. H.Martensson, P.-O.Nilsson (Dept. of Phys., Chalmers Univ. of Technol., Goteborg, Sweden).
Phys. Scr. (Sweden), vol.T4, p.152-4 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).
The authors have performed a least-square fit of a Hodges-Ehrenreich-Lang interpolation scheme to experimentally determine initial-states of Ni from different kinds of measurements. From the band structure obtained in this way, structure plots (energy vs. emission angle) for mirror-plane emission from low-index Ni surfaces have been made. These structure plots are based on free-electronlike final-state dispersion, but by allowing the final-state to have a certain width it is possible to find structures that are rather independent of the final-state dispersion. Using the corresponding measured structures for a refined fit of the interpolation scheme parameters, the authors have got a semi-empirical band structure for Ni giving a good overall agreement with the measured angle-dispersed spectra. It is also shown how the structure plots can be used to determine the accuracy of energy-coincidence measurements. (14 refs.)

De Haas-van Alphen study of the solute atom yttrium in magnesium host ....See Entry 108351

On the resistivity behaviour of some weak-ferromagnetic nickel-based alloys ....See Entry 108385

A critical concentration of Ni-Mn alloys at about 6 at.% Mn ....See Entry 108386

Relation between thermal EMF of low-alloyed nickel base alloys and structure of Ni 3d band ....See Entry 108394

Three body problem in transition metals—application to nickel ....See Entry 108633

Magnetism of linear chains .... See Entry 108635

Induced neutron magnetic form factor of $LaSn_3$ .... See Entry 108637

Composition and temperature dependence of the density of states at the Fermi level in vanadium-based A-15 compound systems [NMR study] ....See Entry 108826

Density-functional theory of the Compton profiles of beryllium metal ....See Entry 109035

Positron study of Nb-Mo alloys .... See Entry 109037

71.25R Band structure of crystalline elemental semiconductors

Electronic structure of anisotropic semiconductors: optical properties and behaviour under hydrostatic pressure ....See Entry 108280

71.25T Band structure of crystalline semiconductor compounds and insulators

108280 Electronic structure of anisotropic semiconductors: optical properties and behaviour under hydrostatic pressure. H.M.Isomaki (Dept. of General Sci., Helsinki Univ. of Technol., Espoo, Finland).
Acta Polytech. Scand. Electr. Eng. Ser. (Finland), no.EL51, p.2-15 (1983).
The results of investigations into the electronic properties of trigonal Se and Te and hexagonal TiS_2, $TiSe_2$, ZrS_2 and $ZrSe_2$ are summarised. The ab initio energy bands are obtained with the use of the self-consistent orthogonalised-plane-wave (OPW) method. The permittivity, reflectivity, absorption coefficient and electron-energy-loss function are calculated for Se, Te, ZrS_2 and $ZrSe_2$ with the use of the rigorously evaluated momentum matrix elements. The local-field effects are estimated to be small which contradicts the recent model studies for Se and Te. (no refs.)

108281 Plasmon approach to the average energy gap of Mg, Ca and Sr compounds. V.K.Srivastava, A.R.Chetal (Dept. of Phys. & Math., Indian School of Mines, Dhanbad, India).
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.1014-18 (July-Aug. 1983).
The average energy gap of magnesium, calcium and strontium compounds has been calculated by using the plasma oscillation theory of solids. The calculated values are in fair agreement with the observed values and the values calculated by different workers. The authors' calculations are not restricted to simple binary and ternary compounds but can also be successfully applied to all types of compounds. (21 refs.)

108282 Energy spectrum of Bi_2Te_2Se. R.S.Erofeev, E.I.Shcherbina.
Inorg. Mater. (USA), vol.18, no.11, p.1546-50 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1802-6 (Nov. 1982).
Analysis of the electron states indicates that Bi_2Te_2Se alloys are not completely ordered. The amount of Te atoms in the central chalcogen layer may be as much as 30%. Bi_2Te_2Se should show electron conduction, while the

electron concentration and the effective mass are definitely dependent on the degree of ordering, as is confirmed by experiment. (7 refs.)

108283 Indirect interband transitions in $Ga_{1-y}In_yP_{1-x}As_x$. G.F.Smirnova (Minsk Radio-Engng. Inst., Minsk, Belorussian SSR).
Inorg. Mater. (USA), vol.18, no.9, p.1252-5 (Sept. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.9, p.1468-70 (Sept. 1982). [received: Sept. 1983]
An equation has been obtained for calculating the indirect forbidden band width of $Ga_{1-y}In_yP_{1-x}As_x$ solid solutions of any composition. Criteria have been proposed for determining the type of the band structure of these solid solutions. (7 refs.)

108284 Theoretical study of lattice instability and lattice dynamics of 2H-TaSe$_2$ and 2H-NbSe$_2$. I. Electron Interaction and generalized electronic susceptibility. K.Motizuki, E.Ando (Dept. of Material Phys., Osaka Univ., Toyonaka, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2849-57 (Aug. 1983).
Lattice instability of $2H$-TaSe$_2$ and $2H$-NbSe$_2$ is studied on the basis of the electronic band structure of these compounds obtained by a tight-binding fit to Mattheiss' (1973) band calculation. The wave number and mode dependences of the electron-lattice coupling matrix and the generalized electronic susceptibility are calculated. The results are discussed in connection with the lattice instability. (32 refs.)

108285 Metastable electron states in doped alloys $Pb_{1-x}Sn_xTe$. B.A.Akimov, N.B.Brandt, L.I.Ryabova (Dept. of Low Temperature Phys., Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.12-18 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.12-18 (1982).
The authors present the results of an investigation of nonequilibrium states and long-lived relaxation processes which occur in doped alloys $Pb_{1-x}Sn_xTe$ at temperatures $T \lesssim 20K$ when the system is brought out of equilibrium by a quantizing magnetic field, IR illumination, or by a strong electric field. The results obtained indicate that the energy spectrum of the alloys studied contain metastable electron states. (4 refs.)

108286 Renormalized atom model (RAM) applied to the heavy rare-earth sesquioxides in cubic crystal structure. F.Lopez-Aguilar, J.Costa-Quintana (Dept. de Electricidad y Electronica, Univ. Autonoma de Barcelona, Barcelona, Spain).
Phys. Status Solidi b (Germany), vol.118, no.2, p.779-87 (1 Aug. 1983).
The electronic structure of the b.c.c. heavy rare-earth sesquioxides is analyzed through the single-site solutions within the renormalized atom model (RAM) and using the relativistic version. The Coulomb correlation energy is calculated in order to determine the unoccupied 4f levels. (35 refs.)

108287 Semirelativistic SCF-SW-Xα calculations of uranium compounds. Electronic structure and chemical bond. V.Heera, G.Seifert, P.Ziesche (Sektion Phys., Tech. Univ. Dresden, Wissenschaftsbereich Theoretische Phys., Dresden, Germany).
Phys. Status Solidi b (Germany), vol.118, no.2, p.K107-12 (1 Aug. 1983).
The authors carried out semirelativistic SCF-SW-Xα calculations of clusters which are representative for bulk materials UO$_2$, α-UO$_3$, and UC. In their semirelativistic approach they consider relativistic corrections, neglecting the spin-orbit interactions, via semirelativistic t_l^{-1} in the scattered wave secular equations. However, they obtain semirelativistic t_l^{-1} from semirelativistic wave functions $P_l(r)$ by averaging the major components of the solution of the Dirac equation within the atomic sphere. (20 refs.)

108288 The electronic structure of CeO$_2$ and PrO$_2$. D.D.Koelling (Argonne Nat. Lab., Argonne, IL, USA), A.M.Boring, J.H.Wood.
Solid State Commun. (USA), vol.47, no.4, p.227-32 (July 1983).
The authors have determined the electronic structure of CeO$_2$ and PrO$_2$ by performing SCF band calculations. They find that in both systems there are metal f- and d-electrons in the oxygen 2p bands. They discuss the question of valency and ionicity in these systems. (11 refs.)

108289 The nature of temperature dependence of energy gaps in layer semiconductors. G.L.Belenkii, E.Yu.Salaev, R.A.Suleimanov, N.A.Abdullaev (Inst. of Phys., Acad. of Sci., Baku, USSR).
Solid State Commun. (USA), vol.47, no.4, p.263-5 (July 1983).
The temperature dependences of direct and indirect energy gaps in layer semiconductors GaS, GaSe and GaS_xSe_{1-x} are investigated in the temperature range 5-150K. The nonmonotonous behaviour of $E_g(T)$ dependences is observed in these crystals. It is shown that the effect of thermal expansion cannot in itself explain the observed anomalies. A new model of electron-phonon interaction explaining the $E_g(T)$ behaviour in layer crystals is proposed. (16 refs.)

Ab initio studies on hydrogen-bonded chains. III. The linear, infinite chain of hydrogen cyanide molecules .... See Entry 106278

Degenerate four-wave mixing due to intervalance band transition in *p*-type mercury cadmium telluride .... See Entry 106825

Growth and physical properties of Ln$_2$GeSe$_5$, Ln$_2$Ge$_2$Se$_7$, Ln$_2$Ge$_3$Se$_9$ single crystals .... See Entry 107578

Structural origin of optical bowing in semiconductor alloys ....See Entry 107594

Partial LCAO densities of states for ScN, TiN, ZrN and ScP .... See Entry 108259

Band structure calculations in N-ary alloys .... See Entry 108261

Self-energy contributions to the band structure of alkali metals: application to potassium .... See Entry 108275

Electron-phonon coupling detection in infrared spectra of ion-radical salts based on dibenztetrathiofulvalen .... See Entry 108311

Photoelectronic properties of Cu$_3$PS$_4$ and Cu$_3$PS$_3$Se single crystals .... See Entry 108416

Electrical transport properties of GaAs and AlAs mixed crystals for semiconductor devices .... See Entry 108417

Electrical studies on (Mo/W)Se$_2$ single crystals. II. Temperature dependence of Hall effect .... See Entry 108457

Self-consistent evaluation of nonuniform superlattice parameters by the harmonic method .... See Entry 108540

Cyclotron resonance in the conduction band of GaP in very high magnetic fields .... See Entry 108789

Magneto-optical investigations of a novel superlattice: HgTe-CdTe .... See Entry 108930

Polarized ZnK- and OK-emission bands of ZnO .... See Entry 109056

Investigation of the sintering process of NiO from the point of view of its electronic structure .... See Entry 109179

71.30 METAL-INSULATOR TRANSITIONS

108290 Electron localization in a magnetic semiconductor: $Gd_{3-x}\nu_xS_4$. S.von Molnar (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), A.Briggs, J.Flouquet, G.Remenyi.
Phys. Rev. Lett. (USA), vol.51, no.8, p.706-9 (22 Aug. 1983).
The metal-insulator transition in the magnetic semiconductor $Gd_{3-x}\nu_xS_4$, where ν stands for vacancies, has been studied by tuning through the transition with the application of a magnetic field at low temperatures. For two samples with $x=0.321$ and 0.325 the transition is continuous. $\sigma(T\rightarrow 0)$ is linear in H-H_c which implies that $\sigma(T\rightarrow 0)\propto(E\text{-}E_c)$, where H_c is a critical field and E_c is the mobility edge. This is consistent with new scaling theories of both localization and interaction effects. (20 refs.)

108291 Role of phonon-induced hybridization in the spinless Anderson model. J.Zielinski, J.Kowalska (Inst. of Phys., Silesian Univ., Katowice, Poland).
Phys. Status Solidi b (Germany), vol.118, no.2, p.805-10 (1 Aug. 1983).
The spinless Anderson model accomplished by phonon-induced hybridization is considered. It is found that in the periodic case an insulator-metal transition appears depending on the values of parameters and temperature. In the case of an isolated impurity a pronounced temperature dependence takes place leading to an increase of the virtual state width. (21 refs.)

108292 A note on some aspects of the disordered effect in the Mott-Hubbard transition. S.Nara (Inst. for Theoretical Phys., Univ. of Stuttgart, Stuttgart, Germany).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.169-74 (1983).
The Hubbard model is extended to include the effect of random atomic potentials and transfer integrals of electron. The density of states of quasiparticles is calculated with the use of Hubbard's third approximation for the electron correlation problem and the coherent potential approximation for the random problem (Shiba's method). The results suggest that the band gap due to the correlation effect in an insulator phase vanishes in the presence of a certain value of the randomness. However, this does not necessarily imply an insulator-to-metal transition which would be determined by the relative position of the mobility edge and the Fermi level. (13 refs.)

108293 Evidence for one-half charge-density-wave wavelength pinning periodicity in Peierls conductors. P.Monceau, M.Renard, J.Richard, M.C.Saint-Lager, H.Salva, Z.Z.Wang (Centre de Recherches sur les Tres Basses Temperatures, CNRS, Grenoble, France).
Phys. Rev. B (USA), vol.28, no.3, p.1646-8 (1 Aug. 1983).
It is shown that, for transition-metal trichalcogenides NbSe$_3$, for TaS$_3$ both with a monoclinic and an orthorhombic unit cell, and for transition-metal tetrachalcogenide (TaSe$_4$)$_2$I, compounds which exhibit transport properties associated with charge-density-wave motion, the linear relationship between the current carried by the charge-density wave and the fundamental frequency of the AC voltage detected in the nonlinear state leads to a pinning potential periodicity which is half the charge-density-wave wavelength in agreement with the recent theory of Josephson oscillations of Barnes and Zawadowski. (28 refs.)

108294 Formal Mott transition between the one dimensional conductor $K_{0.3}MoO_3$ and the highly anisotropic semiconductor $K_{0.33}MoO_3$. G.Travaglini, P.Wachter (Lab. fur Festkorperphys., ETH Honggerberg, Zurich, Switzerland).
Solid State Commun. (USA), vol.47, no.4, p.217-21 (July 1983).
The blue bronze $K_{0.3}MoO_3$ is well known to have a 1-D character along the crystallographic b axis. The red bronze $K_{0.33}MoO_3$, instead, is a semiconductor with a 0.5 eV energy gap. The two bronzes have a different crystallographic configuration. In a microscopic model one can derive the red bronze structure from the one of the blue bronze and one can explain the metal semiconductor 'transition' between $K_{0.3}MoO_3$ and $K_{0.33}MoO_3$ with a formal Mott transition of delocalized into localized states due to a critical overlap between cation-anion-cation orbitals. (15 refs.)

Features of structural changes accompanying the metal-semiconductor phase transition in an oxidized vanadium foil .... See Entry 107908

Phase composition and electrophysical properties of EuS- and Sm-based films .... See Entry 108225

Charge orderings and lattice distortions in complex TCNQ salts .... See Entry 108316

The impurity effect on the phase transitions in quasi-one-dimensional conductors .... See Entry 108398

An experimental determination of the critical exponents at the metal-insulator transition .... See Entry 108481

Metal-nonmetal transition and superconductivity in frozen tin-hydrogen films .... See Entry 108598

71.35 EXCITONS AND RELATED PHENOMENA

(inc. electron-hole drops)

108295 Localization of excitonic eigenfunctions in isotopically mixed naphthalene crystals. J.P.Lemaistre, A.Blumen (Centre de Mecanique Ondulatoire Appliquee, Paris, France).
Chem. Phys. Lett. (Netherlands), vol.99, no.4, p.291-4 (12 Aug. 1983).
Presents numerical calculations for the localization of excitonic eigenfunctions in substitutionally disordered naphthalene crystals. The distribution of the localization indices is evaluated by considering the off-diagonal disorder due to short-ranged triplet interactions. The transition from molecular to crystal-like eigenfunctions occurs gradually as the trap concentration increases. (24 refs.)

108296 Polarization energy of a localized charge in a molecular crystal. VI. Effect of excitons. I.Eisenstein, R.W.Munn (Dept. of Chem., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
Chem. Phys. (Netherlands), vol.79, no.2, p.189-95 (1 Sept. 1983).
For pt.V see ibid., vol.77, p.47 (1983). The polarization energy of a localized charge carrier in a molecular crystal changes by ΔP near an exciton, viewed as a localized excited molecule of changed palarizability. Experimental polarizability changes in the first excited singlet state are used to calculate ΔP for various carrier and exciton positions in benzene, naphthalene, anthracene, and tetracene. As the excited-state polarizability is larger, ΔP is normally negative, with minima ranging from -12 meV in benzene to -83 meV in tetracene. The change in charge-quadrupole energy ΔW_Q is estimated for naphthalene using a theoretical quadrupole moment for the first triplet state. At most sites $|\Delta W_Q|>|\Delta P|$, but the sign of ΔW_Q varies. The net exciton interaction with electrons in naphthalene varies from -49 to $+45$ meV and with holes from -106 to $+29$ meV. This behaviour is broadly complementary to that previously calculated for vacancies. (23 refs.)

108297 Excitons in aluminium. M.S.Miller, H.D.Drew (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA).
J. Phys. F (GB), vol.13, no.9, p.1885-93 (Sept. 1983).
A nearly free electron description of the parallel bands responsible for the 1.6 eV absorption edge in aluminium gives rise to an inverse square-root singularity in the joint density of states. The authors have explored the possibility of excitons associated with the corresponding optical transitions. A calculation based on the Bethe-Salpeter equation with a statically screened Coulomb interaction between carriers shows that the singularity in the joint density of states leads to a singlet exciton with a binding energy of only 5 meV. For the case of a triplet exciton they estimate a binding energy of 20 meV. These results are discussed in relation to experiments. (16 refs.)

108298 Exciton solitons in one-dimensional molecular crystals. S.Takeno (Dept. of Phys., Kyoto Tech. Univ., Kyoto, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1798-80 (June 1983).
Exciton solitons in one-dimensional molecular crystals arising from interactions with lattice vibrations are studied by taking kinematical interactions of excitons into account. The nonlinear Schrodinger equation follows from a nonlinear Klein-Gordon-type equation by the use of rotating-wave approximation. (13 refs.)

108299 Ionization of the direct-gap exciton in photoexcited germanium. H.Schweizer, A.Forchel, A.Hangleiter (Phys. Inst., Univ. Stuttgart, Stuttgart, Germany), S.Schmitt-Rink, J.P.Lowenau, H.Haug.
Phys. Rev. Lett. (USA), vol.51, no.8, p.698-701 (22 Aug. 1983).
The excitonic absorption at the direct gap in Ge is measured as a function of the density and temperature of excitations at the indirect gap. The spectra are analyzed by means of a many-body theory which is valid for arbitrary free-carrier densities. The critical densities for the ionization are determined for temperatures from 8.5 to 60K and compared with other predictions. (19 refs.)

108300 The influence of the variation of the chemical composition and of the nitrogen doping level on the energy spectra of the bound excitons in $GaAs_{1-x}P_x$:N. N.R.Nurtdinov, R.Stegmann, M.Griepentrog (Dept. of Phys., Moscow State Univ., Moscow, USSR).
Phys. Status Solidi b (Germany), vol.118, no.2, p.613-21 (1 Aug. 1983).
The spectras of photoluminescence (PL), photoexcitation (PE) and cathodoluminescence (CL) in $gaAs_{1-x}P_x$:N ($x \geq 0.67$) are investigated. The spectral position of the N_x-line can be described by a logarithmic dependence on the excitation level and on the nitrogen concentration. Different methods are worked out to determine the nitrogen concentration by measurements of PL, PE, and CL. The results allow assertions about the influence of the disorder in the As-P sublattice and of the interaction of the nitrogen atoms on the energy spectra of the bound excitons. (17 refs.)

108301 Exciton-enhanced double injection currents in tetracene crystals. J.Kalinowski, R.Signerski (Inst. of Phys., Tech. Univ., Gdansk, Poland).
Phys. Status Solidi b (Germany), vol.118, no.2, p.K147-50 (1 Aug. 1983).
Provides experimental evidence for the influence of triplet excitons on the I-V behaviour of double injection into single tetracene crystals in the dark and under illumination by highly absorbed light. The monotonic increase in the electroluminescence effect shows that the major part of the emission is the delayed electroluminescence and the monotonic decrease in the magnetic field effect on the current provides evidence that the triplet excitons and not singlets are responsible for the detrapping. This also suggests that in the case when light is used for exciton generation the main role in the detrapping is due to triplet excitons. (15 refs.)

108302 Removal of the degeneracy in the description of electron-hole-cloud configurations. J.S.Kirkaldy, L.R.B.Patterson (Dept. of Phys., McMaster Univ., Hamilton, Ontario, Canada).
Phys. Rev. A (USA), vol.28, no.3, p.1612-17 (Sept. 1983).
The prediction of the stable configuration of an ideal uniformly volume-pumped electron-hole cloud involves the rationalization of a 'free-boundary' problem. That is to say, there are an infinite number of degenerate steady-state solutions which satisfy the fluid-dynamical equations and the boundary conditions. If the stationary states are metastable due to isolation or freedom from large-scale fluctuations in the cloud, then all states are attainable via differing initial conditions (e.g. variable risetime of the laser pump). On the other hand, if configurational changes can occur by fluctuation, creation and annihilation of drops at any 'stationary' state, however slowly, then it is necessary to specify a global thermokinetic optimum if a unique stable solution is to be identified. Both the uniquely stable and hysteresis cases are experimentally observed. In this contribution the authors solve the fluid-dynamical equations for a cloud, explicitly demonstrating the degenerate nature of the boundary-value problem. The global dissipation rate is evaluated and shown to be a function of the exciton-gas density as a unique internal order parameter possessing two zeros and a maximum value, and free of explicit configurational parameters. The hypothesis of a stable maximal state in a topologically fluctuating milieu (already suggested by Onsager's dissipation principle) leads near the saturation line to strictly linear global and local flux-force relations as Euler-Lagrange equations and to explicit expressions for the drop density and exciton density which are in good functional and fair quantitative accord with conventional, low-excitation stripe and cylinder pumped experiments. The theoretical expression for the drop radius is less successful, because of the inappropriateness of the available experimental test and the strong experimental artifacts. (27 refs.)

108303 Electrons and excitons in nonlinear molecular chains. A.S.Davydov, A.V.Zolotariuk (Inst. for Theoretical Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Scr. (Sweden), vol.28, no.2, p.249-56 (Aug. 1983).
The soliton theory is developed to describe the motion of an excess electron (or intramolecular excitation) in molecular chains with a strong electron (exciton)-phonon coupling for a wide class of realistic (nonlinear) nearest-neighbour interactions. To illustrate the theory some examples such as the chain of harmonically coupled molecules (linear chain) and the chains with power anharmonicities and a core potential are considered. (5 refs.)

108304 On the theory of the one-dimensional bi-excitonic molecule. H.T.Coelho (Dept. de Fisica, Univ. Federal de Pernambuco, Recife, Brazil), A.Delfino,Jr., N.Majlis.
Physica B & C (Netherlands), vol.122B+C, no.1, p.73-84 (Sept. 1983).
Presents a model of the bi-excitonic molecule, two electrons and two holes bound together, in a quasione-dimensional semiconductor. The problem is solved following the Hyperspheric Harmonic approach, transforming it into an equivalent problem of one particle in a three-dimensional potential. The formalism admits application to any pair-wise interaction between the particles, and obtaining bound states is reduced to matrix diagonalization. The authors adopt a δ-function interaction and calculate the binding energy of the ground state in the simplest possible approximation, truncating the expansion at $l=0$. They obtain the stability of the bi-exciton, for a ratio σ of the electron and hole effective masses, whenever the colliding excitons have a kinetic energy above a threshold, also given interms of σ. The theory is reliable for $0.2 \leq \sigma \leq 1.0$. The conclusion for TTF-TCNQ is that bi-exciton formation at low T is possible. (13 refs.)

Time-resolved nonlinear luminescence spectroscopy by picosecond excitation correlation .... See Entry 105388

Low temperature photoluminescence of detector-grade HgI_2 .. See Entry 106225

Optical dephasing of excitonic polaritons in CuCl studied by time-resolved, nondegenerate four-wave mixing .... See Entry 108307

An optical characterization of defect levels induced by MBE growth of GaAs . ... See Entry 108335

Field-dependent photocarrier generation in crystalline polydiacetylenes .... See Entry 108470

Optical and optically detected magnetic resonance studies of AgBr:I^- .... See Entry 108838

Analysis of conditions for additional minimum formation in the linear-cross splitting region in exciton reflection spectra .... See Entry 108916

Quantum beating of vibrational factor group components in molecular solids ... . See Entry 108938

Optical absorption and magnetic circular dichroism of MnI_2 .... See Entry 108974

Excitonic reflectance of GaAs crystals cleaved in liquid helium .... See Entry 108975

Quantum yield of the guest in the linear chain of molecules . See Entry 108990

Resonant Raman scattering and hot luminescence at the indirect exciton in BiI_3 .... See Entry 108997

Electroluminescence in In-ZnSe:Cu-ZnSe(s)-Au structures ...... See Entry 109019

71.36 POLARITONS

(inc. photon-phonon and photon-magnon interactions)

108305 Experimental observation of long-range surface plasmon polaritons. Y.Kuwamura, M.Fukui, O.Tada (Dept. of Electronic Engng., Univ. of Tokushima, Tokushima, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2350-5 (July 1983).
The ATR technique (glass prism-index matching oil-Ag-CaF_2 single crystal) has been used to observe long-range surface plasmon polaritons discussed recently by Sarid (1981, 1982). At 632.8 nm, the authors have successfully observed the surface plasmon polaritons in the propagation distance of 105 μm. (8 refs.)

108306 Charge-density excitations at the surface of a semiconductor superlattice: a new type of surface polariton. G.F.Giuliani, J.J.Quinn (Brown Univ., Providence, RI, USA).
Phys. Rev. Lett. (USA), vol.51, no.10, p.919-22 (5 Sept. 1983).
A new type of surface polariton, which can occur at the surface of a semiconducting superlattice, is introduced. Because of the quantization of the electron energy levels by the superlattice potential this new polariton mode has the remarkable property of being free from Landau damping. (11 refs.)

108307 Optical dephasing of excitonic polaritons in CuCl studied by time-resolved, nondegenerate four-wave mixing. Y.Masumoto, S.Shionoya (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan), T.Takagahara.
Phys. Rev. Lett. (USA), vol.51, no.10, p.923-6 (5 Sept. 1983).
Optical dephasing of excitonic polaritons in CuCl is directly measured for the first time in the picosecond time domain by means of time-resolved, nondegenerate four-wave mixing. Dephasing of the ω_1 polariton pulse is probed by an interrogation ω_2 polariton pulse whose group velocity is faster than that of the ω_1 polariton pulse. It is found that the dephasing damping constant $\Gamma/2$ of excitonic polaritons is of order of 0.01 meV and increases as $\hbar\omega_1$ approaches the exciton resonance energy from below. (12 refs.)

108308 Phonon polaritons in the presence of a magnetic field. K.Reginski (Inst. of Fundamental Technol. Res., Polish Acad. of Sci., Warsaw, Poland).
Phys. Status Solidi b (Germany), vol.118, no.2, p.587-93 (1 Aug. 1983).
The problem of propagation of phonon polaritons in the presence of an external magnetic field is investigated on the basis of equations of motion derived previously. First the dispersion relations for diatomic ionic crystals in the absence of a magnetic field are derived. Then the indices of refraction of right and left circularly polarized waves are found in the case of the Faraday configuration of the system. The Faraday rotation as a function of frequency is determined. Numerical calculations are performed for NaI. (4 refs.)

108309 Surface polaritons in nonlinear media. M.Y.Yu (Inst. fur Theoretische Phys., Ruhr-Univ. Bochum, Bochum, Germany).
Phys. Rev. A (USA), vol.28, no.3, p.1855-6 (Sept. 1983).
It is shown that the general dispersion relation of electromagnetic surface waves propagating at the interface of certain types of nonlinear media can be obtained exactly without first solving for the field profiles across the boundary. (7 refs.)

108310 Polaritons in thin crystals. E.I.Bondarenko, N.M.Ivanov, E.N.Myasnikov.
Ukr. Fiz. Zh. (USSR), vol.28, no.7, p.1106-7 (July 1983). In Russian.
It is theoretically shown that the dispersion of self-generated waveguide modes in a thin crystal should be such that as if the force of the oscillator realising the phototransition in the crystal effectively decreases with decreasing thickness. (6 refs.) *V.G.P.*

Polariton solitary waves in a quasi-one-dimensional ferromagnet .... See Entry 108680

Simple theory for surface-plasmon-polariton resonance on sinusoidal metal surface: application to SERS .... See Entry 108943

71.38 POLARONS AND ELECTRON-PHONON INTERACTIONS

(for electron-phonon interactions in lattices, see also 63.20K)

108311 Electron-phonon coupling detection in infrared spectra of ion-radical salts based on dibenztetrathiofulvalen. V.A.Starodub, T.B.Drushlyak, L.A.Sleta (Kharkov A.M. Gorky State Univ., Kharkov, USSR).
Int. J. Quantum Chem. (USA), vol.24, no.2, p.149-59 (Aug. 1983).
The electron-phonon-coupling constants in a cation radical of dibenztetrathiofulvalen ($DBTTF^+$.) have been calculated. To calculate the electronic structure of $DBTTF^+$. in equilibrium and distorted structures use was made of the unrestricted Hartree-Fock method as π-electron approximation for symmetrical vibrations of $DBTTF^+$.. The results obtained are in good agreement with the experimental data on IR spectra of DBTTF-based cation-radical salts. (21 refs.)

108312 Two-polaron solution and its stability in the continuum model of polyacetylene. Y.Onodera, S.Okuno (Dept. of Phys., Tokyo Metropolitan Univ., Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2478-84 (July 1983).
Explicit two-polaron solution, is found in the continuum model of trans-polyacetylene. The solution is explored to examine stability of two polarons. It is found that two free polarons attract each other with a long range force until they form a single polaron with two carriers therein, which then dissociates into charged kink-antikink pair owing to a short range repulsion. Thus the reaction mechanism of two polarons into two charged kinks is clarified.

Theoretical study of lattice instability and lattice dynamics of 2H-$TaSe_2$ and 2H-$NbSe_2$. I. Electron Interaction and generalized electronic susceptibility .... See Entry 108284

Role of phonon-induced hybridization in the spinless Anderson model .... See Entry 108291

Heavy doping effects on donor-acceptor spectra of polar semiconductors at low temperatures .... See Entry 108346

Electron-spin-resonance studies of pyrrole polymers: Evidence for bipolarons .... See Entry 108783

Optical properties of donor electrons in semimagnetic semiconductors .... See Entry 108947

71.45 COLLECTIVE EFFECTS

108313 Defects in the sine-Gordon model: statics. H.Reisinger, F.Schwabl (Phys. Dept., Tech. Univ. Munchen, Garching, Germany).
Z. Phys. B (Germany), vol.52, no.2, p.151-70 (1983).
The one-dimensional sine-Gordon model where the field couples linearly to localized defects is studied. This model describes the phase fluctuations of one-dimensional charge density waves if amplitude fluctuations are neglected. For isolated defects the nonlinear stationarity conditions can be solved analytically. Given these stationary solutions the fluctuation spectrum consisting of a bound state and the scattering states and the relevant correlation functions can be computed exactly. The stationary states for a system of two defects are presented. The free energies as a function of the separation of the defects is computed for the absolutely stable stages and for the local minima of the free energy function. This allows the authors to consider the interaction of the defects induced by the sine-Gordon field. Finally they compute the order parameter correlation function for a random distribution of defects for small concentration n. Devising a cumulant expansion the correlation function is found exactly in the first order in n. Their result contains the combined effect of the defects on the stationary states and on the phonon Green's function. It has applicability beyond the present context. (19 refs.)

108314 On the structure of solitary waves in molecular chains. V.I.Kruglov (Inst. of Phys., Acad. of Sci., Minsk, Byelorussian SSR).
J. Phys. C (GB), vol.16, no.26, p.5083-91 (20 Sept. 1983).
The structure of solitary waves in a quantum molecular chain, with the contribution of phonons with different wavenumbers taken into account, is investigated. The problem is solved on the basis of a non-linear non-local wave equation. It is shown that there exist two types of localised collective excitations which depend on the excitation velocity v and the carrier wave phase velocity v_c. The criteria are considered of continuity and stability of excited bound multiparticle states and the estimation of their validity for the typical parameter values of a molecular chain is presented. (13 refs.)

108315 Neutron investigations of the charge-density wave in α-uranium. J.C.Marmeggi, A.Delapalme, G.H.Lander, C.Vettier (Lab. de Cristallographie, CNRS, Grenoble, France).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.263-6 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The authors report on an experiment to measure the intensities of 240 first-order satellites discovered at low temperature in α-U and having an incommensurable wave vector $\mathbf{q}=[0.5, 0.176, 0.182]$. Details of the model based on the displacements along the three crystallographic axes and some of its possible shortcomings are presented. (13 refs.)

108316 Charge orderings and lattice distortions in complex TCNQ salts. S.Robaszkiewicz, T.Kostyrko (Inst. of Phys., A. Mickiewicz Univ., Poznan, Poland).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.134-52 (1983).
A model for the description of charge orderings and distortions in complex TCNQ salts involving intra- and interchain electron interactions and electron-lattice couplings is investigated. Its thermodynamical properties are analysed in the limit of infinitely strong intramolecular Coulomb repulsion, treating intermolecular interactions within the two-sublattice H-F approximation. Stability conditions for various types of orderings are determined. Site charge ordering and dimerization accompanied by bond charge ordering are found to coexist only in a limited range of parameters diminished by the hopping and the electron-phonon coupling via Coulomb forces. Depending on the value of the latter, interaction phase transitions in the system can be continuous or not. Intermolecular Coulomb interaction stabilizes site charge ordering but it can also essentially enhance transition temperatures and energy gap in dimerized phases. For experimentally reliable values of parameters the energy gaps predicted by the model are in good agreement with those observed in $D^+(TCNQ)_2^-$. (57 refs.)

108317 Commensurate charge-density-wave states of a layer of the 2H-$TaSe_2$ structure. A.E.Jacobs, P.D.Poll, M.B.Walker (Dept. of Phys., Scarborough Coll., Univ. of Toronto, Toronto, Ontario, Canada).
Phys. Rev. B (USA), vol.28, no.3, p.1621-2 (1 Aug. 1983).
The commensurate charge-density-wave states of a single layer of the 2*H*-$TaSe_2$ structure are studied theoretically. A new phase, with two of its charge-density-wave amplitudes much larger than the third is stable in a limited region of the parameter space of the model of Jacobs and Walker. (7 refs.)

Dechanneling anomalies of high-energy ions at the charge-density-wave transition in 1*T*-TaS_2 .... See Entry 107790

Divergent elastic response in the commensurate charge-density-wave state of 2*H*-$TaSe_2$ .... See Entry 107926

A note on some aspects of the disordered effect in the Mott-Hubbard transition .... See Entry 108292

Evidence for one-half charge-density-wave wavelength pinning periodicity in Peierls conductors .... See Entry 108293

Charge-density excitations at the surface of a semiconductor superlattice: a new type of surface polariton .... See Entry 108306

Acceptors in wide-gap semimagnetic semiconductors .... See Entry 108336

The impurity effect on the phase transitions in quasi-one-dimensional conductors .... See Entry 108398

Hysteresis in the electrical properties of orthorhombic tantalum trisulphide: evidence for an incommensurate-commensurate charge-density wave transition? .... See Entry 108401

Infrared conductivity from spin and charge density waves: $(TMTSF)_2X$ .... See Entry 108404

Self-consistent treatment of dynamical diffusion coefficient of two dimensional random electron system under strong magnetic fields. II .... See Entry 108454

Anomaly in the magnetoresistance in graphite under pulsed high magnetic fields .... See Entry 108455

Effects of the electron-hole interaction on the giant quantum attenuation and velocity change of sound waves in pyrolytic graphite .... See Entry 108480

Theory of Josephson-type oscillations in a moving charge-density wave .... See Entry 108484

1/f noise in mobility fluctuations and the Boltzmann equation [nondegenerate semiconductors] .... See Entry 108485

Charge-density-wave transport in orthorhombic TaS_3. III. Narrow-band 'noise' .... See Entry 108487

Observation of a fractional quantum number .... See Entry 108542

Cyclotron resonance in the conduction band of GaP in very high magnetic fields .... See Entry 108789

71.45G Exchange, correlation, dielectric and magnetic functions, plasmons

108318 Plasmon resonance broadening in spheroidal metal particles. W.A.Kraus, G.C.Schatz (Dept. of Chem., Northwestern Univ. Evanston, IL, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.4, p.353-7 (12 Aug. 1983).
An analytical expression for the surface scattering contribution to the width of plasmon resonances in spheroidally shaped metal particles is derived. The result is compared with analogous quantum-mechanical expressions. (6 refs.)

108319 Anisotropy of the dielectric function within a liquid-vapour interface. J.Lekner (Phys. Dept., Victoria Univ. of Wellington, Wellington, New Zealand).
Mol. Phys. (GB), vol.49, no.6, p.1385-400 (20 Aug. 1983).
The authors calculate $\epsilon_\perp(z)$ and $\epsilon_\parallel(z)$, the dielectric functions which characterize the response of a planar interface to an electric field perpendicular to or parallel to the interface. These functions each differ from the Clausius-Mossotti form by an interface term, which depends on the variation in density and in the pair correlation function through the interface. Detailed calculations are carried out for Ar, Kr and Xe, using a molecular dynamics pair correlation function, and three model density profiles. The effect of anisotropy on ellipsometric estimates of the interface thickness is small because of cancellations between opposing terms. (27 refs.)

108320 Spectrum of surface quantum plasmon resonances in high-magnetic field. G.Gumbs, D.J.W.Geldart (Dept. of Phys., Dalhousie Univ., Halifax, Nova Scotia, Canada).
Physica A (Netherlands), vol.120A, no.1-2, p.178-84 (1983).
For long wavelengths, there is an undamped quantum-type plasmon resonance (QPR) near each higher multiple of the cyclotron frequency $n\omega_c$ ($n\geq2$), for a bulk quantum plasma in the presence of an external magnetic field. This mode involves the coupling between magnetoplasmons and single-particle excitations of the Landau levels of the electron gas. The nonlocal surface QPR is examined under high-magnetic field conditions, with the electrons occupying the lowest Landau level only. The magnetic field is perpendicular to the surface of the plasma. The surface QPR is evaluated in the long-wavelength limit, for the degenerate case. It is shown that this mode is naturally damped. (7 refs.)

108321 External fields in the self-consistent theory of electronic states: a new method for direct evaluation of macroscopic and microscopic dielectric response. K.Kunc (Lab. de Phys. des Solides, Paris, France), R.Resta.
Phys. Rev. Lett. (USA), vol.51, no.8, p.686-9 (22 Aug. 1983).
It is shown that the macroscopic and microscopic dielectric responses to a constant electric field can be directly dealt with by a method which is general, alternative to linear-response theory, and not restricted to linear effects. The basic features of the theory are discussed; explicit calculations of the macroscopic dielectric constant, microscopic local fields, and transverse effective charges are presented for Ge and GaAs within the local-density functional theory. (16 refs.)

108322 Effect of screening on exchange effects for an inhomogeneous electron gas at finite temperatures. P.V.Panat, R.E.Amritkar (Dept. of Phys., Poona Univ., Pune, India).
Phys. Rev. A (USA), vol.28, no.3, p.1859-63 (Sept. 1983).
Recently, Gupta and Rajagopal [Phys. Rev. A, 21, 2064, 1980] have calculated thermodynamic-exchange energy and potential in an 'exchange-only' approximation and later calculated the correlation potential exactly within the random-phase approximation [Phys. Rev. A, 22, 2792, 1980]. In this paper the authors estimate the effect of screening in an approximate way. The formula obtained for the correlation potential is shown to be the product of two functions, one being that of density and the other being that of dimensionless temperature. The calculated values agree reasonably in the intermediate degeneracy region and are good at higher temperatures and densities. It is shown that the specific heat for the system can also be expressed in terms of the same parameters and the $(T/\ln T)$-type divergence disappears. (12 refs.)

108323 Concentration-dependent dielectric response of $Ga_{1-x}Al_xAs$. P.Csavinszky, K.R.Brownstein (Dept. of Phys., Univ. of Maine, Orono, ME, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2226-8 (15 Aug. 1983).
The dielectric properties of the semiconductor $Ga_{1-x}Al_xAs$ are of importance in the study of electronic states and charge conduction. In this paper the authors present analytical composition-dependent spatial dielectric functions for $Ga_{1-x}Al_xAs$ involving compositions from $x=0.05$ to $x=0.45$ in steps of 0.05. The spatial dielectric functions they present describe the response of $Ga_{1-x}Al_xAs$ to charges of $Z=\pm1$, ±2 (in atomic units) embedded in the semiconductor. (10 refs.)

108324 Plasma resonance in cubic lattice of 8-atom cluster of indium in zeolite matrix. Yu.A.Alexeev, E.A.Bakulin, V.N.Bogomolov, S.V.Kholodkevich, E.G.Ostroumova, E.V.Stepin (A.F. Ioffe Physico-Tech. Inst., Acad. of Sci., Leningrad, USSR).
Solid State Commun. (USA), vol.47, no.4, p.307-8 (July 1983).
A plasma peak in the spectrum of inelastic electron loss was found on a model object which was a cubic sublattice of 8-atom indium clusters in dielec-

tric zeolite matrix. The plasmon energy (5.2 eV) in such microcluster system differs essentially from that of 11.6 eV in bulk indium and lies within the range where the discrete character of the electron spectrum is well pronounced. (9 refs.)

Algebraic investigations in Landau model of structural phase transitions. III. Extended integrity bases and thermodynamic potential ....See Entry 107860

Application of special-directions method to the optical properties of copper and silver .... See Entry 108277

Plasmon approach to the average energy gap of Mg, Ca and Sr compounds .... See Entry 108281

Experimental observation of long-range surface plasmon polaritons .... See Entry 108305

Surface electromagnetic fields in the semi-classical infinite barrier model: collective and single-particle response .... See Entry 108501

Correlation effects in doped organic semiconductors .... See Entry 108502

Charge density and orientation dependence of the effective mass in electron inversion layers on the principal surfaces of Si .... See Entry 108505

Surface plasmons studies of oxidized Ba films .... See Entry 108576

Dielectric function of SmS. I. Optical transitions .... See Entry 108914

Dielectric function of SmS. II. Infrared response: LO(Γ) phonon softening .... See Entry 108915

Simple theory for surface-plasmon-polariton resonance on sinusoidal metal surface: application to SERS .... See Entry 108943

Tm studied by electron energy-loss spectroscopy and Auger electron spectroscopy .... See Entry 109066

Electron energy loss spectra and X-ray photoelectron spectra of $Ca_2V_2O_7$ .... See Entry 109071

Determination of valence-electron concentration in $AgTe_3$ by electron energy loss spectroscopy .... See Entry 109073

Electron energy loss spectroscopy in glancing reflection from bulk crystals .... See Entry 109075

Calculation of photoemission spectra using an energy dependent potential .... See Entry 109106

71.45N Calculations of total electronic binding energy

(see also 61.50L Crystal binding)

108325 Evaluation of cohesive energies for NaCl-NaBr mixed crystals. N.Agrawal, R.P.Goyal, B.K.Gupta, R.K.Singh (Dept. of Phys., St. John's Coll., Agra, India).
Phys. Status Solidi b (Germany), vol.118, no.2, p.K141-6 (1 Aug. 1983).
To develop a more realistic interaction mechanism in mixed crystal systems the authors have proposed a model potential to predict the accurate values of cohesive energy. The model potential consists of long-range Coulomb and three-body interactions, short-range van der Waals attractions, and Hafemeister-Zarht type repulsion, effective up to second neighbours. The values of cohesive energy calculated from the interionic potential in the case of host crystals are in excellent agreement with the available experimental data. (28 refs.)

Total energy of isolated point defects in solids .... See Entry 107674

X-ray spectra and binding energies of atoms in a solid .... See Entry 109054

71.50 LOCALIZED SINGLE-PARTICLE ELECTRONIC STATES

(exc. impurities; for localisation in disordered structures, see 71.55J)

108326 On quantum localization of conduction electrons under magnetic breakdown conditions. L.Yu.Gorelik.
Fiz. Nizk. Temp. (USSR), vol.9, no.8, p.888-90 (Aug. 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
A model incommensurate system realized under coherent magnetic breakdown conditions is considered. The spectrum and form of localized electron wave functions are found. The transition from periodic to incommensurate phase is analyzed. (6 refs.)

108327 Localisation in the Lloyd model. D.J.Thouless (Dept. of Phys., Univ. of Washington, Seattle, WA, USA).
J. Phys. C (GB), vol.16, no.26, p.L929-31 (20 Sept. 1983).
Recent claims that for the Lloyd model in arbitrarily many dimensions electrons are always localised are shown to be ill founded. (7 refs.)

Renormalized atom model (RAM) applied to the heavy rare-earth sesquioxides in cubic crystal structure .... See Entry 108286

Formal Mott transition between the one dimensional conductor $K_{0.3}MoO_3$ and the highly anisotropic semiconductor $K_{0.33}MoO_3$ .... See Entry 108294

Polarization energy of a localized charge in a molecular crystal. VI. Effect of excitons .... See Entry 108296

Mixed-valent ground state of CeO_2 .... See Entry 108361

Electron localization in 1D conductors due to the phonon scattering .... See Entry 108402

Electron energy loss spectra and X-ray photoelectron spectra of $Ca_2V_2O_7$ .... See Entry 109071

71.55 IMPURITY AND DEFECT LEVELS

108328 Symmetrical contours of deep level EL2 in liquid encapsulated Czochralski GaAs. D.E.Holmes, R.T.Chen, K.R.Elliott, C.G.Kirkpatrick (Microelectronics Res. & Dev. Center, Rockwell Internat., Thousand Oaks, CA, USA).
Appl. Phys. Lett. (USA), vol.43, no.3, p.305-7 (1 Aug. 1983).
The authors have determined the isoconcentration contours of the deep level EL2 across 3-in-diameter, semi-insulating GaAs crystals grown by the liquid encapsulated Czochralski technique. The contours are essentially fourfold symmetric at the seed end of the crystals. The symmetrical pattern is independent of the melt stoichiometry and the relative direction of crystal and crucible rotation. EL2 distributions in the tail of the same crystals are often of lower symmetry. The results support a native defect model for EL2 in which the formation of the defect is enhanced by stress in the crystal. (19 refs.)

108329 The recombination behavior of platinum in silicon. Zhou Jie, Li Shu-ying, Tan Fei (Inst. of Semiconductor, Acad. Sinica, Peking, China).
Acta Phys. Sin. (China), vol.32, no.4, p.497-506 (April 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)* [received: Sept. 1983]
With dark capacitance transient method, electron emission and capture transient processes at deep level, which is located within an energy range of KT above E_F in depleted region of zero-biased junction, have been observed in Pt diffused deep diffusion junction of n-Si and p-Si with different background doping density. These transient behaviors agree with the solution of electron variation rate equation of deep level for different initial conditions at that place. In this paper a mechanism is also proposed to explain the occurrence of emission transient. It is considered that the origin of emission transient is closely related to the structure in the deep diffusion junctions and the capture transient to the capture characteristic of different impurity. (2 refs.)

108330 Thermodynamics of a spin 1/2 Anderson impurity in the $U \to \infty$ limit. P.Schlottmann (Fachbereich Phys., Freie Univ. Berlin, Berlin, Germany).
Z. Phys. B (Germany), vol.52, no.2, p.127-32 (1983).
The Bethe-ansatz describing the thermodynamics of the non-degenerate Anderson model are derived in the $U \to \infty$ limit (double occupation of the localized level is excluded). The set of Bethe-ansatz equations for the $U \to \infty$ limit is considerably different from the one for the U case. The Kondo limit the Fermi liquid behavior at low T and the high T perturbation expansion for the thermodynamic potential are extracted from these equations. (20 refs.)

108331 Characterization of deep levels in semi-insulating GaAs crystals by a spectroscopic photoelectrochemical current. M.Otsubo, T.Murotani (LSI Res. & Dev. Lab., Mitsubishi Electric Corp., Hyogo, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.6, p.L345-7 (June 1983).
A new method for detecting deep levels in semi-insulating GaAs crystals is proposed. With this method determination of deep level distributions over a wafer by a spectroscopic photoelectrochemical current is possible. The deep levels of 1.13 eV, 1.02 eV, 0.98 eV, and 0.70 eV have been detected in both undoped and Cr-doped materials. Two additional deep levels of 0.78 eV and 0.65 eV were detected in Cr-doped materials. A peak intensity ratio of the 1.13 eV band to the 1.43 eV increased linearly with increasing chromium content in the crystals. Nonuniform distribution of deep levels in LEC GaAs crystals has been found. (10 refs.)

108332 Oxygen-related defects in irradiated germanium. N.Fukuoka, H.Saito, Y.Kambe (Dept. of Phys., Coll. of General Education, Osaka Univ., Osaka, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.6, p.L353-5 (June 1983).
Oxygen-related defects produced in oxygen-doped germanium by 1.5 MeV electron irradiation were studied by the DLTS technique. Three electron trapping levels attributable to this type of defect were found. The $E_c-0.25$ eV level is deduced to be introduced by two kinds of defects, namely, the germanium A-center (oxygen-vacancy complex) and the defect associated with the 715 cm^{-1} infrared absorption band reported by Whan (1965). The $E_c-0.29$ eV level and the $E_c-0.13$ eV level are attributable to the defects associated with the 819 cm^{-1} and the 731 cm^{-1} infrared absorption bands in her paper. (16 refs.)

108333 Confirmation of tunneling current via traps by DLTS measurements in InGaAs photodiodes. R.Trommer, H.Albrecht (Res. Labs., Siemens AG, Munchen, Germany).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.6, p.L364-6 (June 1983).
A detailed analysis of the reverse characteristics of $In_{0.53}Ga_{0.47}As$ pin-photodiodes at various temperatures reveals, besides generation, diffusion and band-to-band tunneling of carriers, an additional contribution to the dark current due to tunneling through an energy barrier of 0.16 ± 0.02 eV. In deep-level transient spectroscopy measurements a thermal activation energy of 0.57 ± 0.01 eV, equal to the gap energy minus the tunneling barrier, has been found. From these two measurements it can be concluded that thermal activation of deep traps and subsequent tunneling of carriers into band states leads to the additional dark current component. (13 refs.)

108334 Two-centre defects and low-energy excitations in vitreous silica. L.Ferrari (Istituto di Matematica, Univ. di Ferrara, Ferrara, Italy), G.Russo.
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.965-92 (July-Aug. 1983).
A first-principle chemical model for IVAP-like defects in vitreous silica is proposed. It is shown that these two-centre defects are diamagnetic and, for $T<10$K, display a two-level-like energy spectrum. They also exhibit a dipolar nature in agreement with recent experimental data. A close analogy with the basic idea underlying the tunnelling-atom theory is shown, supporting the connection between low-energy excitations in amorphous materials and two-fold degenerate equilibrium positions of certain lattice sites. In contrast to previous theories, the present model predicts a large contribution of fast relaxing two-level systems at very low temperatures ($T<0.1$K), while slowly relaxing excitations achieve thermal activation only at higher temperature. This result is indirectly confirmed by deviations from linearity of the low-temperature specific heat and seems to bridge in a satisfactory way experimental results which appeared contradictory in the framework of the tunnelling-atom theory as it is usually formulated. (20 refs.)

108335 An optical characterization of defect levels induced by MBE growth of GaAs. J.P.Contour, G.Neu, M.Leroux (Phys. du Solide et Energie Solaire, CNRS, Valbonne, France), C.Chaix, B.Levesque, P.Etienne.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.811-15 (July-Sept. 1983).
GaAs layers grown under As_4 flux at 585°C by MBE (*p*-type NID layers and *n*-type doped layers) have been studied by photoluminescence at 1.9K (UV excitation, selectively excited photoluminescence, and excitation spectroscopy). The photoluminescence lines between 1.5110 and 1.5040 eV ascribed to excitons bound to point defects associated with the use of an As_4 source have been more carefully studied in order to specify the nature of the transitions involved. Two hole spectra, and donor acceptor pair bands analysis allow to identify the excited states of two acceptor levels. The first one is attributed to the carbon contamination, the second one to which the 1.5109 eV exciton is bound is also a shallow acceptor level showing a negative chemical shift and a binding energy of 22.9 meV. (12 refs.)

108336 Acceptors in wide-gap semimagnetic semiconductors. J.Mycielski (Groupe de Phys. des Solides, Ecole Normale Superieure, Paris, France), C.Rigaux.
J. Phys. (France), vol.44, no.9, p.1041-9 (Sept. 1983).
Shallow acceptors in wide-gap zinc-blende-type semimagnetic semiconductors (like $Cd_{1-x}Mn_xTe$) are considered. The fourfold degenerate acceptor ground state is determined using Schechter's (1962) variational method. The exchange interaction with magnetic ions is then included and the splitting of the ground state is studied. It is shown that this splitting is quenched as compared with the free-hole splitting. Matrix elements for the acceptor to conduction Landau states transitions are also calculated. (25 refs.)

108337 Photoionization spectrum of deeply trapped electrons in semiconductors—results in a simple one-dimensional model. Y.Kayanuma (Dept. of Phys., Tohoku Univ., Sendai, Japan).

J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2472-7 (July 1983).

The deep level photoionization spectrum in a simple one-dimensional model is studied within the semiclassical Franck-Condon approximation of the electron-lattice coupling. The line shape functions are obtained exactly both for the one-electron and the two-electron system and various spectral features are discussed. The spectrum of the two-electron trapped state depends on the mutual Coulomb repulsion as well as on the electron-lattice coupling, the potential depth and the temperature. (13 refs.)

108338 Computer simulation of interacting donor electrons in the Anderson-localised regime of semiconductors. T.Takemori, H.Kamimura (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).

J. Phys. C (GB), vol.16, no.26, p.5167-87 (20 Sept. 1983).

A comupter simulation on a cluster model of n-type doped semiconductors is performed at the impurity concentration corresponding to 1.7×10^{18} cm^{-3} of Si:P, with the aim of testing the general physical picture and theoretical treatment in the 'transfer-diagonal' formulation. A simple Gaussian function is used as the basis of one-electron states, in order to calculate and take into account exactly all the matrix elements including those of the electron-electron interaction. The energy levels and wavefunctions of the ground and excited states of the clusters consisting of six randomly distributed donors are obtained. It is found that there are a large number of states which are occupied by single electrons and that the spins of these singly occupied states interact either by ferromagnetic or antiferromagnetic exchange interactions. The numerical results on specific heat and spin susceptibility averaged over 76 clusters reproduce fairly well the characteristic features observed in experiments on Si:P. The microscopic mechanism of these remarkable features is clarified by examining the many-electron wavefunctions obtained and the treatment in the 'transfer-diagonal' formulation is confirmed. (18 refs.)

108339 Splitting of the 3d levels of iron group impurities in crystals with zincblende structure. S.W.Biernacki (Inst. of Phys., Polish Acad. of Sci., Warsaw, Poland).

Phys. Status Solidi b (Germany), vol.118, no.2, p.525-33 (1 Aug. 1983).

A new parametrization scheme is presented of the crystal term energies for 3d impurities in ZnS-structure crystals. This allows a practical analysis of the optical spectra in these structures. This scheme, unlike the Tanabe-Sugano scheme, accounts for the different deformations of e- and t_2-orbitals in the tetrahedral crystal field. To avoid the complexity caused by the many unknown parameters which appear when the e- and t_2-orbitals are considered deformed to different degrees, the point charge model of the crystal field and the Slater form of the d-orbitals are employed. This provides two adjustable parameters for describing the crystal term energies. The results indicate that the energy separation between the crystal terms depends not only on the Racah parameters *B* and *C* but also on the Racah parameter *A*, and it is shown how the Racah parameters for a given impurity depend on the crystal field. The energy separation Δ between the crystal terms A_2 and T_2 is interpreted to be the sum of two terms: Δ_{cryst} the contribution due to the crystal field splitting and Δ_{rep} the contribution due to different repulsion energies between the electrons in the two states. As an example of the application of this parametrization scheme, the impurities Ti^{2+}, V^{2+}, Co^{2+}, and Ni^{2+} in ZnSe are considered. (13 refs.)

108340 Variational calculations for ground-state energies of donor-acceptor pairs. R.Englisch (Sektion Phys., Karl-Marx-Univ. Leipzig, Leipzig, Germany).

Phys. Status Solidi b (Germany), vol.118, no.2, p.605-12 (1 Aug. 1983).

For the calculation of ground-state energies of donor-acceptor (DA) pairs (and also of two related three-body problems) variational ansatzes are tested including the correlation between electron and hole. A refinement of a paper by Kartheuser et al. (1982) is presented for small distances of the DA pairs. Further, another method to solve the integrals occurring is shown which avoids numerical integration. (14 refs.)

108341 Impurity states near the fundamental absorption edge in p-CuInS$_2$. R.Tovar Barradas, J.Gonzalez, C.Rincon (Dept. de Fisica, Facultad de Ciencias, Univ. de Los Andes, Merida, Venezuela).

Phys. Status Solidi b (Germany), vol.118, no.2, p.K103-6 (1 Aug. 1983).

Although the optical, electrical, and thermal properties of $CuInS_2$ have been receiving considerable attention lately, the related problem of the impurity states in $CuInS_2$ is not well understood. An attempt has been made in order to clarify this point by analyzing the experimental results of the absorption coefficient near the fundamental edge at 76K on p-type $CuInS_2$. (11 refs.)

108342 Analytical solutions to the movement of the Fermi energy in a distribution of states. G.G.Roberts (Univ. of Durham, Durham, England), F.W.Schmidlin.

Phys. Rev. B (USA), vol.28, no.4, p.2001-6 (15 Aug. 1983).

Previous papers on this subject have demonstrated the usefulness of adopting the dominant-level approach to interpret activation-energy data. These concepts are now extended to situations involving distributions of states. Some emphasis is placed on answering the question of whether or not a single continuum of states can 'pin the Fermi level' (produce a constant activation energy over an extended temperature range). The complete problem requires numerical analysis but substantial insight can be gained by considering certain limiting situations and adopting the method of approximating state distributions by equivalent discrete densities. The authors find that the Fermi level cannot be pinned within the single distribution of states and conclude that models containing pairs of distributions are more effective in producing a constant activation energy; for example, two low-density and asymmetrical Gaussian distributions can dominate the statistics over an extended temperature range. (17 refs.)

108343 Energy levels of interstitial manganese in silicon. R.Czaputa, H.Feichtinger, J.Oswald (Inst. fuer Experimentalphys., Karl-Franzens-Univ. Graz, Graz, Austria).

Solid State Commun. (USA), vol.47, no.4, p.223-6 (July 1983).

Interstitial manganese in silicon can exist in four charge states which imply single acceptor and double donor behaviour. The corresponding level scheme with the acceptor level ($Mn^{-/o}$) at $E_c-0.13$ eV, the first donor level ($Mn^{o/+}$) at $E_c-0.45$ eV and the second donor level ($Mn^{+/++}$) at $E_v+0.30$ eV is established through EPR-controlled Hall measurements. Another deep donor level at $E_c-0.54$ eV is produced by the donor acceptor pair (MnB) whereas a more shallow one around $E_c-0.28$ eV was already attributed to a Mn_4-cluster. (13 refs.)

108344 Characterization of the potential well of a deep-level defect using field dependence of the thermal carrier emission rate. K.L.Wang, G.P.Li (Electrical Engng. Dept., Univ. of California, Los Angeles, CA, USA).

Solid State Commun. (USA), vol.47, no.4, p.233-5 (July 1983).

The electric field enhanced thermal emission rate was measured for the $E_c-0.35$ eV level of GaAs using a new reverse-biased pulsed DLTS technique. It is shown that the observed field and its temperature dependencies are probably the result of the Poole-Frenkel emission from a polarization potential well. From this study and with other annealing and the capture cross-section data, it is concluded that the defect is probably of a neutral-impurity type. (14 refs.)

108345 Defects in Zn fired ZnTe: detection of a double acceptor (Si_{Te}?). M.Magnea, J.L.Pautrat (Dept. de Recherche Fondamentale, CENG, Grenoble, France), Le Si Dang, R.Romestain, P.J.Dean.

Solid State Commun. (USA), vol.47, no.9, p.703-7 (Sept. 1983).

The authors present a detailed account of electrical and optical measurements including resonantly excited luminescence and photoexcitation spectroscopy on the acceptor and donor defects associated with the annealing of ZnTE in molten zinc. A new acceptor (X) is detected and tentatively attributed to a double neutral acceptor (SI_{Te}?) according to Zeeman and stress experiments. (15 refs.)

108346 Heavy doping effects on donor-acceptor spectra of polar semiconductors at low temperatures. H.Van Cong, S.Brunet, S.Charar (Dept. de Phys., Univ. de Perpignan, Perpignan, France).

Solid State Commun. (USA), vol.47, no.9, p.743-5 (Sept. 1983).

The heavy doping effects on donor-acceptor (DA)-pair spectra at small DA-pair distances *R* are investigated, basing on an effective screened impurity potential model given by Morgan (1965) and on the results of the *R*-dependent electron (hole)—longitudinal optical phonon interaction energy obtained by Kartheuser et al. (1980). It is suggested that the deviation of the electron-hole recombination energy by dense impurities (or at small *R*), found from the energy of the emitted photon for a zero-phonon transition, results from the band-gap narrowing effect. At large *R*, the authors have found that the energy gap of the pure ZnSe crystal is equal to 2.827 eV, in good agreement with observed results. Finally, at small *R*, the numerical results applied to ZnSe doped with In and Li impurities are compared with other theories and with observed results. (12 refs.)

108347 The deformation potential of the lowest impurity state of As in Si. A.E.Belyaev, R.M.Vinetskii, O.P.Gorodnichii.

Ukr. Fiz. Zh. (USSR), vol.28, no.7, p.1097-9 (July 1983). In Russian.

The authors have measured the Hall coefficient R dependence on the uniaxial pressure X in the (100) direction at 63K up to $X=14000$ kgs/cm^2 in monocyrstalline specimens of Si:As with concentration of $N_D\approx10^{15}$ cm^{-3}. The comparison of experimental and calculated R(X) dependencies has permitted them to determine the value of the shift constant for the deformation potential of the lowest As impurity state. (3 refs.) *V.G.P.*

108348 Electrical defect analysis following pulsed laser irradiation of unimplanted GaAs. D.Pribat, S.Delage, D.Dieumegard, M.Croset (Thomson-CSF/LCR, Orsay, France), P.C.Srivastava, J.C.Bourgoin.

Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.647-52

Current-voltage, capacitance-voltage and defect spectroscopy techniques are used to characterize the electrical properties of GaAs crystals after pulsed laser irradiation with either a Nd-YAG or a ruby laser. I(V) and C(V) measurements performed in conjunction on Au/GaAs Schottky structures after laser irradiation at low energy density show an important barrier lowering, of the order of 300 mV. Carrier compensation up to $6\times10^{16}/cm^3$ is observed in a subsurface layer whose thickness increases with deposited laser energy density. DLTS is used to study the tail of laser induced defects behind the heavily compensated layer. Finally the results are compared to those obtained following conventional thermal treatment. (14 refs.)

108349 The electronic structure and formation energy of a vacancy in aluminum. B.Chakraborty, R.W.Siegel (Materials Sci. Div., Argonne Nat. Lab., Argonne, IL, USA).

Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.93-6

The electronic structure of a vacancy in Al was calculated self-consistently using norm-conserving ionic pseudopotentials obtained from ab initio atomic calculations. A 27-atom-site supercell containing 1 vacancy and 26 atoms was used to simulate the environment of the vacancy. A vacancy formation energy of 1.5 eV was also calculated (CF the experimental value of 0.66 eV). The effects of the supercell and the nature of the ionic potential on the resulting electronic structure and formation energy are discussed. Results for the electronic structure of a divacancy are also presented. (6 refs.)

108350 Electronic structure of impurities in transition metals. R.Zeller (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany), P.J.Braspenning, J.Deutz, R.Podloucky, P.H.Dederichs.

Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.97-104

By applying the KKR-Green's function method self-consistent calculations have been performed for the electronic structure of impurities in transition metals. The calculations are based on the density functional theory and a muffin-tin approximation for the atomic potential. The authors discuss the problems connected with the construction of the host Green's function and with obtaining self-consistency for the perturbed potentials. Results are presented for 4d-impurities in Cu, for magnetic impurities in Cu, Ag, Al, and Mo, and for the vacancy in Cu. In the latter case also perturbed potentials at neighbouring host sites are taken into account. Friedel oscillations around 3d-impurities in Cu are also considered. (27 refs.)

108351 De Haas-van Alphen study of the solute atom yttrium in magnesium host. K.Ogawa, H.Aoki (Metal Phys. Div., Nat. Res. Inst. for Metals, Tokyo, Japan).

Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.329-31

Electronic structures of the solute atom Y in Mg host have been studied by measuring the de Haas-van Alphen effect. It has been found that the addition of Y has no effect on the measured dHvA frequency for the orbit $\mu_1{}^5$. The measured Dingle temperatures are nearly isotropic and are about 60K/at.% Y which is a few times larger than those of Li and In in Mg host. The application of phase shift analysis to these results shows that the d character of the outer electrons of Y atom appears to be reduced by a fair amount in Mg host but still remains considerable. (9 refs.)

Apparatus for the investigation of deep level parameters in semiconductors ....See Entry 105332

Search for correlations between electrical characteristics and stoichiometry in mercuric iodide ....See Entry 106227

Trapping of hydrogen by substitutional and interstitial impurities in α-iron ....See Entry 107737

Calculation of interaction energy between atomic defects in BCC transition metals: vacancy-vacancy, vacancy-vacancy cluster, and vacancy impurity pairs ....See Entry 107739

Pseudopotential formulation of point defect interactions in metals ....See Entry 107740

Effect of irradiation on the parameters of neutron-transmutation-doped silicon ....See Entry 107774

Lattice vibrations around point defects in cubic transition metals ....See Entry 107850

Influence of source composition on the properties of flash-evaporated thin films in the Cu-In-Se system ....See Entry 108212

The influence of the variation of the chemical composition and of the nitrogen doping level on the energy spectra of the bound excitons in $GaAs_{1-x}P_x$:N ....See Entry 108300

Defects in the sine-Gordon model: statics ....See Entry 108313

Electrical resistivity of undoped GaAs single crystals grown by magnetic field applied LEC technique ....See Entry 108410

Deep electron traps in undoped semi-insulating GaAs grown by the liquid encapsulated Czochralski method ....See Entry 108440

Recombination and trapping levels in GaS:Mn single crystals ....See Entry 108447

Investigation of formation conditions of thermal donors-I and -II in oxygen-containing n-type silicon within the temperature range 400 to 800°C ....See Entry 108458

Intracenter transitions in the dominant deep level (EL2) in GaAs ....See Entry 108466

Correlation effects in doped organic semiconductors ....See Entry 108502

DLTS determination of the Mo acceptor level in Mo-$GaAs_{0.6}P_{0.4}$ Schottky diodes ....See Entry 108508

Optical and optically detected magnetic resonance studies of AgBr:I^- ....See Entry 108838

Optical properties of donor electrons in semimagnetic semiconductors ....See Entry 108947

Cobalt centres in ammonium chloride: optical absorption studies ....See Entry 108983

Study of the photoluminescence spectrum in high purity CdTe ....See Entry 109001

Tail-tail luminescence in amorphous silicon ....See Entry 109009

Polariton luminescence and additional boundary conditions: comparison between theory and experiment ....See Entry 109014

Electroluminescence in In-ZnSe:Cu-ZnSe(s)-Au structures ....See Entry 109019

Microstructure and imperfections of glassy and glass-ceramic telluride semiconductors on the basis of positron annihilation ....See Entry 109040

X-ray emission spectra and electron structure of Ni and Fe impurity atoms in dilute copper-base solid solutions ....See Entry 109055

AsH_3 to $Ga(CH_3)_3$ mole ratio dependence of dominant deep levels in MOCVD GaAs ....See Entry 109160

71.55J Localization in disordered structures

108352 On the solution of the periodic Anderson model. J.Kowalska, J.Zielinski (Inst. of Phys., Silesian Univ., Katowice, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.2, p.177-84 (Aug. 1983).
The periodic Anderson model is investigated by the method of equations of motion for the Green functions within the approximation which does not lead to the appearance of a hybridization gap in the symmetric case. The density of states for *f*-electrons is similar to the one corresponding to single impurity solution. The specific heat and electrical resistivity are evaluated and an approximate, qualitative discussion of the formation of temperature dependent resonance for infinite Coulomb repulsion is given. (24 refs.)

108353 Localization-delocalization transition by interactions in one-dimensional fermion systems. Y.Suzumura (Dept. of Phys., Tohoku Univ., Sendai, Japan), H.Fukuyama.
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2870-4 (Aug. 1983).
A new view is presented to treat the Anderson localization in one dimension as the impurity pinning of the phase variables of charge and spin. The authors make use of the phase Hamiltonian derived by the bosonization. By this method effects of mutual interactions are naturally included and the authors determined the phase diagram of localized and delocalized states of the spin-dependent Tomonaga model in the plane of the coupling constants.

108354 Phase correlations in one-dimensional disordered systems. M.Ya.Azbel (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), M.Rubinstein.
Phys. Rev. Lett. (USA), vol.51, no.9, p.836-9 (29 Aug. 1983).
The correlation function of the phases of a quantum particle in a one-dimensional random potential is defined and calculated analytically and numerically. Away from eigenstates it decays exponentially with the phase correlation length equal to half of the localization length, while for the eigenstates it saturates at nonzero value. (12 refs.)

108355 Density of states and charge distribution in hydrogenated amorphous silicon. H.King, B.Kramer (Phys.-Tech. Bundesanstalt, Braunschweig, Germany), A.MacKinnon.
Solid State Commun. (USA), vol.47, no.9, p.683-6 (Sept. 1983).
The local density of states and the charge distribution in a cluster model of hydrogenated amorphous silicon is calculated using the recursion method. The results indicate an average charge transfer of 0.3 electrons from silicon to hydrogen. In addition Si-H dipoles carry small negative charges, which are neutralized by a positively charged bulk of silicon atoms. There are also static spatial charge fluctuations, which are due to the topological disorder. (18 refs.)

108356 Localization and dimensionality. M.Ya.Azbel (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Solid State Commun. (USA), vol.47, no.9, p.699-701 (Sept. 1983).
Localization of eigenstates depends not only on dimensionality but also on the nature of the disorder. Thus the states in two dimensions may or may not be exponentially localized. Grain boundaries may localize all states in any dimensionality. It is shown that there exists an exact scaling of the transfer matrix, which is valid in any dimensionality. (15 refs.)

108357 Defect states in trans-polyacetylene. J.P.Albert, C.Jouanin (Groupe des Semiconducteurs, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
Solid State Commun. (USA), vol.47, no.10, p.825-9 (Sept. 1983).
The interaction of a dopant molecule with the π electrons of a single $(CH)_x$ chain is studied within a model potential which incorporates the core repulsive effects. The soliton type defects are found to be energetically favoured upon doping whereas the position of the induced levels inside the gap are strongly affected by the interaction. (9 refs.)

Electron localization in a magnetic semiconductor: $Gd_{3-x}\nu_xS_4$ ....See Entry 108290

Electron localization in 1D conductors due to the phonon scattering ....See Entry 108402

Self-consistent treatment of dynamical diffusion coefficient of two dimensional random electron system under strong magnetic fields. II ....See Entry 108454

Microstructure and imperfections of glassy and glass-ceramic telluride semiconductors on the basis of positron annihilation ....See Entry 109040

71.70 LEVEL SPLITTING AND INTERACTIONS

(see also 75.10 – in magnetic phenomena, 75.30E Exchange and superexchange interactions, 73.20 Electronic surface states)

108358 Electronic states in solution and charge transfer. S.U.M.Khan, J.O'M.Bockris (Dept. of Chem., Texas A&M Univ., College Station, TX, USA).
J. Phys. Chem. (USA), vol.87, no.14, p.2599-603 (7 July 1983).
The Fermi level of electrons in solution is not the negative of the vacuum scale redox potential. One needs to know the ground states of the donor and acceptor ions in solution and the distribution of their higher energy states. Gaussian distribution of electronic states in solution is not consistent with experimental results, whereas Maxwell-Boltzmann distribution of such states exhibits conformity with it. Activation of ions in solution before electron exchange occurs by means of collisional energy transfer. It is possible because of the presence of continuum of vibration-rotation states in the ion-solvent complex. Auger transitions in the electrochemical system are unlikely. Shifting of an applied potential shifts the bulk energy levels (measured with respect to an electron at infinity) in both metal and solution in opposite directions. (34 refs.)

108359 Ground state properties of the Anderson model in the limit of large spin-orbit degeneracy. J.W.Rasul, A.C.Hewson (Dept. of Math., Imperial Coll., London, England).
J. Phys. C (GB), vol.16, no.26, p.L933-8 (20 Sept. 1983).
The spin-orbit degenerate Anderson model is investigated in the limit of large spin-orbit degeneracy (*N*). Low-temperature properties are discussed, yielding the full range of intermediate to local moment behaviour. The relation between ground state susceptibility and valence is examined to leading and next-leading orders in $1/N$. (19 refs.)

108360 Valence fluctuations and magnetic-nonmagnetic transitions in a model for intermediate-valence systems. H.V.Sharma, I.Singh (Dept. of Phys., Univ. of Roorkee, Roorkee, India).
Phys. Status Solidi b (Germany), vol.118, no.2, p.511-20 (1 Aug. 1983).
The magnetic properties of mixed-valence systems are studied using the Anderson lattice model, including an intersite exchange interaction. It is found that (i) the ferromagnetic ordering is favoured in the nearly integral-valent case and (ii) in the intermediate-valence case the ratio of exchange to hybridisation dictates the absence or presence of magnetic ordering. The magnetic phase diagram and the variation of magnetic susceptibility and specific heat in the paramagnetic phase. Fairly good qualitative agreement with the exprimental findings is obtained. (30 refs.)

108361 Mixed-valent ground state of CeO_2. A.Fujimori (Lab. fur Festkorperphys., Eidgenossiche Tech. Hochschule, Zurich, Switzerland).
Phys. Rev. B (USA), vol.28, no.4, p.2281-3 (15 Aug. 1983).
The electronic ground state, core-hole states, and valence-hole states of CeO_2 are studied taking into account strong correlation among the 4*f* electrons. The ground state is considered as a mixture of two configurations, $4f^0$ and spin-singlet totally symmetric $4f^1$-O 2*p*-hole states. By an analysis of the core-level photoemission spectrum, the 4*f* occupancy is obtained to be about 0.6. The possibility of this mixed-valence mechanism in metallic mixed-valent systems and α-Ce is also discussed. (20 refs.)

Chemical reaction at the annealed Si/Yb interface ....See Entry 108198

Density of states and charge distribution in hydrogenated amorphous silicon ....See Entry 108355

Resistivity of the $Ce(Rh_{1-y}Pt_y)_2$ system ....See Entry 108389

Highly anisotropic conductive materials: polymers doped with crystalline charge-transfer complexes ....See Entry 108397

The appearance of the many-body resonance at the Fermi level in Kondo-lattices ....See Entry 108405

Magnetic spectral response in the intermetallic compound $CeSn_3$ ....See Entry 108639

A study of the low spin$\rightleftharpoons$high spin transitions in $[Fe(phen)_2(NCSe)_2]$, $[Fe(bipy)_2(NCS)_2]$, and $[Fe(isoxazole)_6](ClO_4)_2$ complexes using ^1H nuclear magnetic resonance ....See Entry 108817

^{151}Eu isomer shifts and charge transfer in Eu-base intermetallic compounds ....See Entry 108848

Effect of iodine on depolarisation behaviour of polyvinyl fluoride (PVF) films ....See Entry 108860

Dielectric function of SmS. I. Optical transitions ....See Entry 108914

Dielectric function of SmS. II. Infrared response: LO(Γ) phonon softening ....See Entry 108915

***L*-edge X-ray absorption spectra of γ- and α-cerium** ....See Entry 109052

X-ray photoelectron spectroscopy study of the ionic configuration of the spinel $CuMnCoO_4$ ....See Entry 109099

Surface effects in Du intermetallics: a resonant photoemission study ....See Entry 109111

71.70C Crystal and ligand fields

108362 Crystal field splittings and rapid direct relaxation of Fe^{2+} spin states from inelastic neutron scattering. I.Svare (Phys. Dept., Univ. of Trondheim, Trondheim, Norway), K.Otnes.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.159-62 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Inelastic neutron scattering on spin states of Fe^{2+} ($S=2$) in some crystals is reported. The results for the crystal field splitting in $FeSiF_6.6H_2O$ and $Fe(ND_4)_2(SO_4)_2.6D_2O$ are in agreement with far infrared spectroscopy and deductions from specific heat. The inelastic lines in $FeSiF_6.6H_2O$ broaden with increasing temperature and disappear above 100K because the direct relaxation between the Fe^{2+} spin states is very rapid; this is discussed in relation to data from NMR relaxation. (17 refs.)

108363 On the cooperative Jahn-Teller effect in ternary chromium and copper halides. W.J.Crama, W.J.A.Maaskant (Gorlaeus Labs., State Univ. Leiden, Leiden, Netherlands).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.219-32 (1983).
The theory of the cooperative Jahn-Teller effect ($E\otimes\epsilon$) developed by Hock et al. (1978) for crystals with a simple cubic cell is reformulated for crystals with a hexagonal perovskite (2L) type structure, space group $P6_3/mmc$. The description can be characterized as a mean field theory based on a Three States Potts model. Assuming only nearest neighbour interactions between Jahn-Teller centres in the a, b plane and up to next nearest neighbours along the c axis it is possible to derive a large number of structures for the static Jahn-Teller effect. In relation with this the recently found structure types (four) of a number of Cu^{2+} and Cr^{2+} compounds are discussed. Probably the phase transition from the partly disordered phase of $RbCrCl_3$ to the paradistortive phase is of the second order. (19 refs.)

108364 Crystal field for ionic and metallic compounds. I. Crystal field theory. S.Adam (Inst. Central de Fizica, IFIN, Bucuresti, Rumania).
Stud. & Cercet. Fiz. (Rumania), vol.35, no.7, p.623-45 (1983). In Rumanian.
The crystal field Hamiltonian for cubic and hexagonal compounds is brought into the standard form of crystal field theory by a general symmetrization technique which uses point group considerations only. The obtained crystal field coefficients are expressed as products between those given by Hutchings (1964) and some geometrical structure factors, which include the relative contribution of all the neighbouring ions to the crystal field. The classic work of Bethe on the splitting of atomic terms in crystalline fields of the various symmetries is presented, including the introduction of the crystal double groups. (59 refs.)

108365 Crystal field for ionic and metallic compounds. II. Calculation of the nonzero matrix elements of the crystal field Hamiltonian. S.Adam (Inst. Central de Fizica, IFIN, Bucuresti, Rumania).
Stud. & Cercet. Fiz. (Rumania), vol.35, no.7, p.646-70 (1983). In Rumanian.
For pt.I see ibid., vol.35, no.7, p.623 (1983). Three calculation methods for the determination of the matrix elements of the crystal field Hamiltonian are reported: (i) the direct integration method, (ii) Stevens operator equivalents method, and (iii) spin Hamiltonian methods. In each case some examples are given for various compounds. Finally, some physical information which can be drawn from these matrix elements is discussed. (37 refs.)

108366 Hyperfine interactions measurements on ^{181}Ta probes in HfV_2H_x compounds: ($0\leq x\lesssim 4$). R.Heidinger, P.Peretto, S.Choulet (DRF/Lab. Interactions Hyperfines, CENG, Grenoble, France).
Solid State Commun. (USA), vol.47, no.4, p.283-9 (July 1983).
The electric field gradient (EFG) has been measured on ^{181}Ta probe sites in HfV_2H_x alloys ($0\leq x\lesssim 4$) using the time differential perturbed angular correlation technique. One observes that the main component V_{zz} of the EFG decreases by a factor of two for hydrogen concentrations increasing from $x=0$ to $x=4$ hydrogen atoms/formula. The opposite behavior was observed on ^{51}V by using the NMR technique. At $T=4.2K$ the EFG tensor is non-axially symmetric. The observed asymmetry factor for $x=0$ is $\eta=0.58(3)$ and it slightly increases to $\nu=0.70$ for $x\simeq 4$. The system is orthorhombic at low temperatures for all x and the experiments suggest that hydrogen would stabilize a tetragonal phase at higher temperatures. The relaxation effects are absent for $x=0$ and vanishingly small for $x\simeq 4$ but they are observed at intermediate concentrations supporting the idea of a hydrogen ordering for $x=4$. (16 refs.)

Two types of F centres in alkaline earth fluoro-halides. I. Superhyperfine interactions and electronic structure ... See Entry 107693

The Li sites in the RT and low temperature phases of $LiKSO_4$ crystals ... See Entry 107902

Peierls dimerization at the Jahn-Teller phase transition in $PrCl_3$ ... See Entry 107925

Splitting of the 3d levels of iron group impurities in crystals with zincblende structure ... See Entry 108339

Superposition model of the orbit-lattice interaction. I. Analysis of strain results for Dy^{3+}:CaF_2 ... See Entry 108367

Evidence for the Ham effect in bis-tetramethylammonium hexachloroneptunate (IV) ... See Entry 108369

Paramagnetic hyperfine structure of iron (57) in $V_{1-x}Fe_xO_2$ ... See Entry 108370

Resistivity of the $Ce(Rh_{1-y}Pt_y)_2$ system ... See Entry 108389

Effect of crystal-field splitting on the Einstein relation in tetragonal semiconductors ... See Entry 108446

Line width of magnetic excitations in the Cubic Laves-phase compounds $PrNi_2$, $PrAl_2$ ... See Entry 108671

Magnetostriction of dilute rate-earth bismuthides: the effect of non-S-state ions versus 'S-state' ions ... See Entry 108755

The angular dependence of EPR spectra for ions with $S=3/2$ in a crystal field of rhombic symmetry in the case of large zero-field splittings ... See Entry 108760

Evaluation of spin Hamiltonian parameters of electron-nuclear spin-coupled systems from EPR data by the method of least-squares fitting ... See Entry 108761

Low-spin ferric porphyrin complexes: analysis of the electronic structure based on single-crystal electron spin resonance measurements ... See Entry 108766

EPR study of the randomly diluted two-dimensional Heisenberg ferromagnet $K_2Cu_xZn_{1-x}F_4$ ... See Entry 108769

ESR studies of electron irradiated $K_3Ir(CN)_6$ in KCl single crystals. Mono and di-chlorinated species ... See Entry 108774

Temperature dependence of the spin Hamiltonian parameters in KCl:Eu^{2+} crystals ... See Entry 108777

Quadrupolar ordering in a non-magnetic cubic doublet system: Cs_2NaHoF_6 ... See Entry 108800

^{29}Si nuclear magnetic resonance and relaxation in the paramagnetic state of $CeCu_2Si_2$ ... See Entry 108825

Transferred hyperfine interactions between ^{25}Mg nuclei and neighbouring Cr^{3+} impurities in magnesium oxide [ENDOR study] ... See Entry 108835

Spin density distribution in cobaltocene: a proton ENDOR study on $Co(cp)_2$ diluted in $Mn(cp)(CO)_3$ single crystals ... See Entry 108836

Contribution of the direct B-B interaction to the supertransferred hyperfine field at diagmagnetic antimony in oxidic spinels determined by ^{121}Sb Mossbauer spectroscopy ... See Entry 108846

Observation of disappearance of cooperative Jahn-Teller distortion in the two-dimensional magnetic system $K_2Cu_xZn_{1-x}F_4$ by Raman scattering experiments ... See Entry 108960

Absorption spectra, energy levels, and crystal-field analysis of trivalent neodymium in the γ phase of neodymium sesquisulfide (γ-Nd_2S_3) ... See Entry 108970

Optical absorption and magnetic circular dichroism of MnI_2 ... See Entry 108974

Study of the 2.4 and 2.6 eV absorption bands in CdMnTe ... See Entry 108976

Absorption spectrum of Ni^{2+} doped in NH_4Br single crystal ... See Entry 108982

Cobalt centres in ammonium chloride: optical absorption studies ... See Entry 108983

Nickel centers in strontium tartrate tetrahydrate single crystals ... See Entry 108984

Energy and phase relaxation of phosphorescent *F* centers in CaO ... See Entry 108995

Laser induced emission spectra of Pr^{3+} in CaF_2 at low temperatures ... See Entry 109002

71.70E Spin-orbit coupling, Zeeman, Stark and strain splitting

108367 Superposition model of the orbit-lattice interaction. I. Analysis of strain results for Dy^{3+}:CaF_2. S.C.Chen, D.J.Newman (Dept. of Phys., Univ. of Hong Kong, Hong Kong).
J. Phys. C (GB), vol.16, no.25, p.5031-8 (10 Sept. 1983).
The strain results of Baker and Currell (1976) and Calvo et al. (1974) are analysed in terms of the superposition model using a complete diagonalisation of the $J={}^{15}/_{2}$ ground-multiplet Hamiltonian matrix. The order of magnitude of the fitting errors is similar to that of the data uncertainties and sensible values of superposition-model parameters are obtained. There is evidence that internal-strain effects are important and that local-strain effects are not significant in Dy^{3+}:CaF_2. (12 refs.)

Angle-resolved photoemission and band structure of copper ... See Entry 108278

Ground state properties of the Anderson model in the limit of large spin-orbit degeneracy ... See Entry 108359

Absorption spectra, energy levels, and crystal-field analysis of trivalent neodymium in the γ phase of neodymium sesquisulfide (γ-Nd_2S_3) ... See Entry 108970

Optical absorption and magnetic circular dichroism of MnI_2 ... See Entry 108974

Spectroscopic properties of Er^{3+} ions in Li(Er, Gd)P_4O_{12} single crystals—fluorescence, Raman and infrared spectra ... See Entry 108992

Angular resolved photoemission from Cu(110) ... See Entry 109105

On the role of spin-orbit coupling and crystal symmetry on the spin-polarization of photoelectrons in nonmagnetic crystals ... See Entry 109108

Semiconductor core-level to valence-band maximum binding-energy differences: precise determination by X-ray photoelectron spectroscopy ... See Entry 109110

71.70G Exchange interactions

108368 Indirect exchange interaction between two doubly bridged paramagnetic atoms. A coupled-cluster model study. E.L.Bominaar, R.Block (Inst. of Theoretical Chem., Univ. of Amsterdam, Amsterdam, Netherlands).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.109-20 (1983).
A model analysis is made of the influence of the ligands and the geometrical structure on the exchange-coupling constant, ecc, between two paramagnetic cations doubly bridged by two diamagnetic ligands. The model is based on a four-center, six-electron description of the superexchange unit, symmetry D_{2h}, with 1s Slater type orbitals. A coupled-cluster method is employed. First, SCF orbitals are constructed for the unpaired electrons neglecting the interactions between the cations. Then, using these nonorthogonal orbitals, the direct exchange is evaluated. In the latter step, the influence of the ligands is gradually diminished and the results are compared with those from complete configuration interaction. It is found that the Coulomb and exchange ligand potentials are important in the evaluation of the ecc. Further, the cation-ligand-cation angle for which the ecc is equal to zero is not sensitive to variations of the ligand-admixture coefficient in the cation orbitals. The values of the ecc, however, do change essentially. Finally, the usual application of the Heitler-London treatment is revised. It is shown that the off-diagonal Lagrange multipliers in the SCF procedures introduce non-negligible contributions of the ligands to the ecc. (32 refs.)

Acceptors in wide-gap semimagnetic semiconductors ... See Entry 108336

Valence fluctuations and magnetic-nonmagnetic transitions in a model for intermediate-valence systems ... See Entry 108360

Optical properties of donor electrons in semimagnetic semiconductors ... See Entry 108947

Molecular dynamical studies of the dissociation of a diatomic molecular crystal. I. Energy exchange in rapid exothermic reactions ... See Entry 109729

71.70J Nuclear states and interactions

108369 Evidence for the Ham effect in bis-tetramethylammonium hexachloroneptunate (IV). K.D.Warren (Dept,. of Chem., Univ. Coll., Cardiff, Wales).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.427-31 (19 Aug. 1983).
The possible reduction of angular momentum contributions via the Ham effect is considered for the Jahn-Teller-active Γ_8 ground level of f^3 systems in O^* symmetry. The magnetic susceptibility behaviour reported for the title compound is consistent with a predominant $\Gamma_8\otimes\tau_{2g}$ coupling, with

$E_{JT}/\hbar\omega \approx 0.10$, and the interpretation of paramagnetic resonance data for Np^{4+} in Cs_2ZrCl_6 is also facilitated by this assumption. (26 refs.)

108370 Paramagnetic hyperfine structure of iron (57) in $V_{1-x}Fe_xO_2$. J.Pebler (Fachbereich Chem., Philipps-Univ. Marburg, Marburg, Germany).
Phys. Status Solidi a (Germany), vol.78, no.2, p.589-94 (16 Aug. 1983).
With the aid of Fe(57) Mossbauer spectroscopy the nuclear hyperfine structure corresponding to the crystal states of trivalent iron in VO_2 is observed for polycrystalline paramagnetic samples of $V_{0.9985}Fe_{0.0015}O_2$ and $V_{0.9974}Fe_{0.0026}O_2$ at temperatures between 4.2 and 200K. (19 refs.)

108371 Estimation of applicability of the electrostatic model to calculate the crystal field parameters in garnets. M.Wojcik (Inst. of Phys., Polish Acad. of Sci., Warsaw, Poland).
Physica B & C (Netherlands), vol.121B+C, no.3, p.370-88 (Aug. 1983).
The electrostatic model is used to calculate the electric field gradient (EFG) at the cation sites for a number of garnets, such as *R*AlG (*R*=Lu, Yb, Y, Dy, Gd), YFeG, YGaG and $Na_3Sc_2V_3O_{12}$, as well as the optical crystal field parameters (CFP)$-Dq$, ν, ν', for Cr^{3+} ions in YAlG in the octahedral sites. The calculations include the effects of electrical polarization of the oxygen sublattices (self-consistent dipole and quadrupole moments) and the local deformation of the lattice due to substitution of Al^{3+} and Cr^{3+}. It is shown that the calculated EFG correctly reflects the main properties of the experimental data. In the case of CFP for YAlG:Cr^{3+}, it is shown that this model provides a fairly good estimation of the twofold CFP whereas the fourfold CFP require a different analytical approach. (35 refs.)

Nuclear magnetic resonance study of point defects in aluminium and copper .... See Entry 107679

Two types of F centres in alkaline earth fluoro-halides. I. Superhyperfine interactions and electronic structure .... See Entry 107693

Hyperfine interactions measurements on ^{181}Ta probes in HfV_2H_x compounds: ($0 \leq x \lesssim 4$) .... See Entry 108366

Evaluation of spin Hamiltonian parameters of electron-nuclear spin-coupled systems from EPR data by the method of least-squares fitting .... See Entry 108761

Cadmium-113 shielding tensors of cadmium-oxo compounds. I. Single-crystal studies on $Cd(NO_3)_2.4H_2O$ and $3CdSO_4.8H_2O$ .... See Entry 108794

Carbon-13 chemical shielding tensors in L-threonine .... See Entry 108796

Quadrupolar ordering in a non-magnetic cubic doublet system: Cs_2NaHoF_6 .... See Entry 108800

Nuclear acoustic resonance in single-crystal gold metal .... See Entry 108801

High-field static and MAS ^{31}P NMR: chemical shift tensors of polycrystalline potassium phosphates $P_2O_5.xK_2O$ ($0 \leq x \leq 3$) .... See Entry 108802

^{29}Si nuclear magnetic resonance and relaxation in the paramagnetic state of $CeCu_2Si_2$ .... See Entry 108825

Transferred hyperfine interactions between ^{25}Mg nuclei and neighbouring Cr^{3+} impurities in magnesium oxide [ENDOR study] .... See Entry 108835

Contribution of the direct B-B interaction to the supertransferred hyperfine field at diagmagnetic antimony in oxidic spinels determined by ^{121}Sb Mossbauer spectroscopy .... See Entry 108846

Quadrupole interaction of tantalum impurities in bismuth metal .... See Entry 108847

71.90 OTHER TOPICS IN ELECTRON STATES

108372 Electron density profiles in metal particles dispersed in metallic media. M.W.C.Dharma-Wardana, D.Pelletier (Div. of Phys., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
Physica B & C (Netherlands), vol.122B+C, no.1, p.49-54 (Sept. 1983).
Considers the calculation of electron densities associated with metal clusters dispersed in a metallic host. The usual cluster techniques are inapplicable or intractable in this case. However, by introducing a zeroth order jellium-cluster approximation for the metal cluster the authors treat the zeroth order model exactly within density functional methods. The difference between the true cluster and the jellium cluster is suitable for treatment by perturbation theory. Illustrative calculations for Au clusters in Li host, Li in Au host and Cu in Li host have been carried out, for clusters of up to about 100 atoms. The onset of bound states associated with the cluster as a whole (cluster-orbitals), and their significance, are discussed. (9 refs.)

72.00 ELECTRONIC TRANSPORT IN CONDENSED MATTER

(for surfaces, interfaces, and thin films, see 73.)

72.10 THEORY OF ELECTRONIC TRANSPORT; SCATTERING MECHANISMS

108373 Speculation on a scaling law for superconductor-resistor mixture exponent *s* in a percolation system. J.Kertesz (Phys. Dept., Tech. Univ. Munchen, Garching, Germany).
J. Phys. A (GB), vol.16, no.13, p.L471-4 (11 Sept. 1983).
It is argued that looking for a relationship between the exponent *s* and the cluster exponents may be more promising than looking for one between the resistor-insulator exponent *t* and the cluster exponents. The author proposes $s=\nu-\beta/2$. (31 refs.)

108374 Quantum effects in the conductivity of two-dimensional disordered systems. P.A.Vorob'ev (M.V. Lomonosov State Univ., Moscow, USSR).
JETP Lett. (USA), vol.37, no.6, p.308-11 (20 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.6, p.261-3 (20 March 1983). [received: Sept. 1983]
It is shown that the coefficients multiplying the logarithms in the expressions for the quantum corrections to the conductivity of two-dimensional systems depend on the characteristics of the scattering potentials and the geometry of the Fermi surface, and also on the energy of the carriers. (9 refs.)

108375 Comment on the determination of ρ_F from damage-rate measurements. C.Abromeit (Hahn-Meitner-Inst. fur Kernforschung Berlin, Berlin, Germany).
J. Phys. F (GB), vol.13, no.9, p.L169-72 (Sept. 1983).
The determinations of ρ_F (resistivity contribution per Frenkel defect) by damage-rate measurements is discussed critically. An integral equation is derived from which ρ_F can be evaluated using the theshold energy surface concept. The inherent approximations in the numerical procedure of King et al. (1981) can be understood within the scope of this analysis. (4 refs.)

108376 Critical exponent for 3-D percolation conductivity, revisited. C.D.Mitescu, M.J.Musolf (Dept. of Phys., Pomona Coll., Claremont, CA, USA).
J. Phys. Lett. (France), vol.44, no.16, p.L679-83 (15 Aug. 1983).
When the authors apply finite-size-scaling analysis to Monte-Carlo calculations of the electrical conductivity of simple-cubic, bond- and site-percolation lattices, they obtain a correlation-length critical exponent in good agreement with current values but, for the conductivity exponent, they find $t=2.06\pm0.16$, significantly higher than the value currently cited. This new value appears, however, in essential agreement with a recently proposed theoretical conjecture. (18 refs.)

108377 Transfer matrix calculation of conductivity in three-dimensional random resistor networks at percolation threshold. B.Derrida, D.Stauffer, H.J.Herrmann, J.Vannimenus (Service de Phys. Theorique, CENS, Gif-sur-Yvette, France).
J. Phys. Lett. (France), vol.44, no.17, p.L701-6 (1 Sept. 1983).
For very long bars of size $n \times n \times L$, with $L \gg n$, and *n* up to 18, the authors calculate the conductivity of a random network of resistors and insulators. At the percolation threshold in a simple cubic lattice their Monte Carlo data give a conductivity decreasing with bar diameter *n* as $n^{-2.1}$ for site and bond percolation. Taking into account corrections to scaling with a correction exponent ω near unity, their best estimate for the conductivity exponent *t* is t/ν-2.2 ± 0.1 in both the bond and the site cases. (19 refs.)

108378 Influence of electron-phonon coupling on transport near a mobility edge. H.Mueller, P.Thomas (Fachbereich Phys., Philipps-Univ. Marburg, Marburg/Lahn, Germany).
Phys. Rev. Lett. (USA), vol.51, no.8, p.702-5 (22 Aug. 1983).
The authors treat electronic transport in disordered systems, including the electron-phonon interaction, on both sides of a mobility edge ϵ_c on the same footing. By application of a mode-coupling approximation, self-consistent equations are derived from which one gets the matrices describing density relaxation due to both coherent tunneling processes and hopping processes. The resulting conductivity interpolates between a metallic behavior well above and a hopping behavior well below ϵ_c. (15 refs.)

Interdimensional scaling laws for the critical exponents of the percolation threshold .... See Entry 105266

Localization and dimensionality .... See Entry 108356

Band model for excitation transport in disordered solids .... See Entry 108383

Theory of cyclotron resonance halfwidth for electrons scattered by impurities and phonons .... See Entry 108790

72.15 ELECTRONIC CONDUCTION IN METALS AND ALLOYS

Thermal conductivities of a cracked solid .... See Entry 108084

Poly(1,6-heptadiyne), a free-standing polymer film dopable to high electrical conductivity .... See Entry 108577

72.15C Electrical and thermal conduction in amorphous and liquid metals and alloys

108379 Compound-forming effect in the electrical resistivity of liquid Pb-Te alloys. T.Akasofu (Dept. of Phys., Niigata Univ., Niigata, Japan), Shin'ichi Takeda, S.Tamaki.
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2485-91 (July 1983).
The electrical resistivity of liquid Pb-Te alloys has been measured as a function of temperature and concentration. The resistivity isotherm has a remarkable maximum and the temperature coefficient of the resistivity has large negative value around the equiatomic composition, suggesting that a kind of compound formation exists at this composition. The excess resistivities are interpreted in terms of the resonance scattering caused by the compound by PbTe with a finite lifetime. A similar behaviour of the resistivity in liquid Sn-Te alloys is also explained satisfactorily by the same model. (12 refs.)

108380 The influence of small amounts of crystallinity on the transport properties of metallic glasses. B.L.Gallagher, D.Pavuna, W.Calwell (Dept. of Phys., Univ. of Leeds, Leeds, England).
J. Non-Cryst. Solids (Netherlands), vol.57, no.2, p.251-63 (1 Sept. 1983).
Small amounts of crystallinity may be present in 'amorphous' alloy specimens in the form of 'cast-in' crystallites or partially crystallized surfaces. In this paper the possible effects of such low-level crystallinity upon the measured electrical transport properties are considered. It is found that the observed ageing effects in the transport properties of a number of amorphous alloys may be explained as due to surface crystallization driven by selective oxidation. It is further argued that for the ferromagnetic Metglasses cast-in crystallites could have a significant effect particularly upon the thermopower, and that this is probably part of the explanation of the observed discrepancies between the different measured values. It is shown that even very small levels of crystallinity can have significant effects upon the measured transport properties and the many disagreements to be found in the published values are discussed in the light of this. (45 refs.)

108381 Electron charge transfer in liquid copper-tin alloys. Y.Waseda (Dept. of Materials Sci. & Engng., Univ. of Pennsylvania, Philadelphia), K.T.Jacob.
Metall. Trans. A (USA), vol.14A, no.8, p.1748-50 (Aug. 1983).
The authors show the effect of liquid structure, obtained from X-ray diffraction studies, on electron charge transfer in liquid Cu-Sn alloys. (22 refs.)

108382 Measurement of the specific electrical resistance of liquid alloys of systems Ge-Sb, Ge-Te, Sb-Te and Ge-Sb-Te. H.-U.Tshirner, I.P.Pazdrij, R.Weikart (Sektion Phys., Tech. Hochschule Karl-Marx-Stadt, Karl-Marx-Stadt, Germany).
Wiss. Z. Tech. Hochsch. Karl-Marx-Stadt (Germany), vol.25, no.2, p.219-25 (1983). In German.
The binary systems as mentioned in the title are eutectic systems. The number of conductivity electrons per atom are four in liquid germanium and five in liquid antimony. The calculated electrical resistance of liquid Ge at melting point according to the Ziman theory agrees very well with the average experimental results, whereas in the case of Sb there are deviations of about 20% between calculated and experimental results. The experimental measurement of the specific electrical resistance was done using the three-phase field method and the results were determined by comparing with the specific resistance of mercury. The discrepancy was about 2%. Curves show a comparison of theoretical and experimental results for resistance vs. concen-

tration of Sb-Ge, Ge-Te, Sb-Te and also the specific resistance as function of temperature for the compounds in question. (38 refs.) *G.R.S.*

Experimental facility to measure conductivity of liquid metals and semiconductors. ....See Entry 105339

Theory of the interaction between electrons and the two-level system in amorphous metals. III. Experimentally observable quantities ....See Entry 108268

Critical behavior of $Fe_{15}Ni_{65}B_{18}Si_2$ ferromagnetic glass ....See Entry 108704

72.15E Electrical and thermal conduction in crystalline metals and alloys

108383 Band model for excitation transport in disordered solids. R.Parson (Dept. of Chem., MIT, Cambridge, MA, USA).
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.59-62 (26 Aug. 1983).
A model for band excitation transport in a substitutionally disordered tight-binding alloy is described and illustrated. The model enables one to obtain an approximate diffusion coefficient from the pure-crystal band structure and the CPA density of states. (7 refs.)

108384 Residual resistance of metals due to vacancies. V.V.Kolesnikov, E.V.Polozhentsev, A.N.Pavlov (Sci.-Res. Inst. of Phys., State Univ., Rostov-on-Don, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.198-200 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Measurements of the residual resistance of a metal provide one of the simplest methods for monitoring the purity and perfection of metal samples, particularly those subjected to irradiation. A theoretical calculation is made of the contribution of vacancies to the residual resistance. The results are compared with the data on aluminium and it is shown that the contribution of vacancies to the residual resistance is quite important. (5 refs.) *A.T.*

108385 On the resistivity behaviour of some weak-ferromagnetic nickel-based alloys. P.Muth (Wissenschaftsbereich Phys., Hochschule fur Verkehrswesen 'Friedrich List', Dresden, Germany).
Phys. Status Solidi b (Germany), vol.118, no.2, p.K117-20 (1 Aug. 1983).
The addition of elements such as V, Cr, Mn, W, Ru to Ni strongly increases the resistivity and decreases the saturation magnetization. Ferromagnetism is limited to a small range and disappears at concentrations between 10 and 20 at.%. All these alloys do not follow the Slater-Pauling curve indicating that the band structure is completely altered by alloying. to get some information about the change of the electronic structure the residual sub-band resistivities of the majority and the minority spin-band $\rho\uparrow$ and $\rho\downarrow$, have been calculated from measurements of the residual resistivity and the spontaneous resistivity anisotropy. (7 refs.)

108386 A critical concentration of Ni-Mn alloys at about 6 at.% Mn. P.Muth (Wissenschaftsbereich Phys., Hochschule fur Verkehrswesen 'Friedrich List', Dresden, Germany).
Phys. Status Solidi b (Germany), vol.118, no.2, p.K137-9 (1 Aug. 1983).
The magnetic behaviour of Ni-Mn alloys is unusual in the concentration range around 25 at.% Mn due to an order-disorder transformation. But there are, too, unusual physical properties in disordered Ni-Mn alloys in the range between 5 and 10 at.% Mn. To get more information on the transport properties and the electronic structure of these alloys the residual subband resistivities of the majority and the minority spin-band, $\rho\uparrow$ and $\rho\downarrow$ have been calculated as a function of the manganese concentration. (10 refs.)

108387 On the resistive anomaly in NiCuSi and NiCuZn alloys near the Curie temperature. I.Lupsa (Dept. of Phys., Polytech. Inst., Cluj-Napoca, Rumania), E.Burzo.
Phys. Status Solidi a (Germany), vol.78, no.2, p.K155-8 (16 Aug. 1983).
In order to obtain information on the resistive anomaly at the Curie points in more complex systems, the NiCuSi and NiCuZn alloys were studied. Despite the changes of the magnetic properties of NiCuSi and NiCuZn alloys, as a function of composition, the resistive behaviour evidenced around T_C is similar for all samples. The dominant contribution to the magnetic resistivity of NiCuSi and NiCuZn solid solutions seems to be due to short-range fluctuations. (11 refs.)

108388 Transport equations for many-particle systems. W.Hansch, G.D.Mahan (Phys. Dept., Indiana Univ., Bloomington, IN, USA).
Phys. Rev. B (USA), vol.28, no.4, p.1902-22 (15 Aug. 1983).
The formalism of Kadanoff and Baym (1962) is used to derive a new transport equation for many-particle systems in DC electric fields. The authors use it to derive the conductivity of a metal, when limited by the electron-phonon interaction. The final result is identical to Holstein's formula (1964), which he derived from the Kubo formula. They also solved two other problems: the electrical current in a system limited by Gaussian white noise, and the diffusion coefficient from impurity scattering. They also discuss the lack of thermal stability in particle systems limited by Gaussian white noise. (27 refs.)

108389 Resistivity of the $Ce(Rh_{1-y}Pt_y)_2$ system. A.Harrus, J.Timlin, T.Mihalisin (Dept. of Phys., Temple Univ., Philadelphia, PA, USA), A.I.Abou-Aly.
Solid State Commun. (USA), vol.47, no.9, p.731-5 (Sept. 1983).
The electrical resistivities of $Ce(Rh_{1-y}Pt_y)_2$ samples, and of $La(Rh_{1-y}Pt_y)_2$ samples have been measured from 2 to 300K. The data suggest that an evolution takes place from antiferromagnetic crystal field split trivalent Ce behavior for pure $CePt_2$ to Kondo lattice behavior with diminishing crystal field effects for $0.5<y<1$ to mixed valence behavior for $y<0.5$. Comparisons are made to the behavior observed in other systems such as $Ce(Pd_{1-x}Rh_x)_3$, $Ce(Pd_{1-y}Ag_y)_3$ and $Ce(Sn_{1-y}In_y)_3$. (15 refs.)

108390 Low-temperature investigations of the system α-R(H, D)$_x$ with R=Er, Tm, Lu after quench and/or electron irradiation. J.N.Daou, P.Vajda (Univ. Paris-Sud, Orsay, France), A.Lucasson, P.Lucasson.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.325-8
The electrical resistivity of the solid solutions of H in Er, Tm and Lu exhibits an anomaly at ~160K. Quenches across the anomaly and subthreshold electron irradiations at liquid helium introduce a $\Delta\rho$ which recovers in one stage in the anomaly region. The observations are interpreted through a 'condensation' of hydrogen into H-H pairs of lower ρ, with a concentration- and isotope mass-dependent binding energy. Quench and irradiation produce isolated H-atoms as defects; upon annealing, they reform into pairs just before the pair dissociation. The H-defects interact with magnetically ordered structures in Er and Tm. (7 refs.)

Electrical resistivity of ten selected binary alloy systems ....See Entry 105043

Structure and electrical properties of new ternary silicides YIr_2Si_2 and $LaIr_2Si_2$ ....See Entry 107612

Self-interstitial-atoms and their agglomerates in HCP metals ....See Entry 107681

Interaction between self-interstitial and solute atoms in gold ....See Entry 107745

Solubility of hydrogen and deuterium at low concentration in $Fe_{0.5}Ti_{0.5}$ ....See Entry 107949

Filling of the 3d band of the manganese in $GdAl_{2-x}Mn_x$ for $x<0.2$ ....See Entry 108276

Galvanomagnetic effects in quenched aluminium ....See Entry 108391

Charge-density-wave-like transition in V_3Te_4 ....See Entry 108399

Hardening by thermal vacancies and quenching strains in singly-oriented Pb single crystals ....See Entry 109318

On the recovery and annealing kinetics of cold-worked Ni-4.5 at% Cu alloy ....See Entry 109327

Change in structure and properties in stepped aging of V95 aluminum alloy plates ....See Entry 109357

Quenching and annealing experiments on high-purity iron with and without carbon ....See Entry 109375

An investigation of the properties of internally oxidised Cu-Al-Ti-Hf alloys ....See Entry 109420

Characterization of metals and alloys by electrical resistivity measurements ....See Entry 109642

72.15G Galvanomagnetic and other magnetotransport effects

108391 Galvanomagnetic effects in quenched aluminium. Y.Ueda, T.Kino (Lab. of Crystal Phys., Hiroshima Univ., Hiroshima, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.294-6
The Hall coefficient, the transverse magnetoresistance and the longitudinal one of quenched polycrystalline aluminium have been measured in a high-field region at 4.2K. The measured Hall coefficient $R_H=(1.02\pm0.01)\times10^{-10}$ m^3/C agrees with the theoretically calculated value in spite of the existence of vacancies or its clusters. Anomalously small values are obtained for the transverse magnetoresistance and the longitudinal one in specimens quenched from 400°C and subsequently aged at room temperature to form vacancy clusters. A model based on the spacing of vacancy clusters and the cyclotron radius of a conduction electron is proposed to explain the anomalous decrease of the magnetoresistances. (11 refs.)

The appearance of the many-body resonance at the Fermi level in Kondo-lattices ....See Entry 108405

Logarithmic behavior in a new two-dimensional metal: HgTe-CdTe superlattice ....See Entry 108543

72.15H Thermomagnetic effects

108392 Thermopower in high magnetic fields: electron-phonon mass enhancement. W.Hansch, G.D.Mahan (Dept. of Phys., Indiana Univ., Bloomington, IN, USA).
Phys. Rev. B (USA), vol.28, no.4, p.1886-901 (15 Aug. 1983).
The authors calculate the adiabatic thermopower in a high magnetic field. Continuing their previous work, they derive a many-body transport equation including the magnetic field and derive the high-field conductivity tensor. The transport equation is derived by both the Keldysh (1964) and the Kadanoff-Baym (1962) nonequilibrium formulation of many-body systems. The results published by Opsal, Thaler, and Bass (1976) are confirmed to a certain extent. Electron-phonon mass enhancement is present in the adiabatic thermopower in high magnetic fields. (30 refs.)

72.15J Thermoelectric effects

108393 Dependence of the thermal electromotive force of aluminum alloys on the grain size. T.I.Pan'ko, T.L.Borisova, S.D.Vangenheim (Inst. of Phys. Engng., Acad. of Sci., Donetsk, Ukrainian SSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.461-9 (1982). [received: Aug. 1983]
Contributions by the lattice and grain boundaries to the thermal electromotive force of aluminum alloys have been estimated separately from the dependence of the thermal EMF on the grain size. (10 refs.)

108394 Relation between thermal EMF of low-alloyed nickel base alloys and structure of Ni 3d band. V.A.Cherenkov (Res. & Design Inst. of Alloys of Nonferrous Metals, Moscow, USSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.601-5 (1982). [received: Aug. 1983]
The thermal EMF of dilute alloys of nickel and 3d elements is interpreted within the framework of a two-current conduction model using the theory of s-d scattering at phonons, magnons and magnetic impurities. The purpose is to establish a correlation between the thermal EMF and composition of binary nickel-base alloys in a wide temperature range, with the second element being primarily a transition metal. The inadequate description of the thermal EMF of nickel-base alloys in the Ziman and Beal-Monod-Weiner theories may apparently be explained as follows. The theories disregard: i) changes in the Fermi surface of nickel during its alloying, ii) scattering of conduction electrons (from s to d band) at magnons and phonons, and iii) s-d-hybridization. (9 refs.)

108395 Thermo-electromotive force of solid and liquid indium-based metallic solutions. V.I.Ivlev, V.A.Yudin.
Russ. Metall. (GB), no.3, p.33-6 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.3, p.36-9 (1982).
All the impurities that form solid solutions in indium outside the dependence of their position in the periodic table reduce the positive absolute thermo-emf of solid indium in the range from room temperature to melting point. In the two-phase range between solidus and liquidus (with a fairly wide temperature range between), the thermo-emf of indium alloys is determined virtually by the relative amounts of solid and liquid phases. (10 refs.)

The influence of small amounts of crystallinity on the transport properties of metallic glasses ....See Entry 108380

Charge-density-wave-like transition in V_3Te_4 ....See Entry 108399

72.15N Collective modes, e.g. in one-dimensional conductors

108396 Enhancement of electrical conductivity of polyacetylene by electron beam irradiation in the presence of dopant. K.Yoshino, S.Hayashi, G.Ishii, Y.Inuishi (Faculty of Engng., Osaka Univ., Osaka, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.6, p.L376-8 (June 1983).
Electrical conductivity of $(CH)_x$ doped with various dopants like SF_6, C_2H_2, etc. which are usually not effective in increasing conductivity, is found to be enhanced by irradiation with the electron beam. These facts are tentatively ascribed either to the radiation induced complex formation, to the formation of cross-linking preserving the conjugated double bond scheme, or to the effective doping by the molecular fragments created by the decomposition of dopants by the electron beam irradiation. (8 refs.)

108397 Highly anisotropic conductive materials: polymers doped with crystalline charge-transfer complexes. L.Burda, A.Tracz, T.Pakula, J.Ulanski, M.Kryszewski (Polymer Inst., Tech. Univ. of Lodz, Lodz, Poland).
J. Phys. D (GB), vol.16, no.9, p.1737-40 (14 Sept. 1983).
A method of obtaining polymeric materials showing high anisotropy of electrical conductivity (up to 10^8) is reported. Electrical properties of polycarbonate films doped with TTT-TCNQ crystalline CT complex obtained using this method are discussed. (6 refs.)

108398 The impurity effect on the phase transitions in quasi-one-dimensional conductors. Ch.Seidel, V.N.Prigodin (A.F. Ioffe Physico-Tech. Inst., Acad. of Sci., Leningrad, USSR).
Phys. Status Solidi b (Germany), vol.118, no.2, p.713-24 (1 Aug. 1983).
Using bosonization and replica methods the influence of impurities on phase transitions in quasi-1D systems is studied within the framework of the 1D Fermi gas model. The random impurity potential is taken as a white-noise type. It is shown that nonmagnetic impurities suppress the dielectric transition but do not influence the superconducting state. Magnetic impurities suppress both the transitions, but the dielectric one considerably stronger than the superconductor one. Some special features occurring in the commensurate case are studied. Implications for organic 1D conductors are discussed. (20 refs.)

108399 Charge-density-wave-like transition in V_3Te_4. S.Anzai, S.Ohta, A.Yoshino, J.Nishio, M.Hatori (Faculty of Sci. & Technol., Keio Univ., Yokohama, Japan).
Phys. Status Solidi b (Germany), vol.118, no.2, p.K99-102 (1 Aug. 1983).
The charge-density-wave (CDW) states are favored in the poorly correlated electron systems, while the weakly correlated electrons stabilize the weak itinerant antiferromagnetisms. In order to study the poorly and the weakly correlated electron systems, the electrical resistivity, the Seebeck coefficient, and the magnetic susceptibility of V_3Te_4 are investigated. The authors find an electrical and magnetic transition in V_3Te_4 which is similar to that of 1T-VTe_2. (7 refs.)

108400 Low temperature metallic resistivity of the charge-transfer organic conductor $(TMTSF)_2PF_6$. S.K.Kyo (Sandia Nat. Labs., Albuquerque, NM, USA).
Solid State Commun. (USA), vol.47, no.4, p.247-50 (July 1983).
The electrical resistivity arising from electron-electron Umklapp scattering is calculated at low temperatures for the anisotropic but two-dimensional charge-transfer complex $(TMTSF)_2PF_6$. Also, the author considers a specular scattering correction to a recent one-phonon scattering mechanism and finds a significant change in the temperature dependent behavior of the resistivity. Finally an exact solution is obtained for the resistivity arising from two-libron scattering and is found to give a small contribution at low temperatures. Comparing these results with recent data, we find that the electron-electron mechanism yields the most satisfactory agreement at low temperatures, while contributions from the other two mechanisms may not be negligible at high temperatures. (18 refs.)

108401 Hysteresis in the electrical properties of orthorhombic tantalum trisulphide: evidence for an incommensurate-commensurate charge-density wave transition?. A.W.Higgs, J.C.Gill (H.H. Wills Phys. Lab., Bristol, England).
Solid State Commun. (USA), vol.47, no.9, p.737-42 (Sept. 1983).
A study of electrical conduction in orthorhombic TaS_3 has revealed the existence of thermal hysteresis throughout the temperature range 55K<205K. This is attributed to variability in the wavevector q of the charge-density wave (CDW) which develops below T_p=215K, and confirms the recent finding, from electron diffractions, that at temperatures not too far below T_p the CDW is incommensurate with the underlying lattice. Evidence that q becomes commensurate, at least along the chain direction at 55K, is provided by the vanishing of hysteresis at that temperature, and also by a rise in the threshold field for continuous motion of the CDW. From its dependence on temperature it is concluded that between T_p and 55K the conduction in the linear regime is better described as that of a Peierls semi-metal, rather than that of a Peierls intrinsic semiconductor. At most temperatures within that range electrical hysteresis also is observed, and a detailed study of this leads to the tentative conclusion that translation of the CDW conveys negative charge, carried presumably by negatively-charged discommensurations. The mechanisms of conduction below 55K remain uncertain. (18 refs.)

108402 Electron localization in 1D conductors due to the phonon scattering. A.A.Gogolin (L.D. Landau Inst. for Theoretical Phys., Moscow, USSR).
Solid State Commun. (USA), vol.47, no.9, p.753-7 (Sept. 1983).
Electron localization in 1D conductors due to scattering by dispersionless optical phonons at low temperatures has been studied by applying the Berezinsky diagram technique. The large localization length l_{loc}, much longer than the mean free path l, has been found. The low frequency optical absorption is described by the law: Re $\sigma(\omega) \sim \omega^2 |\ln^3 \omega|$. (9 refs.)

108403 On the metallic temperature dependence of the conductivity of doped polyacetylene. Wan Meixiang, Wang Ping, Cao Yong, Qian Renyuan (Inst. of Chem., Acad. Sinica, Beijing, China), Wang Fosong, Zhao Xiaojian, Gong Zhi.
Solid State Commun. (USA), vol.47, no.10, p.759-61 (Sept. 1983).
The true metallic temperature dependence of the conductivity of various doped polyacetylene films of both fibrillar and granular morphology has been experimentally demonstrated by voltage shorted compaction measurements. (11 refs.)

108404 Infrared conductivity from spin and charge density waves: $(TMTSF)_2X$. E.W.Fenton, G.C.Psaltakis (Div. of Phys., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
Solid State Commun. (USA), vol.47, no.10, p.767-72 (Sept. 1983).
Infrared conductivity from an incommensurate spin density wave occurs due to even-order charge density wave harmonics which interact with the host lattice. Phonon states within the density-wave-induced energy gap for single-particle excitations lead to conductivity much different from that of an incommensurate charge density wave including counter-ion ordering. The conductivity expected for relaxed and quenched states of $(TMSF)_2ClO_4$ is discussed. (11 refs.)

Strategic design of organic conductors. Structure of a prototypical molecule ....See Entry 106258

Determination of the spin-Peierls distortion in N-methyl-N-ethyl-morpholinium ditetracyanoquinodimethanide [MEM(TCNQ)$_2$]: neutron diffraction study at 6K ....See Entry 107663

On the translation mode of the kink lattice of a quasi-one-dimensional Peierls-Frohlich system with a nearly half-filled band ....See Entry 107843

Evidence for one-half charge-density-wave wavelength pinning periodicity in Peierls conductors ....See Entry 108293

Charge orderings and lattice distortions in complex TCNQ salts ....See Entry 108316

Theory of Josephson-type oscillations in a moving charge-density wave ....See Entry 108484

Far-infrared powder spectrum of $(N(CH_3)_3D)(I)(TCNQ)$ ....See Entry 108934

72.15Q Scattering mechanisms and Kondo effect

(see also 75.20H Local moments in dilute alloys)

108405 The appearance of the many-body resonance at the Fermi level in Kondo-lattices. F.G.Aliev, N.B.Brandt, V.V.Moschalkov, S.M.Chudinov (Low Temperature Phys. Lab., Moscow State Univ., Moscow, USSR).
Solid State Commun. (USA), vol.47, no.9, p.693-7 (Sept. 1983).
Studying transport and magnetic properties of solid solutions $Ce_xLa_{1-x}Cu_2Si_2$ $(0 \leq x \leq 1)$ and using for $CeCu_2Si_2$ pressure p as an external parameter, the authors have observed the continuous transition from Kondo-impurity regime $(x \ll 1)$ to Kondo lattice $(x \simeq 1,\ p=0,\ \nu_{Ce} \approx 3+)$ and then through the intermediate valence state $(x=1,\ 0<p<p_0 \neq 0,\ 3+<\nu_{Ce}<4+)$ to metal with $\nu_{Ce} \simeq 4+$. They have found that all the anomalous properties of Kondo-lattices ($CeCu_2Si_2$, $CeAl_3$, $CeAl_2$) are caused by the appearance at the Fermi level of the many-body resonance of Abrikosov-Suhl type. (12 refs.)

Transport equations for many-particle systems ....See Entry 108388

Resistivity of the $Ce(Rh_{1-y}Pt_y)_2$ system ....See Entry 108389

Electron localization in 1D conductors due to the phonon scattering ....See Entry 108402

72.20 CONDUCTIVITY PHENOMENA IN SEMICONDUCTORS AND INSULATORS

(for nonelectronic thermal conduction, see 66.70)

Otto-Schott-Colloquium on the State of Optical Glass Research 1982 ....See Entry 105025

72.20D General theory, scattering mechanisms

108406 Acoustic and optical-phonon-limited mobilities in *p*-type silicon within the deformation-potential theory. F.Szmulowicz (Univ. of Dayton Res. Inst., Dayton, OH, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.485-7 (1 Sept. 1983).
The deformation-potential theory of Bir and Pikus (1961), for the hole-optical phonon scattering, has been extended for the treatment of nonparabolic bands and combined with the theory of Tiersten (1961, 1964) for the hole-acoustic phonon scattering, to calculate phonon-limited mobilities in *p*-type silicon. The mobilities were calculated without the relaxation-time approximation from solutions of the full Boltzmann equation, with accurate hole wave functions and valence-band dispersions. Only the hole-optical phonon deformation-potential parameter was adjusted to yield agreement with transport data at room temperature; other experimental input was fixed. This represents the first such calculation for silicon. The conductivity and Hall mobilities, and the Hall factor, are in very good agreement with most of the available experimental data. The agreement between experiment and theory is significantly better than that attained by earlier calculations. (28 refs.)

On the solution of the periodic Anderson model ....See Entry 108352

Electron mobility of high purity VPE-GaAs and LPE-GaAs .See Entry 108407

Electron scattering processes at modulation-doped GaAs-(AlGa)As interfaces ....See Entry 108535

72.20F Low-field transport and mobility; piezoresistance

108407 Electron mobility of high purity VPE-GaAs and LPE-GaAs. Xu Shouding, Li Ruiyun (Inst. of Semiconductors, Acad. Sinica, Beijing, China).
Chin. J. Semicond. (China), vol.4, no.4, p.389-94 (July 1983). In Chinese.
Electrical properties of high purity VPE-GaAs and LPE-GaAs have been measured by using Van der Pauw method at a temperature range of 20K to 300K, their scattering mechanism has also been analysed. The highest peak mobility obtained in the laboratory is 3.76×10^5 cm^2/V.s for VPE-GaAs and 2.54×10^5 cm^2/V.s for LPE-GaAs respectively. (5 refs.)

108408 Z-type jump in electrical conductivity of samarium manganite. N.Kamegashira, Y.Miyazaki, H.Suzuki (Dept. of Materials Sci., Toyohashi Univ. of Technol., Toyohashi, Japan).
Mater. Lett. (Netherlands), vol.2, no.1, p.56-8 (July 1983).
The electrical conductivities of non-stoichiometric samarium manganites were measured as a function of temperature and the existence of a Z-type jump in the conductivity curve was found near 1300K, and a heat anomaly was also observed by differential thermal analysis, which should reflect the same phase transition as in $LaMnO_3$. (11 refs.)

108409 Transport properties of amorphous silicon films on quartz substrate. B.Chakrabarti, S.Chaudhuri, A.K.Pal (Dept. of General Phys. & X-rays, Indian Association for the Cultivation of Sci., Calcutta, India).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.6, p.903-7 (June 1983).
Electrical conductivity and thermoelectric power of vacuum evaporated a-Si films deposited onto a quartz substrate were measured in-situ at a system pressure $\sim 10^{-6}$ Torr. Data were analysed with the well known Mott's relations and it was observed that conduction is governed by variable range hopping in the lower temperature region and by carriers excited into the localised states at the band edges at high temperatures. (27 refs.)

108410 Electrical resistivity of undoped GaAs single crystals grown by magnetic field applied LEC technique. K.Tersashima, T.Katsumata, F.Orito, T.Kikuta, T.Fukuda (Optoelectronics Joint Res. Lab., Kawasaki, Japan).

Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.6, p.L325-7 (June 1983).

The authors have grown undoped GaAs single crystals by the magnetic field applied LEC (MLEC) technique and measured their electrical and optical properties. The most striking result was that the electrical resistivity of undoped GaAs changed from being semi-insulating (10^8 ohm-cm) to semiconducting (10 ohm-cm) by increasing the magnetic field (0 to 1300 Oe). PL, DLTS and SIMS measurements suggest that the decrease of resistivity is mainly due to the decrease in concentration of the deep level defects. (14 refs.)

108411 Electron tunneling and hopping possibilities in RuO_2 thick films. N.C.Halder (Dept. of Phys., Univ. of South Florida, Tampa, FL, USA).

Electrocompon. Sci. & Technol. (GB), vol.11, no.1, p.21-34 (1983).

Proposes that the temperature coefficient of resistivity (TCR) in thick film resistors arises from (i) the usual particle-to-particle conduction, (ii) electron tunneling and (iii) the phonon-assisted hopping. Equations for activation energies are derived for the temperature minimum of the resistance with and without hopping. New equations for TCR are suggested. Some extensive calculations of TCR and activation energy have been made for RuO_2 thick film resistors, the results of which agree well with available experimental measurements. (15 refs.)

108412 The influence of annealing on the resistivity of irradiated n-GaP samples. S.A.Airapetyan, S.K.Nikogosyan, V.A.Saakyan, A.S.Saroyan.

Izv. Akad. Nauk Arm. SSR Fiz. (USSR), vol.17, no.1, p.36-9 (1982). In Russian.

The space charge of disordered regions formed during electron irradiation of *n-GaP* samples modulates the energy zone edges. As a result, the rise of specific resistivity for annealed (above 600°C) samples at low temperatures is moderated. (3 refs.)

108413 Electrical conductivity of transition metal oxide glasses in the system V_2O_5-B_2O_3-TeO_2 at high temperatures. V.G.Dixit, K.Singh (Dept. of Phys., Nagpur Univ., Nagpur, India).

J. Phys. & Chem. Solids (GB), vol.44, no.9, p.859-64 (1983).

Bulk DC conductivities of the electronically conducting transition metal oxide glasses in the system xV_2O_5-$50B_2O_3$-$(50\text{-}x)TeO_2$ were measured at different temperatures in the range 310-623K. The dependence of conductivity on composition is explained on the basis of the role of TeO_2 as a modifier or impurity. The observed kink in the log σ vs. $1/T$ characteristic of the glasses is interpreted as being due to switching over of the conduction mechanism from one type to the other. The activation energies are fitted in a linear relation of the type $E_g=A-BP$, where A and B are constants and P, the composition parameter. Comparing the results obtained with those of previous workers in the V_2O_5-P_2O_5 and V_2O_5-B_2O_3 systems, a physical analysis is presented. (22 refs.)

108414 Dark conductivity in amorphous undoped silicon film. V.Augelli, R.Murri (Dipartimento di Fisica, Bari, Italy).

J. Non-Cryst. Solids (Netherlands), vol.57, no.2, p.225-40 (1 Sept. 1983).

The temperature dependence of the dark conductivity was investigated in amorphous undoped silicon films deposited by glow-discharge in a $SiCl_4$-H_2 mixture. Differential transport processes were identified according to the investigated temperature range. The dependence of the dark conductivity was also examined as a function of some deposition parameters. The experimental results are discussed in terms of the two-phase structure of the film. (42 refs.)

108415 On the mobility dip in polycrystalline silicon. C.H.Ling (Dept. of Electrical Engng., Nat. Univ. of Singapore, Singapore).

J. Phys. D (GB), vol.16, no.9, p.L181-4 (14 Sept. 1983).

Measured Hall mobility in polycrystalline silicon layers shows a minimum at a certain doping concentration. This is interpreted in terms of the decrease in conductivity rather than a decrease in inherent mobility in the grain boundary space charge-region. The inherent mobility is suggested to be about the same as in the surrounding neutral region. (8 refs.)

108416 Photoelectronic properties of Cu_3PS_4 and Cu_3PS_3Se single crystals. J.V.Marzik, A.K.Hsieh, K.Dwight, A.Wold (Dept. of Chem., Brown Univ., Providence, RI, USA).

J. Solid State Chem. (USA), vol.49, no.1, p.43-50 (Aug. 1983).

Single crystals of Cu_3PS_4 and Cu_3PS_3Se grown by chemical vapor transport were shown to be diamagnetic p-type semiconductors. Electrical measurements showed room temperature resistivities ranging from 1 to 5 ohm-cm and carrier concentrations of 10^{17} cm^{-3}. Both materials were shown to be active as cathodes for the photoelectrolysis of water. Spectral response measurements show that substitution of selenium for sulfur lowers the optical band gap from 2.38(5) eV for Cu_3PS_4 to 2.06(4) eV for Cu_3PS_3Se. (20 refs.)

108417 Electrical transport properties of GaAs and AlAs mixed crystals for semiconductor devices. A.K.Saxena (Dept. of Electronics & Communication Engng., Univ. of Roorkee, Roorkee, India).

J. Inst. Electron. & Telecommun. Eng. (India), vol.29, no.3, p.97-107 (March 1983). [received: Aug. 1983]

Proposes a three-level Γ, L, X conduction band structure for $Ga_{1-x}Al_xAs$ alloys with the first direct (Γ) indirect (X) minima cross-over occurring at $x=0.43$. The sub-band energy gaps between the Γ-L and Γ-X minima in GaAs were determined to be 0.285 and 0.485 eV, respectively (in contradiction to the accepted value of 0.36 eV) and a two-level model for the conduction band structure. The deep energy levels are present in the alloys and were found to be strongly coupled to the indirect minima even for the alloy compositions for which the direct energy Γ minimum is the lowest in energy. The various scattering mechanisms and their relative magnitudes in the various minima were determined together with the various scattering parameters for the three minima. In addition to optical and microwave devices, the $Ga_{1-x}Al_xAs$ material should also prove useful for pressure sensor, current limiting and switching devices. (76 refs.)

108418 Many-electron hopping. P.Gosar (Dept. of Phys., E. Kardelj Univ. of Ljubljana, Ljubljana, Yugoslavia).

Phys. Status Solidi b (Germany), vol.118, no.2, p.853-60 (1 Aug. 1983).

Correlated hopping of many electrons in the impurity band of the moderately compensated semiconductor is studied. The calculation of the n-electron cluster transition rate is based on the following assumptions: the one-electron states in the impurity band are strongly localized, the motion of each electron is restricted to the hopping between low impurity sites, the electrons mutually interact by Coulomb forces, and the deformation-potential-type coupling to phonons is used. A statistical approach is applied in the calculation of transition rates for very large clusters. (5 refs.)

108419 Electrical properties of $CuGaTe_2$. S.M.Wasim, G.Marcano, G.Sanchez Perez (Dept. de Fisica, Univ. de Los Andes, Merida, Venezuela).

Phys. Status Solidi a (Germany), vol.78, no.2, p.423-30 (16 Aug. 1983).

A systematic study in made on the effects of annealing $CuGaTe_2$ single crystals in vacuum, under reduced pressure, and in the presence of Gd and Zn. From the variation of hole concentration with temperature, the acceptor state ionization energy is found to lie between 18 and 37 meV. This energy state is associated with a Ga vacancy. There is some indication that Zn acts as donor in this compound. The mobility data are explained by taking into account the scattering of the charge carriers by ionized and neutral impurities, acoustic-mode phonons, and space charge effects. The valence-band deformation potential is found to be 4.32 eV. (23 refs.)

108420 Radiation-induced conductivity in polyethylene. A.P.Tyutnev, V.S.Saenko (Moscow Inst. of Electronic Machine Building, Moscow, USSR), A.V.Vannikov, G.S.Mingaleev.

Phys. Status Solidi a (Germany), vol.78, no.2, p.689-96 (16 Aug. 1983).

The radiation-induced conductivity of PE is studied under varying irradiation conditions: pulse length 5 μs to 1 ms, dose rate 10^4 to 2×10^7 Gy/s, dose per pulse 1 to 10^4 Gy including continuous excitation. The bias field is varied in the 4×10^6 to 2×10^8 V/m range. Tests are made in vacuum (3×10^{-3} Pa) at room temperature. At short pulses of irradiation (≤1 ms) the conductivity is attributed to geminate electrons undergoing dispersive transport whereas at longer times free carriers predominate. The geminate recombination is estimated to be almost complete in roughly 0.1 to 1 s at room temperature. No polarization phenomena can be detected in PE under irradiation. (25 refs.)

108421 Electrical conductivity of $Li_{16-2x}Zn_x(GeO_4)_4$. P.Kurek, W.Bogusz (Inst. of Phys., Warsaw Tech. Univ., Warsaw, Poland).

Phys. Status Solidi a (Germany), vol.78, no.2, p.K117-19 (16 Aug. 1983).

The formula $Li_{16-2x}Zn_x(GeO_4)_4$ where $0<X<4$ describes the family of solid solutions between Li_4GeO_4 and Li_2ZnGeO_4. The authors report an investigation of the electrical conductivity of compounds characterized by $x=0.5$, 1.0, 1.25, 1.5, and 2.0. Their electrical properties were determined by means of admittance spectroscopy. (8 refs.)

108422 Drift mobility measurements on single crystals of orthorhombic benzophenone using the electron bombardment technique. M.Saleh (Dept. of Phys., Univ. of Nairobi, Nairobi, Kenya).

Phys. Status Solidi a (Germany), vol.78, no.2, p.K137-40 (16 Aug. 1983).

The work reported is aimed at studying the temperature dependence of carrier mobilities in single crystals of orthorhombic benzophenone in the temperature range $160K\leq T\leq300K$, using the electron bombardment technique, and to obtain evidence which might assist in the identification of the charge carrier transport mechanisms for such type of crystals. (10 refs.)

108423 Effect of ytterbium on the electrophysical properties of Ga_2Se_3 single crystals. B.G.Tagiev, G.M.Niftiev, G.K.Aslanov, I.M.Askerov, F.N.Sultanov (Inst. of Phys., Acad. of Sci., Azerbaidzhan SSR).

Phys. Status Solidi a (Germany), vol.78, no.2, p.K189-93 (16 Aug. 1983).

Gives the results of investigations of the temperature dependences of electric conductivity (σ(T)), the current-voltage characteristics, and the thermostimulated depolarization currents of Ga_2Se_3 single crystals doped with ytterbium (Yb) over wide ranges of temperatures (140 to 410K) and electric fields (10 to 5×10^4V/cm). (10 refs.)

108424 Surface effects in semiconductors in contact with liquids deduced from conductivity and Hall coefficient measurements. M.Petrescu (Inst. de Constructii, Bucuresti, Rumania), N.Gherbanovschi.

Stud. & Cercet. Fiz. (Rumania), vol.35, no.7, p.671-8 (1983). In Rumanian.

Conductivity and Hall coefficient measurements, on high resistivity germanium samples, with adequate geometries, explain surface effects in some dielectric liquids, at various temperatures. These effects have an influence on the behaviour, in such mediums, of semiconductor devices with geometries which emphasize the part of the surface in comparison with the volume. (11 refs.)

108425 An efficient numerical scheme for spreading resistance calculations based on the variational method. S.C.Choo, M.S.Leong, J.H.Sim (Dept. of Electrical Engng., Nat. Univ. of Singapore, Singapore).

Solid-State Electron. (GB), vol.26, no.8, p.723-30 (Aug. 1983).

The authors present a simple and efficient numerical scheme for evaluating the correction factor integrals that arise in the variational method. The scheme is a modification of one recently proposed by Berkowitz and Lux (see J. Electrochem. Soc., vol.128, p.1137, 1981) for the uniform flux method. The abscissae and the weights required for the integration are given in a form which allows the numerical scheme to be readily implemented. Using this scheme it takes, on an average, 0.8 sec to compute one value of correction factor on an Apple II microcomputer. For a slab of varying thickness, backed by either a perfectly conducting or a high resistivity substrate, the correction factors obtained agree with those derived from the exact constant-potential method to within 1%. (13 refs.)

108426 Damaged-induced isolation in *n*-type InP by light-ion implantation. P.E.Thompson, S.C.Binari, H.B.Dietrich (Naval Res. Lab., Washington, DC, USA).

Solid-State Electron. (GB), vol.26, no.8, p.805-10 (Aug. 1983).

A detailed study of the insulating properties of ion-implantation induced damage in InP has been carried out for H, He, B and Be implantation. For each ion, there was found to be an optimal implantation fluence for the formation of resistive layers. At this fluence, a maximum resistivity of 10^3 to 10^4 Ω.cm was observed. Lower resistivities were observed for higher and lower implantation fluences. The primary anneal stage for the maximum resistivity layers was between 250 and 300°C. Anomalous results were observed for H implantation in that the resistivity observed depends on the test structure geometry. Measurements carried out by contacting the front and back of the damage layer gave resistivity values two orders of magnitude greater than those measured by contacting adjacent points on an epitaxial structure. For all other ions, the results obtained for the two geometries were in good agreement. It has been shown that a conductive layer produced by the proton bombardment of the underlying Fe-doped substrate gives rise to a low resistance shunt in the epitaxial study. (6 refs.)

108427 On electrical transport in non-isothermal semi-conductors. J.M.Dorkel (Inst. Nat. des Sci. Appliquees de Toulouse, Toulouse, France).

Solid-State Electron. (GB), vol.26, no.8, p.819-21 (Aug. 1983).

The analysis of transport mechanisms in a non-isothermal semiconductor is today of growing interest in the modelling of power devices. In 1972 Stratton proposed an expression of the electron current which can serve as the basis of a non-isothermal device model. In particular he demonstrated that the expression of the current contained a supplementary term linked to the presence of a temperature gradient in the structure. This supplementary term led to the definition of a thermal diffusion coefficient of the carriers which, like the mobility and the classical diffusion constant, is linked to the scattering mechanisms to which the carriers are subjected. In his analysis Stratton gave an explicit form of this thermal diffusion coefficient in the particular case of the dominance of the lattice-scattering mechanism. The present paper proposes a calculation method for this thermal diffusion coefficient, applicable to the more general case where the lattice scattering and the ionized impurity scattering mechanisms are equally significant. (5 refs.)

108428 Fundamental models of electronic transport in amorphous semiconductors. D.Emin.
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.2-3, p.303-14 (1983). In English. (Otto-Schott-Colloquium on the State of Optical Glass Research 1982, Jena, Germany, 1982).
Electronic excitations in condensed matter are either quasifree or self-trap. This fundamental dichotomy results in two distinct models for electronic carriers in amorphous semiconductors. In one the predominant charge carriers behave as quasifree particles; in the other they form small polarons and move by small-polaronic hopping. The salient features of the electronic transport arising from the high-mobility (Mott-CFO) model and the small-polaron model are contrasted. While some amorphous semiconductors support high-mobility transport many of the commonly studied materials (e.g. chalcogenide glasses) display small-polaron transport. (46 refs.)

Enhancement of gas sensitivity by controlling microstructure of α-Fe_2O_3 ceramics .... See Entry 105317

Experimental facility to measure conductivity of liquid metals and semiconductors. .... See Entry 105339

Crystallization of bismuth telluride from a melt containing excess tellurium .... See Entry 107576

Growth and physical properties of Ln_2GeSe_5, $Ln_2Ge_2Se_7$, $Ln_2Ge_3Se_9$ single crystals .... See Entry 107578

Formation of p^+-layer in GaAs by dual implantation of Zn and As .... See Entry 107724

Doping of germanium telluride with bismuth and copper .... See Entry 107725

Photodoping of Ag into single crystal As_2S_3 .... See Entry 107726

Distribution of Cu between solid CdS and liquid $CdCl_2$+CdS .... See Entry 107733

Radiation-induced defect formation in InSb doped with Gd, Ge, Cu, Ag, Zn, and Cd .... See Entry 107766

Mechanical, thermal, and microstructural properties of neutron-irradiated SiC .... See Entry 107777

Structure transformation in mixed polycrystalline $Zn_{1-x}Cd_xS$ doped with Mn and Cu .... See Entry 107903

Study of thermal properties, electrical conductivity, and the crystallization process of the glassy alloy $SeGe_{20}$ .... See Entry 108085

Phase composition and electrophysical properties of EuS- and Sm-based films .... See Entry 108225

Hysteresis in the electrical properties of orthorhombic tantalum trisulphide: evidence for an incommensurate-commensurate charge-density wave transition? .... See Entry 108401

Acoustic and optical-phonon-limited mobilities in *p*-type silicon within the deformation-potential theory .... See Entry 108406

Effect of crystal-field splitting on the Einstein relation in tetragonal semiconductors .... See Entry 108446

High temperature oscillations of magnetoresistance in bismuth and semimetallic BiSb alloys .... See Entry 108452

Investigation of formation conditions of thermal donors-I and -II in oxygen-containing n-type silicon within the temperature range 400 to 800°C .... See Entry 108458

Electron transport in highly compensated, undeformed *n*-type InSb in the temperature range 4.3-300K .... See Entry 108459

Stability of the thermoelectric properties of p-type solid solutions based on Bi_2Te_3 .... See Entry 108460

Electrical conduction in nickel ferrite .... See Entry 108461

An experimental determination of the critical exponents at the metal-insulator transition .... See Entry 108481

1/f noise in mobility fluctuations and the Boltzmann equation [nondegenerate semiconductors] .... See Entry 108485

Low field mobility of 2-d electron gas in modulation doped $Al_xGa_{1-x}As/GaAs$ layers .... See Entry 108545

Epitaxial layers of iron-doped gallium arsenide .... See Entry 108580

A study of the Hall coefficient and electrical conductivity of thin CdHgTe films subjected to laser irradiation .... See Entry 108581

Preparation and properties of single crystals of some cadmium-containing indium, thallium, and cesium halides .... See Entry 109133

Hydrogenated amorphous silicon produced by laser induced chemical vapor deposition of silane .... See Entry 109158

Investigation of the sintering process of NiO from the point of view of its electronic structure .... See Entry 109179

Rapid thermal annealing of Se and Be implanted InP using an ultrahigh power argon arc lamp .... See Entry 109339

72.20H High-field and nonlinear effects

108429 A study of the transformations between stationary and transit domains in a Gunn device. Wang Shouwu, Zheng Yiyang, Xi Xiaolin, Zhang Jinchang (Inst. of Semiconductors, Acad. Sinica, Beijing, China).
Chin. J. Semicond. (China), vol.4, no.4, p.321-33 (July 1983). In Chinese.
The transformations between stationary and transit domains in a Gunn device which has a n^+-n-n^+ structure with a doping gradient near the anode are investigated. Experimental observation and computer simulation are carried out. When the domain reaches the anode, it stops and become a quasi-stationary domain, and the field outside the domain reaches its maximum value. If the bias voltage is not high enough to cause a new domain to be created at the notch near the cathode, the quasi-stationary domain readjusts itself to become a real stationary domain, while the field outside the domain will decrease to a fixed value, which is independent of the bias voltage. Theoretical analysis has been carried out and an analytical relationship between the field outside the domain for real stationary domains and the doping density in the active region of the device is obtained. (14 refs.)

108430 High-field transport properties of $In_{0.765}Ga_{0.235}As_{0.5}P_{0.5}$. M.Deb Roy (Phys. Dept., Jadavpur Univ., Calcutta, India), B.R.Nag, D.Chattopadhyay.
Appl. Phys. A (Germany), vol.A32, no.1, p.39-43 (Sept. 1983).
Monte-Carlo results on the velocity-field characteristics, AC diffusion-constant and thermal-noise voltages are presented for $In_{0.765}Ga_{0.235}As_{0.5}P_{0.5}$ at 300K. Recently available values of physical constants have been used in the calculations. The values of diffusion constants are close to those of InP but the thermal noise voltages are found to increase faster with the field. The peak velocity is 1.9×10^7 cm/s and the threshold field for negative differential mobility is about 6 kV/cm. (19 refs.)

108431 Effect of optical-phonon scattering on the energy distribution of hot electrons in semiconductors at low temperature. E.F.El-Wahidy, L.Abou El-Nasr (Dept. of Phys., Alexandria Univ., Alexandria, Egypt).
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.1175-86 (July-Aug. 1983).
The variational method is used in finding the solution of the transport equation for a system of hot electrons in *n*-Ge at $T=20$K in the presence of high electric field. The role of the emission of optical phonons by hot electrons together with the effect of electron capture by repulsive centres on the formulation of the distribution function are studied. It is shown that the emission of optical phonons plays a dominant role in the formulation of the distribution. The influence of electron capture is very small, it may become appreciable at higher trap concentrations. The obtained distribution function is then used in calculating the capture rate of electrons by negatively charged centres. It is shown that the capture rate increases with electric field. (10 refs.)

108432 High-field unipolar charge injection into insulators of various geometries. L.S.Miller, R.Kershaw (Dept. of Materials & Energy Sci., Coventry Polytech., Coventry, England).
J. Phys. D (GB), vol.16, no.9, p.1749-54 (14 Sept. 1983).
Single carrier space-charge-influenced effects (for non-zero injection fields) are considered. Initial, transient, and DC currents are derived analytically. The transient problem is solved only for planar samples. The transient current shows the normal space-charge-limited (SCL) form even for space-charge-free conditions. For fixed non-zero injection fields a sharp rise of current with voltage above the 'switch-on' voltage (V_I) gives way to the normal SCL square-law for $V \gtrsim 5\ V_I$. The 'zero-time' current-voltage curve is universal in form for the simple geometries. For Schottky injection, the initial rise with voltage is less rapid; both cases could readily be misinterpreted as due to a trap-filled limit. (7 refs.)

108433 Nonlinear oscillations and chaos in electrical breakdown in Ge. S.W.Teitsworth, R.M.Westervelt (Dept. of Phys., Harvard Univ., Cambridge, MA, USA), E.E.Haller.
Phys. Rev. Lett. (USA), vol.51, no.9, p.825-28 (29 Aug. 1983).
Self-generated nonlinear oscillations and chaos are found in the conductance of liquid-He-cooled far-infrared photoconductors made from ultrapure Ge. Complex behavior includes a period-doubling cascade to chaotic oscillation with increasing applied electric field, quasiperiodic oscillation, frequency locking, and intermittent switching between modes of oscillation. A rate-equation model is presented which includes impurity impact ionization and space-charge injection. (16 refs.)

108434 Correlation functions for high-field transport in semiconductors. J.J.Niez, K.-S.Yi, D.K.Ferry (Dept. of Electrical Engng., Colorado State Univ., Fort Collins, CO, USA).
Phys. Rev. B (USA), vol.28, no.4, p.1988-96 (15 Aug. 1983).
The relevant correlation functions for the differential mobility and the diffusion cofficient are developed here for the far-from-equilibrium steady state appropriate to high-field transport in semiconductors. The authors present a unified analysis for the evolution of several generic correlation functions related to this steady state. They emphasize the initial values and the temporal evolution of these functions. (35 refs.)

Nonlocal photovoltaic response function for the interpretation of hologram writing in ferroelectric crystals .... See Entry 106727

Electric-field-independent electron mobilities in anthracene .... See Entry 108438

Charge-density-wave transport in orthorhombic TaS_3. III. Narrow-band 'noise' .... See Entry 108487

High magnetic field studies of the two-dimensional electron gas in GaInAs-InP superlattices .... See Entry 108527

A study of the luminescent and electrical characteristics of films of ZnS doped with Mn .... See Entry 109018

72.20J Charge carriers: generation, recombination, lifetime, and trapping

108435 Spin dependent trapping in a polycrystalline silicon integrated circuit resistor. W.K.Schubert, P.M.Lenahan (Sandia Nat. Labs., Albuquerque, NM, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.497-9 (1 Sept. 1983).
Spin dependent trapping of majority carriers at trivalent silicon centers in the grain boundaries of a polycrystalline silicon integrated circuit resistor has been observed. The phenomenon has been studied both in a silicon bicrystal and in thin-film polycrystalline silicon with essentially identical results. This not only identifies the trapping center responsible for the large barriers observed at silicon grain boundaries, but also demonstrates that the technique has the sensitivity required to work with actual microelectronic devices. (10 refs.)

108436 A note on the nature of two recombination centres in indium antimonide. S.Qing, Z.Yuanxi, S.Weiying (Shanghai Inst. of Metall., Acad. Sinica, Shanghai, China).
Mater. Lett. (Netherlands), vol.2, no.1, p.79-80 (July 1983).
The probable nature of the two recombination centres commonly found in InSb (E_v+0.071 eV, E_v+0.11 eV) is discussed. By assuming certain interactions among defects and impurities in InSb, it is postulated that $V_{In}O_iV_{In}$ and Sb_{In} could tentatively be assigned to the said centres respectively. (11 refs.)

108437 Mobilities of electrons and holes in naphthalene and perdeuterated naphthalene. L.B.Schein, W.Warta (Xerox Corp., Webster Res. Center, Rochester, NY, USA), A.R.McGhie, N.Karl.
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.34-6 (26 Aug. 1983).
Charge carrier mobilities are presented over a wide temperature range (77-300K) for electrons and holes in naphthalene and perdeuterated naphthalene for the *a*, *b*, and *c′* crystallographic directions. Consideration is given to the implications of the observed deuteration effects on the validity of band and hopping models in these materials. (5 refs.)

108438 Electric-field-independent electron mobilities in anthracene. L.B.Schein, R.S.Narang, R.W.Anderson, K.E.Meyer (Xerox Corp., Webster Research Center, Rochester, NY, USA), A.R.McGhie.
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.37-40 (26 Aug. 1983).
It is experimentally shown that the electron drift mobility in the *c′* direction of anthracene is independent of the electric field up to 28 V/μm at 140K. These data provide a challenge to theories of charge transport which must account for both a temperature-independent and an electric-field-independent (to 28 V/μm) drift mobility. (16 refs.)

108439 Contactless measurement of photoinduced carrier lifetime and injection level in silicon wafer using additional eddy current. T.Maekawa, S.Inoue (Dept. of Electronics, Chiba Inst. of Technol., Chiba, Japan), A.Usami.
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.6, p.968-74 (June 1983).
A new contactless method for measuring the lifetime and the injection level of photoinduced excess carriers in a silicon wafer is described. In order for the measuring current to flow in the wafer, a pair of high frequency magnetic fluxes in opposite directions is used so as to concentrate the induced eddy current in the central part even for narrow wafers. The voltage in the wafer caused by eddy current and the photoconductivity are analyzed, and it is shown that the injection level of excess carriers can be calculated from the relation between the above voltage and lifetime measured for different illumination intensities. The dependence of lifetime on the injection level for NTD Si and normally doped n-C.Z Si wafers are found to be considerably different. The measurement sensitivity and the spatial resolution of this method are discussed. (19 refs.)

108440 Deep electron traps in undoped semi-insulating GaAs grown by the liquid encapsulated Czochralski method. Y.Imamura, J.Osaka (Atsugi Electrical Communication Labs., Nippon Telegraph & Telephone Public Corp., Kanagawa, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.6, p.L333-5 (June 1983).
Semi-insulating undoped GaAs grown by the liquid encapsulated Czochralski (LEC) method has been studied on deep traps using the photocurrent method, Hall effect measurements and the thermally stimulated current method. Obvious differences in the photocurrent spectra and the thermal activation energy for carrier density have been observed between crystals grown from Ga rich melt and As rich melt, in spite of either high resistivity or n-type properties. The reason is conceived to be the existence of two kinds of deep trap: approximate levels from the conduction band are 0.72 eV for Ga rich melt, and 0.86 eV for As rich melt. (5 refs.)

108441 Analysis of the recombination properties of Si heat treated under the conditions obtaining in the production of semiconductor instruments. V.I.Alekseenko, N.M.Litovchenko, N.M.Bondar', Yu.P.Medvedev.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.1, p.57-61 (1982). In Russian.
The change in lifetime of minority current carriers under various conditions of heat treatment is studied using industrial dislocation-free electronic Si ingots of large diameter (i.e. $d \simeq 60$ mm) doped with P, of specific resistance 4-5 Ohm.cm, with the spread of the specific resistance not exceeding 10%. The maximum decrease in hole lifetime t_h is observed, as would be expected, during oxidative cycles (generally 1000-1150°C), and the magnitude of t_h depends on the temperature and the duration of the oxidative cycle, which can be explained in terms of diffusion of impurities from the surface, these being effective recombination centres. Speaking generally, the change in t_h should be determined only by the heat treatment conditions and should not depend on the properties of the initial starting material, i.e. t_h should be about the same for all ingots subjected to the same heat treatment, which does not happen in practice, and in fact during heat treatment different concentrations of recombination centres are established, which can be explained in terms of internal gettering together with diffusion impurities. (14 refs.) *N.F.S.*

108442 The effect of cure on thermally stimulated discharge measurements in epoxy resin coatings. J.H.Daly, L.Bunton, R.A.Pethrick (Dept. of Pure & Appl. Chem., Univ. of Strathclyde, Glasgow, Scotland).
J. Mater. Sci. (GB), vol.18, no.9, p.2817-25 (Sept. 1983).
Thermally stimulated discharge (TSD) measurements are reported as a function of the degree of cure for a series of dicyandiamide cured powder epoxy resins. Data are presented on the effects of ageing and water uptake on the TSD traces. The observed effects are interpretated in terms of the generation of traps, creation of voids and changes in the bulk conductivity on the charge mobility. The TSD data are compared with dynamic mechanical analysis (DMA) and differential scanning calorimetry (DSC) observations on these systems. These studies indicate that the method is very sensitive to changes in the state of the coating and has potential as a test method for the characterization of epoxy resin coatings. (17 refs.)

108443 Many-electron hopping in semiconductors. P.Gosar (Dept. of Phys., E. Kardelj Univ., of Ljubljana, Ljubljana, Yugoslavia).
Physica A (Netherlands), vol.120A, no.1-2, p.339-50 (1983).
Correlated hopping of many electrons in the impurity band of moderately compensated semiconductors at low temperature is studied. The growth of the electric dipole moment of the n-electron cluster after the adiabatic switch on of the electron-phonon interaction and the external electric field is calculated. One- and two-phonon processes are considered. The theory is based on the following assumptions: one-electron states in the impurity band are strongly localized, the motion of each electron is restricted to the hopping between two impurity sites, the Coulomb interaction between electrons in the cluster is strong, and the deformation potential type coupling to phonons is assumed. It is shown that the exchange of virtual phonons during the hopping events results in the renormalization of the transfer matrix elements. The calculation also reveals an interference effect between the contributions of different electrons to the current. (3 refs.)

108444 Femtosecond relaxation of photoexcited nonequilibrium carriers in $Al_xGa_{1-x}As$. C.L.Tang, D.J.Erskine (Cornell Univ., Ithaca, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.9, p.840-3 (29 Aug. 1983).
Optical saturation of highly excited states in the conduction band of a semiconductor and the subsequent extremely fast energy relaxation due to carrier-carrier and optical-phonon scattering at room temperature are observed. The corresponding measured life-time for states 160 meV above the band edge in $Al_{0.34}Ga_{0.66}As$ is in the range of 80 to 30 fs depending upon the photoexcited carrier density. (12 refs.)

108445 Free-carrier absorption in n-PbSe at low temperatures due to eectron-electron scattering. N.Van Huong (Inst. of Theoretical Phys., Warsaw Univ., Warsaw, Poland).
Phys. Status Solidi b (Germany), vol.118, no.2, p.631-40 (1 Aug. 1983).
Free-carrier absorption due to the electron-electron interaction in strongly degenerate n-PbSe in calculated using the theory developed in a previous paper. This theory is specified for the case of a weakly anisotropic conduction band. Numerical results for the free-carrier absorption are compared with those corresponding to other electron scattering processes, and with experimental data on this material at 30K. (8 refs.)

108446 Effect of crystal-field splitting on the Einstein relation in tetragonal semiconductors. A.N.Chakravarti, K.P.Ghatak, K.K.Ghosh, H.M.Mukherjee (Inst. of Radio Phys. & Electronics, Univ. Coll. of Sci. & Technol., Calcutta, India).
Phys. Status Solidi b (Germany), vol.118, no.2, p.843-52 (1 Aug. 1983).
An attempt is made to study the effect of crystal-field splitting on the Einstein relation for the diffusivity-mobility ratio of the carriers in tetragonal semiconductors, taking inherently degenerate n-Cd_3As_2 as an example. It is found on the basis of the Bodnar model, which has recently been demonstrated in the literature to be the most valid model for Cd_3As_2, that the above ratio increases with increasing carrier concentration as expected for degenerate semiconductors. It is also shown that the tetragonal crystal-field effectively reduces the ratio with increasing amount of reduction with increasing carrier concentration. (22 refs.)

108447 Recombination and trapping levels in GaS:Mn single crystals. B.G.Tagiev, G.M.Niftiev, S.A.Abushov (Inst. of Phys., Acad. of Sci., Baku, Azerbaidzhan SSR).
Phys. Status Solidi a (Germany), vol.78, no.2, p.K183-7 (16 Aug. 1983).
Determines the parameters of recombination centres and traps in GaS:Mn by the methods of current-voltage characteristics, thermostimulated conductivity, and temperature dependences of photocurrent and dark current. (13 refs.)

108448 Thermally stimulated depolarization effect in thiourea-formaldehyde condensate. H.S.Nalwa, P.Vasudevan (Dept. of Chem., Indian Inst. of Technol., New Delhi, India).
Polymer (GB), vol.24, no.9, p.1197-8 (Sept. 1983).
A thiourea-formaldehyde condensate was synthesized in an acid medium and characterized by elemental analysis, infrared spectroscopy, and thermal methods of analysis. The thermally stimulated depolarization effect was studied in samples polarized under different conditions. The results indicate two distinct transitions in the temperature ranges 94-100°C and 122-126°C. The polarization-depolarization phenomena were correlated with the physicochemical changes occurring in the matrix. Depolarization kinetics data such as activation energy and relaxation times of the electrets are reported. (20 refs.)

108449 Enhancement of Auger recombination in semiconductors by electron-hole plasma interactions. M.Takeshima (Semiconductor Lab., Matsushita Electronics Corp., Osaka, Japan).
Phys. Rev. B (USA), vol.28, no.4, p.2039-48 (15 Aug. 1983).
It is shown that electron-hole plasma interaction has a very important effect on band-to-band Auger recombination in semiconductors. The effect is an enhancement, by a factor of about 5, of the Auger recombination rate as compared to the value calculated with the neglect of the electron-hole plasma interaction. Quantitative agreements between theories and experiments in a number of previous papers are fortuitous as a result of overestimation of overlap integrals. By careful estimation of overlap integrals the present theory gives a satisfactory explanation of experiments. (33 refs.)

108450 A study of the conduction and thermostimulated polarization currents in single crystals of Ca-Ga-Ge and Gd-Ga garnets. A.E.Nosenko, V.N.Shevchuk, V.V.Kravchishin.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1229-33 (Aug. 1983). In Russian.
Currents of thermostimulated polarization of Ca-Ga-Ge garnet single crystals and conduction currents of Ca-Ga-Ge and Gd-Ga garnets are studied at DC in vacuum of $\sim 10^{-5}$ mm Hg within 170-500K. It is shown that the polarization effects are substantial within 200-410K. At a temperature of about 410K and higher the current through a sample is determined by equilibrium conduction. (11 refs.)

Search for correlations between electrical characteristics and stoichiometry in mercuric iodide .... See Entry 106227

Nonlocal photovoltaic response function for the interpretation of hologram writing in ferroelectric crystals .... See Entry 106727

Temperature processing effects in proton-implanted n-type GaAs .... See Entry 107722

Incoherent focused radiation for activation of implanted InP .... See Entry 107753

Mismatch and electron mobility in MBE $Ga_xIn_{1-x}As$ epitaxial layers on InP substrates .... See Entry 108213

Metastable electron states in doped alloys $Pb_{1-x}Sn_xTe$ .... See Entry 108285

Exciton-enhanced double injection currents in tetracene crystals .... See Entry 108301

Electrical transport properties of GaAs and AlAs mixed crystals for semiconductor devices .... See Entry 108417

Effect of ytterbium on the electrophysical properties of Ga_2Se_3 single crystals .... See Entry 108423

High-field transport properties of $In_{0.765}Ga_{0.235}As_{0.5}P_{0.5}$ .... See Entry 108430

Barrier-layer photo-EMF under conditions of heating of charge carriers by light .... See Entry 108467

Field-dependent photocarrier generation in crystalline polydiacetylenes .... See Entry 108470

Electric-field-dependent charge-carrier trapping in a one-dimensional organic solid .... See Entry 108472

Transverse Dember effect in lead chalcogenides under linearly polarized light excitation .... See Entry 108473

Experimental verification of electron-hole recombination theory for Si-SiO_2 interface traps with nonequilibrium, steady-state, admittance measurements .... See Entry 108556

Measurements of capture cross section of traps in insulating films by photoinjection current decay .... See Entry 108557

A new method for the fabrication of submicron thick gallium arsenide membranes .... See Entry 109145

Rapid thermal annealing of Be, Si, and Zn implanted GaAs using an ultrahigh power argon arc lamp .... See Entry 109340

Photomodulated and one-beam and two-beam potential modulated photoelectrochemical spectroscopies .... See Entry 109756

Silicon MDS and SDS solar elements .... See Entry 109886

72.20M Galvanomagnetic and other magnetotransport effects

108451 Galvanomagnetic and thermoelectric properties of p-$Pb_{1-x}Ge_xTe$ in a 80-300K temperature range. V.L.Vassilev, S.K.Dimitrova (Faculty of Phys., Sofia Univ., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.5, p.587-9 (1983).
In recent years there has been a growing interest in the system of semiconductor solid solutions lead-telluride-germanium telluride, which is connected with their practical application (lasers and detectors in the IR region, thermoelectric generators), as well as with the observed phase transition Fm3m-R3m, whose temperature can be changed gradually by introducing germanium telluride in lead telluride from 0 to 700K. The paper deals with some preliminary investigations of the specific electroconductivity, the coefficient of thermo-electric power, the Hall effect and the transverse Nernst-Ettingshausen effect for p-type polycrystalline specimens of $Pb_{1-x}Ge_xTe$ for compositions with $x \leq 0.18$. (5 refs.)

108452 High temperature oscillations of magnetoresistance in bismuth and semimetallic BiSb alloys. Yu.A.Bogod, Vit.B.Krasovitskii, E.T.Lemeshevskaya.
Fiz. Nizk. Temp. (USSR), vol.9, no.8, p.832-44 (Aug. 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The electric conductivity, magnetic resistance, Shubnikov-de Haas oscillations and 'high temperature' oscillations (HTO) of magnetoresistance of semimetallic BiSb alloys are investigated at Sb concentrations C up to 2.6 at.%. The results obtained are compared with those for Bi. It is found that HTO periods can, through the similarity transformation, be expressed in terms of cyclotron masses at extreme crosses of the Fermi surface. In the range of $0 \leq C \leq 2.6$ at.% the relative change in the periods of the HTO and Shubnikov-de Haas oscillations connected with holes appears to be similar. The HTO amplitude is described within generalized $\ln\tilde{\rho}(T)$ coordinates: at $T \gtrsim 10$K the functions $\ln\tilde{\rho}(T)$ plotted for samples of different compositions form a family of parallel straight lines. The shape of the dependence of HTO amplitude on the value of magnetic field is found. The possibility of HTO application to the investigation of the energy spectrum in a wide temperature range is discussed. (26 refs.)

108453 Magnetic conductivity of thin layers of semimetals in ultraquantum magnetic fields. A.V.Butenko, V.V.Andrievskii.
Fiz. Nizk. Temp. (USSR), vol.9, no.8, p.880-3 (Aug. 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The conductivity of bismuth films is studied in the ultraquantum region of longitudinal or transverse magnetic fields. The results obtained are in agreement with Abrikosov's theory of semimetal conductivity within the quantum limit. The relation between impurity concentration and film thickness is found. (4 refs.)

108454 Self-consistent treatment of dynamical diffusion coefficient of two dimensional random electron system under strong magnetic fields. II. Y.Ono (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2492-8 (July 1983).
On the assumption that the Landau subband splitting is much larger than the subband width, the dynamic diffusion coefficient $D(\omega,E)$ of a two dimensional electron system scattered by randomly distributed short-ranged impurities under strong magnetic fields is determined through diagramatic self-consistent treatment. The case where the Fermi energy E lies within the N-th Landau subband with $N \neq 0$ is considered. Essential features of $D(\omega, E)$ are the same as in the case with $N=0$. The quantity $D(0,E)$ is finite only when the Fermi energy E is equal to E_N (the 'subband center') at which the real part of the Green function for the N-th subband becomes zero, i.e. all the states are localized except for those at the subband center. The N-dependence of $D(0,E_N)$ and the N- and E-dependences of the localization length for $E \neq E_N$ are discussed.

108455 Anomaly in the magnetoresistance in graphite under pulsed high magnetic fields. K.Nakamura, T.Osada, G.Kido, N.Miura, S.Tanuma (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2875-81 (Aug. 1983).
The anomaly of the magnetoresistance in graphite at low temperatures and high magnetic fields has been extensively investigated by d.c. and a.c. measurements using pulsed high magnetic fields up to 45 T. Several new aspects of the anomaly were observed. Especially it was found that the anomaly was suppressed strongly in a.c. measurements. The observed aspects of the anomaly suggest that the anomaly should originate from some many body effect such as a transition into a CDW state. (10 refs.)

108456 Magneto-resistance of a semiconductor with the dislocation wall in the quantum limit. K.O.Kechechyan, A.A.Kirakosyan (Erevan State Univ., Erevan, USSR).
Phys. Status Solidi b (Germany), vol.118, no.2, p.521-4 (1 Aug. 1983).
By the use of the 'energy loss' method the longitudinal and the transverse magneto-resistances of a semiconductor at magnetic field orientations, normal to and along the wall of edge dislocations are calculated. The dependences of the magneto-resistance on temperature, the charge carrier concentration, the magnetic field, and the interdislocation distance in the wall are obtained. In particular it is shown that there is a maximum in magneto-resistance versus interdislocation distance dependence, the location of which depends on the values of the rest of parameters. (11 refs.)

108457 Electrical studies on (Mo/W)Se_2 single crystals. II. Temperature dependence of Hall effect. M.K.Agarwal, P.D.Patel, O.Vijayan (Dept. of Phys., Sardar Patel Univ., Vallabh Vidyanagar, India).
Phys. Status Solidi a (Germany), vol.78, no.2, p.469-73 (16 Aug. 1983).
For pt.I see ibid., vol.78, p.133 (1983). The temperature dependence of the Hall parameter in single crystals of the series $Mo_xW_{1-x}Se$ ($0 \leq x \leq 1$) is studied in the temperature range from 300 to about 550K and compared with previously reported data. The results in general indicate that the crystals are in intrinsic conduction in the temperature range of investigation. The results suggest that the band structures of these crystals are identical. (21 refs.)

108458 Investigation of formation conditions of thermal donors-I and -II in oxygen-containing n-type silicon within the temperature range 400 to 800°C. P.I.Baranskii, V.M.Babich, N.P.Baran, Yu.P.Dotsenko, V.B.Kovalchuk, V.A.Shershel (Inst. of Semiconductors, Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Status Solidi a (Germany), vol.78, no.2, p.733-9 (16 Aug. 1983).
Thermally induced donors in Czochralski-grown dislocation-free phosphorus-doped n-Si crystals of different oxygen and carbon contents are investigated by different techniques. Hall effect within the temperature range 20 to 450K, dependences of piezoresistance and Hall coefficient on uniaxial elastic deformation within the mechanical stress range 0 to 15000 kp/cm^2 and electron paramagnetic resonance are used. The dependence of the donor behaviour on both the heat treatment and the starting materials is studied. It is established that thermally induced donors at 450°C differ from donors, which are induced at 650°C, if not in their chemical composition then, at any rate, in their structure and, possibly, in their surrounding. (23 refs.)

108459 Electron transport in highly compensated, undeformed *n*-type InSb in the temperature range 4.3-300K. H.Kishan, S.K.Agarwal, K.D.Chaudhuri (Dept. of Phys. & Astrophys., Univ. of Delhi, Delhi, India).
Phys. Rev. B (USA), vol.28, no.4, p.2078-90 (15 Aug. 1983).
Measurements of Hall coefficient, DC conductivity, and magnetoresistances have been made on highly compensated, undeformed *n*-type InSb samples from liquid helium to room temperature. The measurements show that the extent of the impurity-band conduction depends considerably on the compensation ratio and the effective concentration of the carriers. Two activation energies have been identified in the impurity-conduction region. The magnetoresistance at 4.2K is due to impurity-band conduction and is found to be positive. It shows approximately a square-law dependence on a magnetic field. The observed behavior of magnetoresistance at 300 and 77.4K is consistent with the behavior expected for free electrons. The variation of $\Delta\rho/\rho$ with temperature in the range 4.2-300K at 0.3 kG is essentialy governed by the variation of μ_H in the same temperature range. (32 refs.)

Doping of germanium telluride with bismuth and copper ....See Entry 107725

Radiation-induced defect formation in InSb doped with Gd, Ge, Cu, Ag, Zn, and Cd ....See Entry 107766

Kinetics of the decomposition of a solid solution of aluminium antimonide in germanium ....See Entry 107945

Low compensation vapor phase epitaxial gallium arsenide .....See Entry 108208

Mismatch and electron mobility in MBE $Ga_xIn_{1-x}As$ epitaxial layers on InP substrates ....See Entry 108213

Instabilities of (110) III-V compounds grown by molecular beam epitaxy ....See Entry 108219

The anomalous strain resistor effect in $Bi_{2-x}Sb_xTe_3$ polycrystalline films ....See Entry 108247

Energy spectrum of Bi_2Te_2Se ....See Entry 108282

Metastable electron states in doped alloys $Pb_{1-x}Sn_xTe$ ....See Entry 108285

Electron localization in a magnetic semiconductor: $Gd_{3-x}\nu_xS_4$ ....See Entry 108290

Exciton-enhanced double injection currents in tetracene crystals ....See Entry 108301

Energy levels of interstitial manganese in silicon ....See Entry 108343

The deformation potential of the lowest impurity state of As in Si ....See Entry 108347

The appearance of the many-body resonance at the Fermi level in Kondo-lattices ....See Entry 108405

Acoustic and optical-phonon-limited mobilities in *p*-type silicon within the deformation-potential theory ....See Entry 108406

Electrical transport properties of GaAs and AlAs mixed crystals for semiconductor devices ....See Entry 108417

Surface effects in semiconductors in contact with liquids deduced from conductivity and Hall coefficient measurements ....See Entry 108424

Far-infrared magneto-plasma wave transmission and the dielectric constant in bismuth under high magnetic fields ....See Entry 108463

An experimental determination of the critical exponents at the metal-insulator transition ....See Entry 108481

Hall effect, anisotropy, and temperature-dependence measurements of $1/f$ noise in silicon on sapphire ....See Entry 108486

High magnetic field studies of the two-dimensional electron gas in GaInAs-InP superlattices ....See Entry 108527

Observation of a fractional quantum number ....See Entry 108542

Logarithmic behavior in a new two-dimensional metal: HgTe-CdTe superlattice ....See Entry 108543

Surface and interfacial properties of $Ga_{0.47}In_{0.53}As\text{-}Al_2O_3$ MIS structures ....See Entry 108560

Surface roughness scattering at the $Si\text{-}SiO_2$ interface ....See Entry 108562

Epitaxial layers of iron-doped gallium arsenide ....See Entry 108580

A study of the Hall coefficient and electrical conductivity of thin CdHgTe films subjected to laser irradiation ....See Entry 108581

72.20N Thermomagnetic effects

Galvanomagnetic and thermoelectric properties of $p\text{-}Pb_{1-x}Ge_xTe$ in a 80-300K temperature range ....See Entry 108451

72.20P Thermoelectric effects

108460 Stability of the thermoelectric properties of p-type solid solutions based on Bi_2Te_3. N.K.Stark, S.N.Chizhevskaya, T.E.Svechnikova (A.A. Baikov Inst. of Metall., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1566-9 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1824-6 (Nov. 1982).
The stability of the thermoelectric properties of the alloys $Bi_2Te_{3-x}Se_x$ ($x=0.12$ to 0.6) doped with SbI_3 and Hg_2Cl_2 has been investigated at room temperature and upon heating up to 300°C for 500 to 600 h. The properties of all the alloys are stable when they are kept at room temperature for up to 5 to 6 years. The properties of alloys containing a small amount of selenium, which have no tendency to undergo ordering, remain invariant upon heating. Alloys of the composition $Bi_2Te_{2.4}Se_{0.6}$ doped with Hg_2Cl_2 change their properties when heated above 200°C. The change in the properties is attributed to the transfer of chlorine atoms from Se positions to Te^I positions. When this occurs, the coefficient of thermoelectric efficiency remains constant. (9 refs.)

108461 Electrical conduction in nickel ferrite. P.Venugopal Reddy, R.Satyanarayana, T.Seshagiri Rao (Dept. of Phys., Osmania Univ., Hyderabad, India).
Phys. Status Solidi a (Germany), vol.78, no.2, p.K109-11 (16 Aug. 1983).
Polycrystalline nickel ferrite samples were prepared by the conventional double-sintering process. The samples were sintered at 1300°C in air for 4 h. The electrical conductivity for this material was determined over a temperature range 300 to 920K by the two-probe method. Thermoelectric power studies have also been carried out from room temperature to 430K by the hot-probe method. From the sign of the observed Seebeck coefficient the nickel ferrite sample is found to be an n-type semiconductor. (13 refs.)

108462 Thermoelectric power of $TiSe_{2-x}S_x$ mixed crystals at low temperatures. A.A.Lakhani, S.Jandl (Dept. de Phys., Faculte des Sci., Univ. de Sherbrooke, Sherbrooke, Quebec, Canada), C.Ayache, J.-P.Jay-Gerin.
Phys. Rev. B (USA), vol.28, no.4, p.1978-82 (15 Aug. 1983).
The authors present thermoelectric power (TEP) measurements, as a function of temperature in the range 7-450K, of $TiSe_{2-x}S_x$ mixed crystals for $x=0$, 0.5, 0.75, 1, and 1.25. A pronounced negative minimum is observed near 150K in the samples which exhibit the superlattice state. In contrast, in the nontransforming crystals, the TEP varies monotonically with temperature. They interpret the 150-K TEP dip in the transforming samples as due to a phonon-drag effect, in which the strong interaction between electrons and holes and the softening TA-phonon mode L_1^-—the mode actually defining the $2a_0 \times 2c_0$ superlattice condition—plays a primary role. (41 refs.)

Doping of germanium telluride with bismuth and copper ....See Entry 107725

Phase composition and electrophysical properties of EuS- and Sm-based films ....See Entry 108225

Energy spectrum of Bi_2Te_2Se ....See Entry 108282

Transport properties of amorphous silicon films on quartz substrate ....See Entry 108409

Galvanomagnetic and thermoelectric properties of p-$Pb_{1-x}Ge_xTe$ in a 80-300K temperature range ....See Entry 108451

72.30 HIGH-FREQUENCY EFFECTS; PLASMA EFFECTS

108463 **Far-infrared magneto-plasma wave transmission and the dielectric constant in bismuth under high magnetic fields.** K.Hiruma, G.Kido, N.Miura (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2550-60 (July 1983).
Far-infrared magneto-plasma wave transmission in Bi was observed in pulsed high magnetic fields up to 40 T using an HCN laser(337 μm wavelength). The Fabry-Perot interferograms due to the propagation of the Alfven wave were observed as well as the cyclotron resonance, the combined resonance, and the Shubnikov-de Haas effect. The mass densities were obtained for the magnetic field parallel to the binary axis and electric field parallel to the bisectrix and trigonal axis. The lattice dielectric constant $\epsilon_{\parallel}$ was obtained as $\epsilon_{\parallel}=48$. As for $\epsilon_{\perp}$, however, an anomalously large increase of $\epsilon_{\perp}$ was observed as the magnetic field was increased above 14 T. The large field-dependence of $\epsilon_{\perp}$ was explained semi-quantitatively by the interband coupling between the lowest Landau levels of the conduction and valence bands for light electrons.

108464 **Far-infrared investigations of magnetoplasma effects in Bi in quantizing magnetic fields.** R.W.van der Heijden, P.Wyder (Res. Inst. for Materials, Univ. of Nijmegen, Nijmegen, Netherlands).
Physica B & C (Netherlands), vol.121B+C, no.3, p.299-342 (Aug. 1983).
A comprehensive experimental study is made of the magneto-optic absorption of Bi in the Voigt configuration in quantizing magnetic fields at frequencies covering the far-infrared range. At these frequencies, the typical magnetoplasma absorption features (cyclotron resonances, hybrid resonances and dielectric anomalies) gradually change character due to the strong quantization of the charge carrier system and because the experimental and cyclotron frequency become comparable to—and finally exceed—the plasma frequency. The fundamental quantum cyclotron resonance lineshape becomes strongly affected by transitions with $k_B \neq 0$ (k_B momentum along magnetic field), due to the nonparabolic band structure. Effects of carrier redistribution over different carrier pockets in the quantizing field region are strongly reflected in the hybrid resonance and dielectric anomaly lineshapes. In order to analyze the data, the absorption spectra are calculated in the limit of local electrodynamics, using either a conventional classical method or a more appropriate quantum-mechanical model. The latter model accounts qualitatively well for all major effects observed experimentally, taking into account the proper expression for the velocity matrix element for a nonparabolic band of the two-band model, over the entire frequency range. Nonlocal effects, clearly seen in the experimental data, are discussed qualitatively; these effects are illustrated by some additional experimental results obtained for Sb where nonlocal effects are very pronounced and strong. (80 refs.)

108465 **Nonlinear interaction of electromagnetic and plasma waves in periodic semiconductor structures.** A.A.Bulgakov (Inst. for Radiophys. & Electronics, Acad. of Sci., Kharkov, Ukrainian SSR).
Solid State Commun. (USA), vol.47, no.9, p.713-16 (Sept. 1983).
Interaction of waves in periodic laminar structures is considered. The matrix element for a classical superlattice consisting of alternating superconductor layers has been calculated. The periodicity of the medium is shown to entail new interactions nonexistent in uniform or semi-infinite geometries. Estimates predict a high efficiency of wave conversion in classical superlattices. (10 refs.)

Enhancement of Auger recombination in semiconductors by electron-hole plasma interactions ....See Entry 108449

72.40 PHOTOCONDUCTION AND PHOTOVOLTAIC EFFECTS; PHOTODIELECTRIC EFFECTS

108466 **Intracenter transitions in the dominant deep level (EL2) in GaAs.** M.Kaminska, M.Skowronski, J.Lagowski, J.M.Parsey, H.C.Gatos (MIT, Cambridge, MA, USA).
Appl. Phys. Lett. (USA), vol.43, no.3, p.302-4 (1 Aug. 1983).
Intracenter transitions in the major deep level EL2 in GaAs were identified for the first time by superimposing photocurrent measurements on those of optical absorption. These transitions were found to be responsible for the characteristic EL2 absorption band between 1.0 and 1.3 eV. At low temperatures (<60K) intracenter absorption exhibits a fine structure involving the zero phonon line and replicas at energies close to those of transverse acoustic phonons (TA). This coupling with TA phonons is a strong indication that EL2 is an extrinsic self-trapping center. (24 refs.)

108467 **Barrier-layer photo-EMF under conditions of heating of charge carriers by light.** Yu.G.Gurevich, V.B.Yurchenko (Lenin Kharkov Polytech. Inst., Kharkov, Ukrainian SSR).
Appl. Sol. Energy (USA), vol.18, no.5, p.5-10 (1982). Translation of: *Geliotekhnika (USSR)*, vol.18, no.5, p.6-10 (1982). [received: Aug. 1983]
The article is a theoretical study of the photovoltaic effect on a p-n junction under conditions of nonuniform electron heating with interband absorption of light. With the aim of enhancing the efficiency of photoelectric converters (PEC), the authors made a theoretical study of the photovoltaic effect on the p-n junction in a semiconductor with light electrons and heavy holes, under the condition that the electrons scattered energy quasi-elastically, and, in contrast to holes, they are heated with interband absorption of light. (7 refs.)

108468 **Photoelectric properties of nSiC-pSi heterojunctions.** V.M.Evdokimov, D.S.Strebkov, V.A.Tikhomirova, G.B.Fedosova (All Union Sci. Res. Inst of Current Sources, USSR).
Appl. Sol. Energy (USA), vol.18, no.5, p.11-16 (1982). Translation of: *Geliotekhnika (USSR)*, vol.18, no.5, p.10-15 (1982). [received: Aug. 1983]
The article describes studies of the photoelectric properties of heterojunction photoelements based on nSiC-pSi, manufactured by the method of fusing silicon onto monocrystalline silicon carbide. (8 refs.)

108469 **Investigation of lux-ampere characteristics of photoconducting layers of group $A^{II}B^{VI}$ semiconductors.** V.E.Bezvenyuk, V.B.Bogdanovich, A.N.Zyuganov.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.1, p.81-7 (1982). In Russian.
An attempt is made to apply existing theory to an accurate quantitative description of the lux-ampere characteristics of the title semiconductors and to develop on its basis a method of studying their physical parameters, in the light of information published since 1963, on the assumption that the photoconductor is excited by a sufficiently wide radiation spectrum, including inherent and impurity photo-exciters. It is concluded that the method provides a means of replacing piecewise-exponential approximations by a simple analytical formula suitable for a wide range of illumination. (8 refs.) *N.F.S.*

108470 **Field-dependent photocarrier generation in crystalline polydiacetylenes.** U.Seiferheld, B.Ries, H.Bassler (Fachbereich Phys. Chem., Philipps-Univ., Marburg, Germany).
J. Phys. C (GB), vol.16, no.26, p.5189-201 (20 Sept. 1983).
The electric field dependence of the photocarrier generation rate has been measured for crystalline polydiacetylenes (PTS and DCH) in the range $10<E<10^5$ V cm^{-1}. For $E<10^4$ V cm^{-1} it follows the predictions of the one-dimensional Onsager theory, above 10^4 V cm^{-1} a superlinear increase with no indication of saturation is noted. The high-field behaviour is interpreted in terms of field-assisted ionisation of Frenkel excitation states that are degenerate with conduction band states. Applicability of the 1D Onsager theory to treat geminate pair dissociation is consistent with the recently developed concept of strong electron-phonon interaction leading to short carrier mean free paths. The microscopic anisotropy of the carrier mobility parallel and perpendicular to the polymer chain direction is found to be greater than 10^4, larger than inferred from macroscopic conduction experiments. (50 refs.)

108471 **Influence of Cr^{3+} doping on photoelectronic processes of $La_2Ti_2O_7$ pyrochlore and $La_{2/3}TiO_3$ perovskite anodes.** G.Campet, J.Claverie (Lab. de Chimie du Solide, CNRS, Talence, France), P.Salvador.
J. Phys. & Chem. Solids (GB), vol.44, no.9, p.925-9 (1983).
Photoelectrical properties of $La_2TiO_2O_7$ and $La_{2/3}TiO_3$ anodes undoped and Cr^{3+}-doped have been investigated. The onset of photocurrent for both the undoped and Cr^{3+} doped pyrochlore is at 400 nm while for undoped perovskite it is at 420 nm. A shift of the spectral photoresponse down to 550 nm is observed for the Cr-doped perovskite. The experimental data have been analyzed according to the Schottky barrier model of the semiconductor-electrolyte junction. This analysis has allowed the authors to propose a photoconduction mechanism. (18 refs.)

108472 **Electric-field-dependent charge-carrier trapping in a one-dimensional organic solid.** U.Seiferheld, H.Bassler (Fachbereich Phys. Chem., Philipps-Univ., Marburg, Germany), B.Movaghar.
Phys. Rev. Lett. (USA), vol.51, no.9, p.813-16 (29 Aug. 1983).
The relaxation of photoconduction in a polydiacetylene crystal containing a high density of defects is shown to follow the predictions of the theory for field-dependent diffusion in one dimension. At intermediate times and fields an $\exp[-3(t/\tau_1)^{1/3}]$ law is observed merging into an $\exp(-t/\tau_2)$ behavior as $t \rightarrow \infty$. The predicted functional change of $\tau_2(E)$ at a critical field is recovered. (17 refs.)

108473 **Transverse Dember effect in lead chalcogenides under linearly polarized light excitation.** D.Genzow (Sektion Phys., Humboldt-Univ. zu Berlin, Germany).
Phys. Status Solidi b (Germany), vol.118, no.2, p.K159-62 (1 Aug. 1983).
Deals with the transverse Dember effect in lead chalcogenides in the case that one valley is populated preferentially by linearly polarized optical excitation. The study of the transverse Dember effect leads to a direct comparison of the recombination time with the intervalley scattering time. If $\tau^* \ll \tau$, the effect vanishes because the transfer of excess carriers keeps the population of the valleys equalized. In pure PbSnTe samples at low temperature the intervalley scattering does not play an important role. (8 refs.)

108474 **Investigations of the effect of nonexponential distribution of gap states of photoconductivity.** E.Bhattacharya, K.L.Narasimhan (Tata Inst. of Fundamental Res., Bombay, India).
Phys. Rev. B (USA), vol.28, no.4, p.2287-8 (15 Aug. 1983).
The power-law dependence of photoconductivity on light intensity is generally taken as evidence for the density of states in the gap to be given by an exponential distribution. The authors have computed the photoconductivity for some nonexponential distributions of gap states. They show that neither the intensity dependence of photoconductivity nor the temperature dependence of the exponent can be used as evidence for an exponental gap-state distribution. An examination of the results of photoconductivity and space-charge-limited current on *a*-Si:H suggests that the distribution of gap states is not exponential as is commonly assumed. (11 refs.)

108475 **Detection of photoquenching in $CuGaTe_2$.** N.V.Joshi, R.Echeverria (Centro de Estudios Avanzados en Optica, Facultad de Ciencias, Univ. de Los Andes, Merida, Venezuela).
Solid State Commun. (USA), vol.47, no.4, p.251-3 (July 1983).
The photoconductivity spectrum of a single crystal of p type of $CuGaTe_2$, has been examined at 300K and 77K. Structural details, which appeared on the high energy side of the band gap transition, are attributed to the valence band structure. Pronounced photoquenching is also observed on the high energy side and it is due to the recombination of holes with the ejected electrons from the inner 3d level of copper atom. Such a photoquenching effect has not been reported so far. (8 refs.)

108476 **Energy distribution of photoelectrons from epitaxial $Ga_{0.82}In_{0.18}As$ layers.** M.L.Kapitsa, R.L.Nemchenok, Yu.A.Kudinov (M.I. Kalinin Polytech. Inst., Leningrad, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.28, no.2, p.261 (Feb. 1983). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.53, no.2, p.415-16 (Feb. 1983). [received: Sept. 1983]
The authors study the energy distribution of photoelectrons from epitaxial $Ga_{0.82}In_{0.18}As$ (110) and GaAs (111) p-type layers doped to $\approx 5.10^{18}$ cm^{-3} and activated with cesium and oxygen in order to determine the maximum integrated sensitivity. Quantum yield curves were also recorded; the energy distribution curves were recorded in a spherical capacitor with a single grid by applying a retarding voltage and using passive differentiation. (2 refs.)

108477 **Dye sensitization effects on photovoltaic phenomena in MBBA liquid-crystal cells.** S.Sato, M.Kobayashi (Mining Coll., Akita Univ., Akita, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part C (Japan), vol.J66C, no.6, p.484-5 (June 1983). In Japanese.
The dependence of short-circuit photocurrents on dye concentrations, temperature, and cell thickness is measured in nematic liquid-crystal cells containing methyl red. The photocurrents consist of three components: the first negative, the second positive, and the third negative peak. The second and the third components are controlled by diffusion processes. (5 refs.)

108478 **Interference oscillations of photocurrent in layered GeS crystals.** D.I.Bletskan, N.V.Polazhinets.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1233-5 (Aug. 1983). In Russian.
The results of studies in photoconductivity (PC) and transmission spectra anisotropy of thin ($d \approx 10.50$ μm) layered GeS crystals are presented. It is shown that due to the layered structure and good quality of the crystals under study the interference phenomenon appearing as oscillations in PC and transmission spectra is easily observed. (6 refs.)

The photoelectric determination of *h/e*: a new approach to an old problem .... See Entry 105070

Nonlocal photovoltaic response function for the interpretation of hologram writing in ferroelectric crystals .... See Entry 106727

Metastable electron states in doped alloys $Pb_{1-x}Sn_xTe$ .... See Entry 108285

Characterization of deep levels in semi-insulating GaAs crystals by a spectroscopic photoelectrochemical current .... See Entry 108331

Contactless measurement of photoinduced carrier lifetime and injection level in silicon wafer using additional eddy current .... See Entry 108439

Deep electron traps in undoped semi-insulating GaAs grown by the liquid encapsulated Czochralski method .... See Entry 108440

Recombination and trapping levels in GaS:Mn single crystals .... See Entry 108447

Electrical and photoelectrical properties of three-layer heterostructures *n*-$Al_{0.3}Ga_{0.7}As$-*p*-$Al_{0.1}Ga_{0.9}As$-*p*-GaAs and *p*-$Al_{0.65}Ga_{0.35}As$-*n*-GaAs-*n*-GaAs .... See Entry 108537

Photovoltaic properties of sputtered *n*-CdO films on *p*-Cu_2O .... See Entry 108544

The semiconductor-electrolyte interface: optical transitions in CdMnTe alloys .... See Entry 108547

Measurements of capture cross section of traps in insulating films by photoinjection current decay .... See Entry 108557

Low-intensity differential photocapacitance of MOS structures .... See Entry 108573

Numerical simulation of the long-term performance and corrosion of photoelectrochemical cells .... See Entry 109548

Photomodulated and one-beam and two-beam potential modulated photoelectrochemical spectroscopies .... See Entry 109756

Effect of boron compensation on the photovoltaic properties of amorphous silicon solar cells .... See Entry 109883

Photovoltage generation in the solid phenosafranine-EDTA sandwich cell .... See Entry 109901

72.50 ACOUSTOELECTRIC EFFECTS

108479 Acoustoelectric injection in piezoelectric CdS resonators. I.V.Ostrovskii, A.I.Polovina.
Ukr. Fiz. Zh. (USSR), vol.28, no.7, p.1109-10 (July 1983). In Russian.
The authors studied acoustoelectric injection in CdS piezoelectric plate-resonators. The electrons are injected into CdS from In contacts under the action of a piezoelectric ultrasonic field. They show that the ultrasonically injected charge influences the current-voltage characteristics, as well as being captured by traps giving the crystal a negative charge as a whole. (2 refs.)
V.G.P.

72.55 MAGNETOACOUSTIC EFFECTS

108480 Effects of the electron-hole interaction on the giant quantum attenuation and velocity change of sound waves in pyrolytic graphite. T.Inoue, T.Fukami, H.Kuriyaki (Dept. of Phys., Kyushu Univ., Fukuoka, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2862-9 (Aug. 1983).
The sound attenuation and velocity change in pyrolytic graphite have been simultaneously measured as a function of the temperature, frequency and magnetic field intensity. It has been found that both the attenuation coefficient and the velocity change are greatly enhanced when some electron and hole Landau levels cross simultaneously the Fermi level at a certain field. The interrelation between the enhancement rate in the attenuation coefficient and that in the velocity change is reasonably explained in terms of the electron-hole correlation interaction proposed by Kuramoto (1979). However, the experimental results of rather strong temperature dependence of both quantities and weak frequency dependence of the velocity change remain unexplained. (8 refs.)

72.60 MIXED CONDUCTIVITY AND CONDUCTIVITY TRANSITIONS

108481 An experimental determination of the critical exponents at the metal-insulator transition. A.N.Ionov, I.S.Shlimak, M.N.Matveev (A.F. Ioffe Phys. Tech. Inst., Acad. of Sci., Leningrad, USSR).
Solid State Commun. (USA), vol.47, no.10, p.763-6 (Sept. 1983).
This works deals with a determination of the magnitude of the critical exponents and their ratio from an analysis of the temperature dependence of the conductivity and magnetoresistivity of doped Ge⟨As⟩ with an impurity concentration making it an insulator near the metal-insulator transition. The values found are $\nu=0.60\pm0.04$, $\xi=1.38\pm0.07$, $\xi/\nu=2.3\pm0.2$; neither the critical exponents nor their ratio depend on compensation within $0<k<60\%$. (8 refs.)

108482 Electrical and structural properties of iron-doped β-alumina. J.H.Kennedy, S.M.Stuber, S.F.Parker (Dept. of Chem., Univ. of California, Santa Barbara, CA, USA), P.H.Barrett.
Solid State Ionics (Netherlands), vol.8, no.4, p.323-31 (July 1983).
β-alumina containing 50 w/o Fe exhibits high electronic conductivity when sintered in air but Mossbauer studies have shown the presence of Fe_3O_4. Single-phase β-alumina containing 50 w/o Fe could be prepared by sintering at 1400°C for 4-4.5 h followed by annealing at 1300°C for 96 h encapsulated with coarse β-alumina powder enriched with Na_2CO_3. Mossbauer spectroscopy indicated that all iron was present as Fe(III). Complex-plane impedance data showed a maximum bulk $\sigma_{25^\circ C}=5.56\times10^{-4}$ $(\Omega\ cm)^{-1}$ with little electronic conductivity. Reduction treatments on Fe-doped β-alumina utilizing H_2:N_2 gas were successful in producing a mixed conductor containing Fe(II) and Fe(III) but also produced a distorted β-alumina lattice. This material exhibited an electronic conductivity $\sigma_{e,25^\circ C}=2\times10^{-4}$ $(\Omega\ cm)^{-1}$ and a bulk ionic conductivity $\sigma_{b,25^\circ C}=1.35\times10^{-4}$ $(\Omega\ cm)^{-1}$. (12 refs.)

Influence of electron-phonon coupling on transport near a mobility edge .... See Entry 108378

Charge-density-wave-like transition in V_3Te_4 .... See Entry 108399

72.70 NOISE PROCESSES AND PHENOMENA

108483 A mechanism for 1/*f* noise in metals. F.N.H.Robinson (California Inst. of Technol., Pasadena, CA, USA).
Phys. Lett. A (Netherlands), vol.97A, no.4, p.162-3 (22 Aug. 1983).
The random motion of frozen-in lattice defects is shown to provide a possible origin for 1/*f* noise in metal films. (3 refs.)

108484 Theory of Josephson-type oscillations in a moving charge-density wave. S.E.Barnes (Dept. of Phys., Univ. of Miami, Coral Gables, FL, USA), A.Zawadowski.
Phys. Rev. Lett. (USA), vol.51, no.11, p.1003-6 (12 Sept. 1983).
A theory of Josephson-type phenomena is presented in which the two macroscopic quantum states are the two components of an incommensurate charge-density wave with opposite wave vectors. The Fermi levels of these two states are split for a moving charge-density wave and impurity scattering induces quantum oscillations. Such oscillations may be responsible for the observed narrow-band noise in materials such as $NbSe_3$ and TaS_3. (16 refs.)

108485 1/f noise in mobility fluctuations and the Boltzmann equation [nondegenerate semiconductors]. A.van der Ziel, C.M.van Vliet (Dept. of Electrical Engng., Univ. of Florida, Gainesville, FL, USA), R.J.J.Zijlstra, R.P.Jindal.
Physica B & C (Netherlands), vol.121B+C, no.3, p.420-22 (Aug. 1983).
The 1/*f* noise in mobility and diffusivity are discussed. The two noise densities are related due to an instantaneous Einstein relation, valid for times larger than the collision time. The Boltzmann equation treatment shows that Hooge's relation (1982) for the collective band mobility noise, $S_\mu(f)/(\bar{\mu})^2=\alpha/fN$, can be justified for a nondegenerate and spatially noncorrelated electron or ion gas. (14 refs.)

108486 Hall effect, anisotropy, and temperature-dependence measurements of 1/*f* noise in silicon on sapphire. R.D.Black (Dept. of Electrical Engng., Univ. of Illinois, Urbana, IL, USA), P.J.Restle, M.B.Weissmann.
Phys. Rev. B (USA), vol.28, no.4, p.1935-43 (15 Aug. 1983).
Measurements of several properties of 1/*f* noise in *n*-type silicon-on-sapphire wafers were made in the temperature range 100-330 K. The resistance fluctuations were nearly scalar, independent of temperature. The magnitude of the Hall-effect noise was larger than that predicted for simple carrier-number fluctuations at 100 and 140K, but less at 300K. The correlation between the Hall fluctuations and resistivity fluctuations had the same sign and slightly lower magnitude than would be expected for majority-carrier number fluctuations. Temperature-dependent features in the spectrum showed that the kinetics were thermally activated, while the weak temperature dependence of the magnitude of the features showed that the activated process could not be a simple electronic transition alone. A model involving slow processes at lattice defects modulating the depth of traps is suggested, and similarities and contrasts with other materials are discussed. (37 refs.)

108487 Charge-density-wave transport in orthorhombic TaS_3. III. Narrow-band 'noise'. A.Zettl, G.Gruner (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2091-103 (15 Aug. 1983).
For pt.II see ibid., vol.26, p.5773 (1982). Narrow-band noise measurements are reported for the linear chain Peierls semiconductor, orthorhombic TaS_3. In the nonlinear conductivity region, sharp narrow-band noise peaks are observed with several harmonics. The amplitudes of the peaks are temperature dependent, starting from zero just below the charge-density-wave (CDW) transition at $T_p\sim215K$, and remaining approximately constant below $T=170K$. Between T_p and approximately 100K, where both the field- and the frequency-dependent conductivities suggest highly coherent response of the CDW condensate, the noise spectrum is simple (fundamental and harmonics). At low temperatures the noise spectrum becomes quite complicated, with many fundamental and harmonic peaks present, due to a loss of the transverse coherence in the material and indicative of a disordered CDW state. At intermediate temperatures a linear relationship is found between the excess CDW current and the fundamental noise frequency. Analysis in terms of coherent motion of the CDW indicates that the characteristic distance associated with the narrow-band noise is approximately equal to one CDW wavelength λ and that pinning is dominated by impurities rather than by commensurability. A comparison of the data is made with the predictions of the classical model of CDW transport and with Bardeen's theory (1982) of coherent current oscillations. The noise observations are compared to and contrasted with related measurements performed on the similar CDW material $NbSe_3$. (38 refs.)

Transport equations for many-particle systems .... See Entry 108388

Nonlinear oscillations and chaos in electrical breakdown in Ge .... See Entry 108433

72.80 CONDUCTIVITY OF SPECIFIC SEMICONDUCTORS AND INSULATORS

(see also 81.40R Electrical and magnetic properties related to materials treatment)

Z-type jump in electrical conductivity of samarium manganite .... See Entry 108408

72.80C Elemental semiconductors

Kinetics of the decomposition of a solid solution of aluminium antimonide in germanium .... See Entry 107945

Interface properties of *n*-ZnSe-*p*-Ge heterojunctions grown by organometallic chemical vapor deposition .... See Entry 108199

Internal stress in evaporated tellurium films .... See Entry 108214

Energy levels of interstitial manganese in silicon .... See Entry 108343

Acoustic and optical-phonon-limited mobilities in *p*-type silicon within the deformation-potential theory .... See Entry 108406

Transport properties of amorphous silicon films on quartz substrate .... See Entry 108409

Dark conductivity in amorphous undoped silicon film .... See Entry 108414

On the mobility dip in polycrystalline silicon .... See Entry 108415

Surface effects in semiconductors in contact with liquids deduced from conductivity and Hall coefficient measurements .... See Entry 108424

Nonlinear oscillations and chaos in electrical breakdown in Ge .... See Entry 108433

Spin dependent trapping in a polycrystalline silicon integrated circuit resistor .... See Entry 108435

Contactless measurement of photoinduced carrier lifetime and injection level in silicon wafer using additional eddy current .... See Entry 108439

Analysis of the recombination properties of Si heat treated under the conditions obtaining in the production of semiconductor instruments .... See Entry 108441

Magnetic conductivity of thin layers of semimetals in ultraquantum magnetic fields .... See Entry 108453

Investigation of formation conditions of thermal donors-I and -II in oxygen-containing n-type silicon within the temperature range 400 to 800°C .... See Entry 108458

Investigations of the effect of nonexponential distribution of gap states of photoconductivity .... See Entry 108474

Hall effect, anisotropy, and temperature-dependence measurements of $1/f$ noise in silicon on sapphire .... See Entry 108486

Experimental verification of electron-hole recombination theory for Si-SiO_2 interface traps with nonequilibrium, steady-state, admittance measurements .... See Entry 108556

Electrical characteristics and device applications of zone-melting-recrystallized Si films on SiO_2 .... See Entry 108582

Hydrogenated amorphous silicon produced by laser induced chemical vapor deposition of silane .... See Entry 109158

Effect of boron compensation on the photovoltaic properties of amorphous silicon solar cells .... See Entry 109883

Silicon MDS and SDS solar elements .... See Entry 109886

72.80E III-V and II-VI semiconductors

Temperature processing effects in proton-implanted *n*-type GaAs .... See Entry 107722

Formation of p^+-layer in GaAs by dual implantation of Zn and As .... See Entry 107724

Distribution of Cu between solid CdS and liquid $CdCl_2+CdS$ .... See Entry 107733

Incoherent focused radiation for activation of implanted InP .... See Entry 107753

Radiation-induced defect formation in InSb doped with Gd, Ge, Cu, Ag, Zn, and Cd .... See Entry 107766

Structure transformation in mixed polycrystalline $Zn_{1-x}Cd_xS$ doped with Mn and Cu .... See Entry 107903

Kinetics of the decomposition of a solid solution of aluminium antimonide in germanium .... See Entry 107945

Interface properties of *n*-ZnSe-*p*-Ge heterojunctions grown by organometallic chemical vapor deposition .... See Entry 108199

Low compensation vapor phase epitaxial gallium arsenide .... See Entry 108208

High-resistivity ($>10^5$ Ω.cm) InP layers by liquid phase epitaxy .... See Entry 108210

Mismatch and electron mobility in MBE $Ga_xIn_{1-x}As$ epitaxial layers on InP substrates .... See Entry 108213

Instabilities of (110) III-V compounds grown by molecular beam epitaxy .... See Entry 108219

Electron mobility of high purity VPE-GaAs and LPE-GaAs .... See Entry 108407

Electrical resistivity of undoped GaAs single crystals grown by magnetic field applied LEC technique .... See Entry 108410

The influence of annealing on the resistivity of irradiated n-GaP samples .... See Entry 108412

Electrical transport properties of GaAs and AlAs mixed crystals for semiconductor devices .... See Entry 108417

Damaged-induced isolation in *n*-type InP by light-ion implantation .... See Entry 108426

High-field transport properties of $In_{0.765}Ga_{0.235}As_{0.5}P_{0.5}$ .... See Entry 108430

A note on the nature of two recombination centres in indium antimonide .... See Entry 108436

Deep electron traps in undoped semi-insulating GaAs grown by the liquid encapsulated Czochralski method .... See Entry 108440

Electron transport in highly compensated, undeformed *n*-type InSb in the temperature range 4.3-300K .... See Entry 108459

Intracenter transitions in the dominant deep level (EL2) in GaAs .... See Entry 108466

Investigation of lux-ampere characteristics of photoconducting layers of group $A^{II}B^{VI}$ semiconductors .... See Entry 108469

Energy distribution of photoelectrons from epitaxial $Ga_{0.82}In_{0.18}As$ layers .... See Entry 108476

Transport characteristics of *L*-point and Γ-point electrons through GaAs-$Ga_{1-x}Al_xAs$-GaAs (111) double heterojunctions .... See Entry 108529

Electron-beam-induced current measurements in silicon-on-insulator films prepared by zone-melting recrystallization .... See Entry 108578

Properties and ion implantation of $Al_xGa_{1-x}N$ epitaxial single crystal films prepared by low pressure metalorganic chemical vapor deposition .... See Entry 108579

Epitaxial layers of iron-doped gallium arsenide .... See Entry 108580

A study of the luminescent and electrical characteristics of films of ZnS doped with Mn .... See Entry 109018

Optical and electrical properties of laser-synthesized CdTe .... See Entry 109033

A new method for the fabrication of submicron thick gallium arsenide membranes .... See Entry 109145

High-quality ZnSe thin films grown by molecular beam epitaxy .... See Entry 109153

Rapid thermal annealing of Se and Be implanted InP using an ultrahigh power argon arc lamp .... See Entry 109339

Rapid thermal annealing of Be, Si, and Zn implanted GaAs using an ultrahigh power argon arc lamp .... See Entry 109340

Photomodulated and one-beam and two-beam potential modulated photoelectrochemical spectroscopies .... See Entry 109756

72.80G Transition-metal compounds

Enhancement of gas sensitivity by controlling microstructure of α-Fe_2O_3 ceramics .... See Entry 105317

Hysteresis in the electrical properties of orthorhombic tantalum trisulphide: evidence for an incommensurate-commensurate charge-density wave transition? .... See Entry 108401

Photoelectronic properties of Cu_3PS_4 and Cu_3PS_3Se single crystals .... See Entry 108416

Electrical properties of $CuGaTe_2$ .... See Entry 108419

Electrical studies on (Mo/W)Se_2 single crystals. II. Temperature dependence of Hall effect .... See Entry 108457

Electrical conduction in nickel ferrite .... See Entry 108461

Charge-density-wave transport in orthorhombic TaS_3. III. Narrow-band 'noise' .... See Entry 108487

72.80J Other crystalline inorganic semiconductors

Search for correlations between electrical characteristics and stoichiometry in mercuric iodide .... See Entry 106227

Influence of physical parameters of a liquid crystal on the steepness of the volt-contrast characteristic of the twist effect .... See Entry 107538

Crystallization of bismuth telluride from a melt containing excess tellurium .... See Entry 107576

Growth and physical properties of Ln_2GeSe_5, $Ln_2Ge_2Se_7$, $Ln_2Ge_3Se_9$ single crystals .... See Entry 107578

Doping of germanium telluride with bismuth and copper .... See Entry 107725

Photodoping of Ag into single crystal As_2S_3 .... See Entry 107726

Influence of source composition on the properties of flash-evaporated thin films in the Cu-In-Se system .... See Entry 108212

Phase composition and electrophysical properties of EuS- and Sm-based films .... See Entry 108225

Energy spectrum of Bi_2Te_2Se .... See Entry 108282

Metastable electron states in doped alloys $Pb_{1-x}Sn_xTe$ .... See Entry 108285

Effect of ytterbium on the electrophysical properties of Ga_2Se_3 single crystals .... See Entry 108423

Free-carrier absorption in n-PbSe at low temperatures due to eectron-electron scattering .... See Entry 108445

Recombination and trapping levels in GaS:Mn single crystals .... See Entry 108447

Stability of the thermoelectric properties of p-type solid solutions based on Bi_2Te_3 .... See Entry 108460

Transverse Dember effect in lead chalcogenides under linearly polarized light excitation .... See Entry 108473

Detection of photoquenching in $CuGaTe_2$ .... See Entry 108475

Interference oscillations of photocurrent in layered GeS crystals .... See Entry 108478

Preparation and properties of single crystals of some cadmium-containing indium, thallium, and cesium halides .... See Entry 109133

Transparent conducting tin oxide films for application in heterojunction solar cells .... See Entry 109900

72.80L Organic semiconductors

Drift mobility measurements on single crystals of orthorhombic benzophenone using the electron bombardment technique .... See Entry 108422

Electric-field-independent electron mobilities in anthracene .... See Entry 108438

Electric-field-dependent charge-carrier trapping in a one-dimensional organic solid .... See Entry 108472

72.80N Amorphous and glassy semiconductors

Study of thermal properties, electrical conductivity, and the crystallization process of the glassy alloy $SeGe_{20}$ .... See Entry 108085

Transport properties of amorphous silicon films on quartz substrate .... See Entry 108409

Dark conductivity in amorphous undoped silicon film .... See Entry 108414

Investigations of the effect of nonexponential distribution of gap states of photoconductivity .... See Entry 108474

Hydrogenated amorphous silicon produced by laser induced chemical vapor deposition of silane .... See Entry 109158

Effect of boron compensation on the photovoltaic properties of amorphous silicon solar cells .... See Entry 109883

72.80P Liquid semiconductors

Experimental facility to measure conductivity of liquid metals and semiconductors. .... See Entry 105339

73.00 ELECTRONIC STRUCTURE AND ELECTRICAL PROPERTIES OF SURFACES, INTERFACES, AND THIN FILMS

73.20 ELECTRONIC SURFACE STATES

(for emission and impact phenomena, see 79.)

108488 Calculation of the ionization energy of a donor atom near a semiconductor surface. Liu Zhenpeng (Dept. of Phys., Liaoning Univ., China). *Chin. J. Semicond. (China)*, vol.4, no.4, p.313-20 (July 1983). In Chinese.
The method of one-dimensional Euler's equation is used to calculate the ioization energy of a donor atom near a semiconductor surface. The results show

that, when the nucleus is located at the surface, the one-dimensional equation has an analytical solution matching with Levine's exact solution and is in agreement with Hellmann-Feynman theorem quantitatively, when the nucleus is far from the surface, the asymptotic solution of the equation coincides with that of the free donor atom. (11 refs.)

108489 The problem of the electron energy bands interconnection in abrupt semiconductor heterojunctions. M.Garcia (Dept. de Fisica, Univ. Nacional de Colombia, Bogota, Colombia).
Rev. Colomb. Fis. (Colombia), vol.15, no.1, p.115-35 (1981). In Spanish. [received: Aug. 1983]
A review is made of the different theoretical methods for determination of the electron energy bands discontinuities in abrupt semiconductor heterojunctions. There are two different points of view. One of these, with a 'first principles' treatment, makes some predictions about the energetic differences assuming only bulk properties of the semiconductors involved. The other analyzes different physical situations making all the emphasis in the junction interface. From the experimental point of view, it is difficult to make accurate measurements in the electronic levels in the junction. However, at least two successful methods have been developed and, for the sake of consistency, both are described. (24 refs.)

108490 Static response to a charge impurity near a metal surface. Finite-barrier treatment. G.Eano (Istituto di Fisica, Ferrara, Italy), A.Magnaterra.
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.1187-202 (July-Aug. 1983).
The static response to a charge impurity near a metal surface is computed in the RPA approximation for the case of a finite barrier. Particular attention is given to the problem of the correct infinite-volume limit and to the contribution of the one-particle states with energy higher than the potential barrier, which has been found to be not negligible. An integral equation for the self-consistent potential is derived and solved numerically. Results for Na and Zn are exhibited, showing remarkable difference with respect to the infinite-barrier case. (16 refs.)

108491 Electronic structure of metal-semiconductor interfaces. I.P.Batra (IBM Res. Lab., San Jose, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.558-63 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
In a recent paper, the author investigated the electronic properties of a set of Ge-Al lattice-matched interfaces. These interfaces were constructed by placing an ideal (001)Ge substrate next to a 45° rotated (001)Al film. In all cases the Ge-Al interatomic distance was kept fixed at some ad hoc value. Using a self-consistent pseudopotential approach, the author now extends these calculations to consider the case where the interlayer distance is fixed for the on top and interstitial model but the Ge-Al interatomic distance is allowed to vary. One striking result of the calculation is that the differences among diverse interface geometries lead only to small differences in electronic properties if the interlayer distance is kept fixed. Single atomic metal overlayer calculations by Chelikowsky (1977), and Zhang and Schluter (1978) in different configurations show more pronounced differences. The results indicate that inclusion of more than one metal layer tends to smear out these differences. The author also calculates an optimal geometrical arrangement by minimizing the total energy of the system. The author critically discusses the weakly interacting cluster model and the chemisorption model of metal-semiconductor interfaces and places the work in context. The author also presents a semiclassical calculation which relates the interface density of occupied states to surface quantized level spacing. It suggests a possible surface absorption experiment for determining this state density. Future ramifications of the idealized model and the role it can play in simulating interfacial chemical reactions are briefly stated. (45 refs.)

108492 Interface formation at PbTe(100) surfaces: Ge, Al, and In overlayers. F.Cerrina (Synchrotron Radiation Center, Univ. of Wisconsin, Stoughton, WI, USA), R.R.Daniels, Te-Xiu Zhao, V.Fano.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.570-3 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Adsorption processes were investigated for the first time on a IV-VI substrate, PbTe, by photoemission spectroscopy with synchrotron radiation. Ge, Al, and In overlayers on cleaved PbTe(100) all create an inversion layer at the PbTe side of the interface. Substantial Pb and Te outdiffusion is observed even at room temperature, resulting in nonabrupt interfaces. The band discontinuities of the PbTe-Ge interface are much different from those theoretically predicted by the electron affinity rule. (11 refs.)

108493 The effect of surface oxygen on the intermixing and Schottky barrier at GaAs(110)-Au interfaces. Z.M.Lu, W.G.Petro, P.H.Mahowald, M.Oshima, I.Lindau, W.E.Spicer (Stanford Electronics Labs., Stanford, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.598-601 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The effect of placing controlled amounts of oxygen on the clean, cleaved (110) surface of GaAs before exposure to Au has been investigated with ultraviolet photoemission spectroscopy (UPS) and X-ray photoemission spectroscopy (XPS). The authors studied: (a) the shape of the Ga-3d level and changes of Ga (or As) intensity with oxygen and subsequent Au deposition; (b) the position of the Ga-3d core level, with special regard to the surface or interface Fermi level (E_{fs}), as a function of oxygen and Au coverages; and (c) the valence band structure (where both oxygen and Au provide strong characteristic structure). For chemisorbed oxygen coverages of a small fraction up to 1 monolayer (ML) or above the Au:GaAs intermixing and E_f shifts are significantly reduced. For the *p*-type sample, after much less than 1 ML of oxygen, the maximum rise of E_{fs} is suppressed as Au is added; after 10^7L exposure E_{fs} remains stationary until approximately 1 ML of Au is deposited; for high oxygen coverage ($\geq 10^8$L), the oxygen appears to effectively retard the Au-GaAs interaction up to 10 ML of Au coverage. The width of the Ga-3d core level increases monotonically with increased oxygen exposure. With 10^{10}L exposure of oxygen, the Au coverage necessary to drop the Ga intensity to $1/e$ of its value on the oxidized surface is decreased to 4 ML, instead of 6 ML for the unoxidized surface. Supporting evidence from XPS spectra further demonstrates the intermixing is reduced between Au and GaAs by oxygen. The valence band structure shows the Au is dispersed on the oxidized surface. The results show that, for GaAs surfaces with a few tenths to above 1 ML of oxygen (before Au is deposited and with no annealing), the oxygen-GaAs interaction inhibits Au intermixing with GaAs. It causes a more abrupt interface than the case without oxygen. (12 refs.)

108494 The effect of doping on Fermi level position at a semiconductor-metal interface. A.Zur, T.C.McGill, D.L.Smith (Thomas J. Watson, Sr., Lab. of Appl. Phys., California Inst. of Technol., Pasadena, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.608-9 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Summary form only given. The authors have investigated the phenomenon of Fermi level pinning by charged interface states at the semiconductor-metal interface. Two limiting cases were investigated. In the first case, they modeled an interface with an infinitely thick metal. In the second case, they modeled a submonolayer coverage by using a free semiconductor surface containing defects. In both cases, it was assumed that most of the defect induced interface states are localized a few angstroms inside the semiconductor. Under these conditions the authors have estimated the difference in Fermi level position between *n*- and *p*-type semiconductors to be less than 0.05 eV in the case of a thick metallic coverage, which agrees with the theoretical results of Draw and Smith (1980). This difference was shown to be the maximum one, and it occurs only when there is no pinning by the defects. When there is pinning, this difference is even smaller. No such upper bound on the difference in Fermi level position exists in the case of submonolayer coverage. The authors have also found that the number of interface states required to pin the Fermi level is $\approx 10^{14}$ cm^{-2} in the case of coverage by a thick metal, but only $\approx 10^{12}$ cm^{-2} in the case of a submonolayer coverage. (7 refs.)

108495 Schottky barrier formation and the initial metal-atom bonding state: InP(110)-Al vs GaAs(110)-Al. Te-Xiu Zhao, R.R.Daniels, A.D.Katnani, G.Margaritondo (Dept. of Phys., Univ. of Wisconsin, Madison, WI, USA), A.Zunger.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.610-12 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The authors have investigated the adatom states for different Al coverages of InP(110) by synchrotron-radiation photoemission, including ultralow coverages below 0.2 monolayer. The adatom states below 0.1 monolayer and above ~3 monolayer appear similar to the corresponding Al-adatom states on GaAs(110). In particular, the results for both systems appear consistent with the formation of Al clusters at 0.1-2 monolayer coverage, and the Fermi-level pinning occurs when the cluster formation starts. However, the similarity between the two systems is limited at intermediate (0.1-2 monolayer) coverages. At those coverages the authors observe a new bonded state for Al on InP, which is not observed on GaAs. The results emphasize, in general, the need to extend the experiments to ultralow coverages when studying the Schottky barrier formation process. (14 refs.)

108496 Electronic properties of the reconstructed Si(111)-7×7 surface. Yia-Chung Chang (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.709-13 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Electronic properties of the Si(111)-7×7 surface have been examined in several structure models, including the Lander's (1962-3) vacancy, Cardillo's (1981) triangular trough, and McRae's (1982) island models. The surface-atom resolved local density of states for these models are calculated in a realistic tight-binding scheme by the Green's function method. For McRae's model, the effect due to the dimerization of the second-layer edge atoms surrounding the island is also included. The comparison of the author's theoretical results with the experimental measurements for the electron density of states indicates that McRae's island model is a better candidate for the Si(111)-7×7 surface than the other models under examination. (31 refs.)

108497 Si(111)2×1 surface reconstructions calculated by the density-functional method. O.H.Nielsen, R.M.Martin, D.J.Chadi, K.Kunc (Xerox Palo Alto Res. Center, Palo Alto, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.714-17 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The π-bonded chain and molecular models for the reconstruction of the Si(111)2×1 surface are compared with each other and with angle-resolved photoemission data. The calculations are based on the local-density-functional approach, using ab initio pseudopotentials for calculating total energy and forces. The chain model is found to have lower energy than the molecular model. The experimental dispersion also favors the chain model, but the molecular model cannot be ruled out from the present data. (13 refs.)

108498 A first principles LCAO study of ideal and reconstructed diamond (111) 1×1 and 2×1 surfaces. D.Vanderbilt, S.G.Louie (Dept. of Phys., Univ. of California, Berkeley, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.723-5 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
A first principles self-consistent LCAO approach is applied to the study of the C (111) ideal 1×1 and reconstructed 2×1 surfaces. The surface states are calculated for a variety of buckled, π-bonded chain, dimerized π-bonded chain, and π-bonded molecule reconstructions. None of the models studied to date are found to be in good agreement with photoemission experiments; the theoretical occupied dangling bond surface bands are either too deep in the gap, too dispersive, or both. The dimerized π-bonded chain model is in closest qualitative agreement with experiment. (23 refs.)

108499 Effects of an order-disorder transition on surface deep levels in metastable $(GaAs)_{1-x}Ge_{2x}$. M.A.Bowen, A.C.Redfield, D.V.Froelich, K.E.Newman, R.E.Allen, J.D.Dow (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.747-50 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The major chemical trends in the energy levels of deep point defects at the (100) surfaces of $(GaAs)_{1-x}Ge_{2x}$ alloys are elucidated. These levels are predicted to exhibit bifurcation as functions of alloy composition x (at $x_c \simeq 0.3$) because of an order-disorder phase transition from a zincblende phase for $x < x_c$ to a diamond phase for $x > x_c$. Levels associated with distinct anion and cation sites of the zincblende structure coalesce into a single level of the diamond structure. (25 refs.)

108500 Interface states at Ni/c-Si(111) and Ni silicide/c-Si(111). M.Attard, P.Muret, A.Deneuville (Groupe des Transitions de Phases, CNRS, Grenoble, France).
Phys. Scr. (Sweden), vol.T4, p.173-5 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).
Ideality factor *n*, potential barriers ϕ_B and interface states (A and B) are determined for Ni, Ni_2Si, NiSi and $NiSi_2$/*c*-nSi and pSi diodes. ϕ_B increases (0.58 to 0.67 eV) with the relative Si content in the metallic compound, while B state is nearly constant and A state presents a minimum for Ni_2Si. (17 refs.)

108501 Surface electromagnetic fields in the semi-classical infinite barrier model: collective and single-particle response. R.R.Gehardts (Inst. fur Theoretische Phys., Freie Univ., Berlin, Berlin, Germany).
Phys. Scr. (Sweden), vol.28, no.2, p.235-45 (Aug. 1983).
The electromagnetic field near a metal surface is calculated within the 'SCIB' model, which replaces the surface by a specular reflection condition on a homogeneous system and assumes the conduction electrons to respond according to Lindhard's dielectric function The longitudinal fields included in the model are separated into contributions from a collective plasmon mode and from noncollective particle-hole excitations producing Friedel-type oscillations. The analytical properties of Lindhard's function in the complex k-plane are exploited to prove that these contributions sum in such a manner that, in contrast to previous erroneous statements, the normal component of the total electric field is continuous and no singular surface charges occur. Numerical results are presented which show that in a large frequency regime most of the electronic response is carried out by the plasmon mode. These results, which refute earlier speculations about the physical implications of the SCIB model, are compared with other model calculations of surface fields. (20 refs.)

108502 Correlation effects in doped organic semiconductors. N.A.Cade (Dept. of Phys., Queen Mary Coll., London, England).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.55-61 (1983).
The interaction between an isolated acceptor impurity and a conjugated, linearly extended, semiconducting polymer is modelled with an Anderson-like Hamiltonian. This system serves to illustrate the important correlation effects which ensure that only one electron can be transferrerd to the acceptor. A variational method is used which improves on the Hartree-Fock result and does not produce a magnetic ground state. The method is illustrated by a calculation for O_2 weakly adsorbed on a polydiacetylene chain. (13 refs.)

108503 Surface states in the presence of adsorbed atoms within the approximation of small radius potentials. L.Jurczyszyn (Inst. of Experimental Phys., Univ. of Wroclaw, Wroclaw, Poland), M.Steslicka.
Physica B & C (Netherlands), vol.122B+C, no.1, p.35-42 (Sept. 1983).
An approximation of the small radius potentials has been utilized to study the behaviour of the surface state energy in the presence of adsorbed atoms, forming a regular two-dimensional structure. The basic model assumption is that an electron in the vicinity of the crystal surface is moving only perpendicularly to the surface and is scattered by adsorbed atoms in all directions. The corresponding energy expression has been derived, solved numerically and discussed for different values of the most characteristic quantity for this approach, i.e. scattering length. The preliminary results indicate that for the coverage lower than the monolayer, the value of the surface state energy can be quite different at different points of the crystal surface. However, for the coverage corresponding to the monolayer, this change seems to be negligible. (7 refs.)

108504 Observation of a new surface state on Cu(001). S.D.Kevan (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2268-70 (15 Aug. 1983).
High-resolution angle-resolved photoemission studies of the Cu(001) surface demonstrate the existence of a surface state which has not previously been reported. The state is located in a relative bulk band gap near the Fermi energy at the $\bar{X}$ point of the two-dimensional Brillouin zone. Its energy position and dispersion are in excellent agreement with recent calculations for this surface. Comparisons are made on this state's natural energy width and dispersion with similar states on other copper surfaces. (25 refs.)

108505 Charge density and orientation dependence of the effective mass in electron inversion layers on the principal surfaces of Si. E.Batke, D.Heitmann (Inst. fur Angewandte Phys., Univ. Hamburg, Hamburg, Germany).
Solid State Commun. (USA), vol.47, no.10, p.819-23 (Sept. 1983).
The effective mass in two dimensional space charge layers has been determined from plasmon resonance experiments on the three principal surfaces of Si for a wide range of charge densities $N_s=0.5\times10^{12}$ cm^{-2} to 1.2×10^{13} cm^{-2} and different directions of the plasmon wavevector in the surface. The authors report first plasmon experiments on Si(110) and verify an anisotropic plasmon mass. Special attention is paid to the low density regime, where electron-electron interaction and localization effects are expected. On all surfaces they find a mass enhancement with decreasing charge density. The onset of the mass enhancement occurs at different charge densities for the different surfaces and is correlated with the Fermi energy. (24 refs.)

108506 Electronic structure of a cobalt monolayer on Cu(100). R.Miranda (Inst. fur Phys. Chem., Univ. Munchen, Munchen, Germany), D.Chandesris, J.Lecante.
Surf. Sci. (Netherlands), vol.130, no.2, p.269-81 (Aug. 1983).
Angular resolved photoemission spectra using synchrotron radiation have been measured for different amounts of cobalt evaporated on Cu(100). At room temperature cobalt grows layer-by-layer forming well-ordered layers in registry with the substrate, as judged by AES, LEED and UPS measurements. The energy position and linewidth of the Cu peaks remain unchanged when cobalt is deposited onto the surface, suggesting a rather weak interaction between the d-bands of Co and Cu. The two-dimensional band structure of the monolayer of cobalt has been determined. The authors have obtained a value for the magnetic exchange splitting of $\Delta E_{exch}=0.80\pm0.15$ eV, which is nearly identical to the bulk value. A shift in the energy positions of the critical points for the monolayer versus bulk of cobalt is interpreted in terms of a narrower 2D density of states in the monolayer as compared to the bulk. A resonant valence-band two-electron satellite has been found. The correlation energy and screening effects of the two d-holes are very similar to the corresponding bulk values, while the decreased intensity of the satellite at resonance compared to the one for Co(0001) suggests that there are more d-states relative to s-states in the monolayer than in a bulk cobalt single crystal, in agreement with recent models of the valence band electronic structure at surfaces. (45 refs.)

Similarities in chemical intermixing at the Cu/InP and Cu/Si interfaces .... See Entry 108071

Surface studies with (clean) supported metal particles and clusters .... See Entry 108147

Oxygen and hydrogen adsorption on GaAs (110) .... See Entry 108161

Ab initio cluster study of the interaction of fluorine and chlorine with the Si(111) surface .... See Entry 108180

Some observations on Ge:GaAs(001) and GaAs:Ge(001) interfaces and films .... See Entry 108200

Charge-density excitations at the surface of a semiconductor superlattice: a new type of surface polariton .... See Entry 108306

Spectrum of surface quantum plasmon resonances in high-magnetic field .... See Entry 108320

Schottky barrier formation of Ag on GaAs(110) .... See Entry 108512

Schottky barrier formation and intermixing of noble metals on GaAs(110) .... See Entry 108513

On the dependence of Schottky barrier height and interface states upon initial semiconductor surface parameters in GaAs {001}/Al junctions .... See Entry 108515

Effects of compositional grading on GaAs-Ga$_{1-x}$Al$_x$As interface and quantum well electronic structure .... See Entry 108530

Electrical measurements of the conduction band discontinuity of the abrupt Ge-GaAs ⟨100⟩ heterojunction .... See Entry 108532

Band discontinuities and interface Fermi-level positions in Ge-GaAs (110) heterojunctions .... See Entry 108533

Determination of the discrete 'surface' energy level in semi-infinite superlattice structures .... See Entry 108539

Microscopic study of semiconductor heterojunctions: photoemission measurement of the valence-band discontinuity and of the potential barriers .... See Entry 108541

Observation of a fractional quantum number .... See Entry 108542

Low field mobility of 2-d electron gas in modulation doped Al$_x$Ga$_{1-x}$As/GaAs layers .... See Entry 108545

Fermi-level position at a semiconductor-metal interface .... See Entry 108554

Experimental verification of electron-hole recombination theory for Si-SiO$_2$ interface traps with nonequilibrium, steady-state, admittance measurements .... See Entry 108556

Surface and interfacial properties of Ga$_{0.47}$In$_{0.53}$As-Al$_2$O$_3$ MIS structures .... See Entry 108560

The effect of low pressure plasma on Si-SiO$_2$ structures and GaAs substrates .... See Entry 108561

Quasi-classical quantization for potentials with an infinite surface barrier. Subbands in inversion layers .... See Entry 108567

DLTS investigations of Si-SiO$_2$ interface states of electron-beam irradiated MOS structures .... See Entry 108568

Nonstoichometric germanium nitride. A new insulating material for MIS microelectronics. II. Composition, properties, and the interface with a semiconductor .... See Entry 108569

Two-dimensional versus three-dimensional motion of inversion electrons in a magnetic field .... See Entry 108570

Rapid interface parameterization using a single MOS conductance curve .... See Entry 108572

Surface plasmons studies of oxidized Ba films .... See Entry 108576

Some features of surface formation during brittle failure of covalent crystals with diamond-type lattice according to EPR data .... See Entry 108784

Simple theory for surface-plasmon-polariton resonance on sinusoidal metal surface: application to SERS .... See Entry 108943

Electron correlation and hole localization in photon-stimulated ion desorption from solid N$_2$, CO, and C$_2$H$_2$ .... See Entry 109058

Elementary surface excitations and electron energy loss spectroscopy .... See Entry 109074

Electron energy loss spectroscopy in glancing reflection from bulk crystals .... See Entry 109075

Angle-resolved photoemission study of GaAs(100) surfaces grown by molecular beam epitaxy .... See Entry 109094

Transition from adiabatic to sudden core-electron excitation: N$_2$ on Ni(100) .... See Entry 109102

XPS investigation of Ni/Si(111) interfaces .... See Entry 109109

Semiconductor core-level to valence-band maximum binding-energy differences: precise determination by X-ray photoelectron spectroscopy ... See Entry 109110

Surface effects in Du intermetallics: a resonant photoemission study .... See Entry 109111

XPS and XAES studies of transient enhancement of Cu^1 at CuO surfaces during vacuum outgassing .... See Entry 109538

Titanium oxycarbide on TiC (100) surface .... See Entry 109541

73.25 SURFACE CONDUCTIVITY

Adsorption and electrophysical properties of doped gallium arsenide .... See Entry 108165

Phase composition and electrophysical properties of EuS- and Sm-based films .... See Entry 108225

Numerical computation of charge accumulation on insulators repeatedly contacted by a metal sphere .... See Entry 108523

Thermostimulated depolarization currents on a glass surface in ambient gases .... See Entry 108859

73.30 SURFACE DOUBLE LAYERS, SCHOTTKY BARRIERS, AND WORK FUNCTIONS

108507 Evaluation of the work function distribution of impregnated cathodes. J.C.Tonnerre, D.Brion, P.Palluel, A.M.Shroff (Thomson-CSF Electron Tube Div., Boulogne-Billancourt, France).
Appl. Surf. Sci. (Netherlands), vol.16, no.1-2, p.238-49 (May-June 1983). (3rd Tri-Service Cathode Workshop, Fort Monmouth, NJ, USA, 23-26 March 1982).
A mathematical treatment of the current-voltage characteristics of a close space planar diode has been used to evaluate work function distributions of cathode surfaces. Results obtained on various cathode types operated at different temperatures and time are presented. (9 refs.)

108508 DLTS determination of the Mo acceptor level in Mo-GaAs$_{0.6}$P$_{0.4}$ Schottky diodes. J.C.Lou, M.S.Lin, C.P.Wan (Dept. of Electrical Engng. Nat. Tsing Hua Univ., Hsinchu, Taiwan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.6, p.L336-7 (June 1983).
The results of deep level transient spectroscopy (DLTS) and Auger electron spectroscopy (AES) have shown the correlation between the trap levels, existing in the metal-semiconductor interface or in the bulk of these thermally degraded Mo-GaAs$_{0.6}$P$_{0.4}$ Schottky diodes, and the metal-semiconductor interdiffusion. These trap levels enhance the generation-recombination effect and degrade the diode performance. From the experimental results, it is revealed that the Mo-indiffusion induced hole trap $E_v+(0.83\pm0.01)$ eV plays a major role in Mo-GaAs$_{0.6}$P$_{0.4}$ Schottky diode degradation. (4 refs.)

108509 The Schottky barrier height of platinum nickel silicide. R.C.Ellwanger (Signetics Corp., Orem, UT, USA), A.E.Morgan, W.T.Stacy, Y.Tamminga.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.533-9 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Films of $Pt_{0.4}Ni_{0.6}$ of different thicknesses were sputter deposited onto *n*-type (111)Si and annealed at various temperatures. The structure and composition of the ensuing $Pt_xNi_{1-x}Si$ films were determined using STEM/EDS, AES, RBS, and electron diffraction. The films were found to consist of several layers of distinct composition. The barrier height (ϕ_B) as determined from the diode forward *I-V* characteristics bore little relationship to the composition of the interfacial silicide layer. Furthermore, when successively thinning a film, ϕ_B decreased from 0.737 to 0.694 eV upon removal of the adjacent Pt-rich ($x=0.75$) layer thereby leaving only the Ni-rich ($x=0.1$) interfacial layer. These and other data are presented which indicate that the barrier height of platinum nickel silicide is not determined solely by interfacial properties. (12 refs.)

108510 Study of the GaAs-Au and Si-SiO$_2$ interface formation by the Kelvin method. L.Lassabatere, J.M.Palau, E.Vieujot-Testemale, A.Ismail, C.Raisin, J.Bonnet, L.Soonckindt (Lab. d'Etude des Surfaces, Interfaces et Composants, Univ. des Sci. et Techniques du Languedoc, Montpellier, France).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.540-5 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
In this paper the authors describe typical and simple results concerning the deposition of metal on GaAs surfaces and the first steps of Si oxidation. In the case of GaAs/metal, typical results illustrating the barrier formation, the electron affinity modification, the contribution of initial surface defects, and metal induced defects are presented and discussed, using the unified model of Spicer, Lindau et al. In the case of Si/SiO_2, the authors focus on illustrating the method of the growth of the oxide and the resulting work function modifications. (23 refs.)

108511 The dependence of Al Schottky barrier height on surface conditions of GaAs and AlAs grown by molecular beam epitaxy. W.I.Wang (Rockwell Internat., Microelectronics Res. & Dev. Center, Thousand Oaks, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.574-80 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
A systematic study of the Al Schottky barrier height on clean GaAs (100) and AlAs (100) as a function of initial arsenic surface coverage has been performed. Two new surface phases on AlAs (100) have been observed. Al Schottky barrier height showed a steady decrease with increasing arsenic coverage on GaAs, and showed steady increase with increasing arsenic coverage on AlAs. The results are compared with current models of Schottky barrier formation. (21 refs.)

108512 Schottky barrier formation of Ag on GaAs(110). R.Ludeke (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), T.-C.Chiang, T.Miller.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.581-7 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Photoemission studies of Ag deposits on cleaved *n*- and *p*-type GaAs for coverages from ~0.003 to 20 monolayers indicate clustered Ag growth and undetectable chemical interactions with the substrate. The position of the surface Fermi level changed throughout the deposit range. The data is inconsistent with most of the existing Schottky barrier models. The results are interpreted in terms of donor- and acceptor-like interface states which are characteristic of the clusters but modified by the screening at the interface. Values for the Schottky barrier of 0.89 eV on *n*-type and 0.35 eV on *p*-type material were obtained for the thickest coverage. (25 refs.)

108513 Schottky barrier formation and intermixing of noble metals on GaAs(110). S.H.Pan, D.Mo, W.G.Petro, I.Lindau, W.E.Spicer (Stanford Electronics Labs., Stanford Univ., Stanford, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.593-7 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Photoemission measurements are used to study the Schottky barrier formation and the intermixing (with GaAs) of the three metals, Cu, Ag, and Au, deposited at room temperature on GaAs(110) cleaved surfaces. It is tentatively concluded that Fermi level pinning cannot be followed satisfactorily for metal coverages above a monolayer. The work of Palau (1982) on Schottky barrier height (*I-V* and *C-V*) for Au and Ag deposited on cleaved GaAs(110) in UHV indicate pinning positions surprisingly close to those found for other overlayers in the 'unified defect' model. It was found that 'intermixing' between noble metals and GaAs decreases in the order of Cu, Au, and Ag. Although island formation probably occurs, it is tentatively concluded that the principle reason for difficulty in using the photoemission measurements to determine E_{fs} for the noble metals is the inclusion of Ga (as well as As) in or on the noble metal overlayer. (12 refs.)

108514 Barrier height and leakage reduction in n-GaAs-platinum group metal Schottky barriers upon exposure to hydrogen. D.E.Aspnes, A.Heller (Bell Labs., Murray Hill, NJ, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.602-7 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Current-voltage (*I-V*), capacitance-voltage (*C-V*), and photovoltage (PV) data are obtained for Ru, Rh, Pd, Os, Ir, and Pt contacts deposited on chemically cleaned ⟨100⟩ *n*-GaAs wafers. By explicitly evaluating the relevant equations using realistic values of all parameters, the authors show that the currents obtained for small voltages are far too large to be explained by thermionic or recombination effects alone but are indicative of barrier height variations as proposed by Freeouf et al. (1982). The authors used the fact that the thermionic emission component is always present to reconcile the difference between apparent barrier heights determined by *I-V* and *C-V* measurements to obtain a consistent set of values for all materials. Upon exposure of the Ru and Ir contacts to atmospheric-pressure hydrogen, the barrier heights are reduced by 160 and 70 mV, respectively, and the ideality factors by 0.3 and 0.3, showing that hydrogen simultaneously lowers the barrier height and makes it more uniform over the contact for these junctions. The introduction of hydrogen into the bulk of these hydrogen-alloying metals has no effect on the transport properties of the Pt, Rh, and Pd junctions despite a reported work function change of nearly 1 eV for Pt, over 0.5 eV for Rh, and a phase change to a metallic hydride for Pd. The change in optical properties with ambient in the Drude region of Ru shows that the bulk Fermi level does not change by more than 40 meV upon hydrogenation, indicating that hydrogen is affecting primarily the interface dipole. (26 refs.)

108515 On the dependence of Schottky barrier height and interface states upon initial semiconductor surface parameters in GaAs {001}/Al junctions. C.Barret (Inst. d'Electronique Fondamentale, Univ. Paris-Sud, Orsay, France), J.Massies.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.819-24 (July-Sept. 1983).
Single crystal Al growth was achieved in situ by molecular beam epitaxy (MBE) onto *n*-type GaAs {001} epitaxial layers with surfaces ranging from the $C(8\times2)$ Ga rich to the 1×1 As rich compositions. Two kinds of characterization have been undertaken on Schottky diodes defined by photolithography: classical barrier height measurements by the current-voltage method and interface states spectrum determination by Schottky capacitance spectroscopy. From these experiments two types of results have been obtained: (i) there is no significant influence of the initial semiconductor surface stoichiometry nor of the metal work function on the Schottky barrier height; (ii) three kinds of interface states appear in the upper half of the band gap. The dependence of these states to the initial semiconductor surface stoichiometry is only weak. These results are discussed in light of the existing models of metal semiconductor interfaces. (37 refs.)

108516 Evaluation of the effective work functions of a binary salt using thermochemical data on its two constituent elements. H.Kawano, T.Kenpo, H.Koga, Y.Hidaka (Dept. of Chem., Ehime Univ., Matsuyama, Japan).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.241-6 (1 Sept. 1983).
The effective work functions (Φ^+ and Φ^-) for the emission of positive and negative ions (M^+ and X^-), respectively, from an inhomogeneous surface of a binary salt (MX) such as an alkali metal halide are investigated on the basis of experimental results achieved in the authors' previous work. Each of the work functions is generally expressed as a function of the thermochemical values of the constitutive elements: $\Phi^+=I+D+D^0-2D^+$ and $\Phi^-=A-D-D^0+2D^-$ where I is the first ionization energy of the electropositive atom M, A the electron affinity of the electronegative atom X, D the dissociation energy of the molecule MX, D^0 the desorption energy (or the heat of sublimation) of MX, and $D^\pm$ the desorption energy of M^+ or X^-. (16 refs.)

108517 Silicon-nickel silicide Schottky barriers formed by ion mixing. N.N.Gerasimenko, A.E.Gershinskii, A.Yu.Surtaev, S.A.Sokolov, E.I.Cherepov, B.I.Fomin, G.V.Timofeeva (Inst. of Semiconductor Phys., Acad. of Sci., Novosibirsk, USSR).
Phys. Status Solidi a (Germany), vol.78, no.2, p.K151-4 (16 Aug. 1983).
The formation and some electrical properties of silicon-Ni silicide Schottky barriers formed by ion implantation of Ar^+ ions are reported. The composition of the formed silicide layers was determined by transmission electron microscopy (TEM) and their thickness was measured by electrochemical anodic etching. (7 refs.)

108518 Schottky barriers on single-crystal indium telluride. S.Sen, D.N.Bose (Materials Sci. Centre, Indian Inst. of Technol., Kharagpur, India).
Solid-State Electron. (GB), vol.26, no.8, p.757-9 (Aug. 1983).
Schottky barriers on single-crystal *p*-In_2Te_3 were formed with evaporated films of materials Al, Ag and Cu with work-functions $\phi_M<(E_g+X_s)$ while Au, Ni and Pd films with larger ϕ_M produced ohmic contacts. The barrier heights were found to be 0.72, 0.67 and 0.69 eV respectively, while the ideality factors were 1.15, 3.48 and 6.54. The interface index s was 0.16 compared with the theoretical value of 0.146, its small magnitude indicating the covalent nature of the semiconductor. Barriers on *n*-In_2Te_3 showed $\phi_{bn}+\phi_{bp}=1.29$ eV compared with $E_g=1.12$ eV. A surface-state rather than a chemical bonding theory provided a satisfactory explanation of the results. (14 refs.)

108519 Variational calculation of the work function for small metal spheres. D.R.Snider, R.S.Sorbello (Dept. of Phys., Univ. of Wisconsin-Milwaukee, Milwaukee, WI, USA).
Solid State Commun. (USA), vol.47, no.10, p.845-9 (Sept. 1983).
A variational calculation based on the density functional formalism is performed for small metal spheres. The electron density is expressed in terms of two variational parameters chosen to minimize the energy. The authors find that the work function decreases as the size of the particle increases, approximately in agreement with the classical result for radii greater than a few angstroms. (17 refs.)

108520 Effects of the modification with temperature of the bulk properties on electron affinity and ionisation energy variations of some zinc-blende-type semiconductors. L.Soonckindt, J.Bonnet, P.Masri, L.Lassabatere (Lab. d'Etudes des Surfaces, Univ. des Sci. et des Tech. du Languedoc, Montpellier, France).
Surf. Sci. (Netherlands), vol.130, no.2, p.L337-43 (Aug. 1983).
Measurements of work function variation with temperature can be used, in principle, to determine the surface state position from space charge and surface barrier height modifications. In practice, interpretation of the results is complicated by possible charges concerning the barrier height, band gap energy, electron affinity, and ionisation energy. The variation with temperature of electron affinity and ionisation energy is discussed for some zincblende semiconductors. (10 refs.)

108521 Work function measurements and their relation to modern surface analysis techniques. G.A.Haas, R.E.Thomas, A.Shih, C.R.K.Marrian (Naval Res. Lab., Washington, DC, USA).
Ultramicroscopy (Netherlands), vol.11, no.2-3, p.199-206 (1983). (Surface Imaging and Analysis with High Spatial Resolution, Wickenburg Inn, AZ, USA, 12-15 Jan. 1983).
Since the work function of a solid is affected by the atoms in the outermost atomic layers of that solid, it provides a very sensitive measure of the nature of the surface. Traditional methods of measuring the work function generally involved heating the solid and analyzing the density of thermionic emitted electrons in order to obtain an average value of the work function. The use of low energy incident electrons, however, can also provide a determination of the work function and, furthermore, allows the surface to be investigated below thermionic temperatures. Also, by scanning the incident electron beam, the work function can be determined with comparatively high spatial resolution at any point on the surface. Such a scanning low energy electron probe (SLEEP) system has been used to obtain a topographic work function image of the surface as well as to provide a quantitative plot of the distribution in work function of the surface. Examples are given of how such work function results can be correlated with other surface analysis techniques. (8 refs.)

10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces ....See Entry 105017

Apparatus for the investigation of deep level parameters in semiconductors ....See Entry 105332

Initial reactions at the interface of Pt and amorphous silicon ....See Entry 108069

Similarities in chemical intermixing at the Cu/InP and Cu/Si interfaces ....See Entry 108071

Auger depth profiling studies of interdiffusion and chemical trapping at metal-InP interfaces .... See Entry 108072

Fermi levels in electrolytes and the absolute scale of redox potentials .... See Entry 108260

Influence of Cr^{3+} doping on photoelectronic processes of $La_2Ti_2O_7$ pyrochlore and $La_{2/3}TiO_3$ perovskite anodes .... See Entry 108471

The effect of surface oxygen on the intermixing and Schottky barrier at GaAs(110)-Au interfaces .... See Entry 108493

Schottky barrier formation and the initial metal-atom bonding state: InP(110)-Al vs GaAs(110)-Al .... See Entry 108495

Properties and ion implantation of $Al_xGa_{1-x}N$ epitaxial single crystal films prepared by low pressure metalorganic chemical vapor deposition .... See Entry 108579

Study of the surface potential decay characteristics in cellulose acetate films .... See Entry 108585

XPS investigation of Ni/Si(111) interfaces .... See Entry 109109

Photo-electron emission microscopy of work function changes .... See Entry 109114

73.40 INTERFACES

108522 Work function change of hydrogen chemisorbed Si (100) surface. Chen Binglai, Zhuang Chengqun, Wang Xun (Dept. of Phys., Fudan Univ., China).
Chin. J. Semicond. (China), vol.4, no.4, p.403-6 (July 1983). In Chinese.
The work function change of Si (100) surface after exposure to atomic hydrogen has been measured continuously as a function of hydrogen exposure time by electron beam retarding potential technique. A two step work function evolution curve has been found. The first step is supposed to be corresponding to the formation of a monohydride adsorbed phase which leads to a work function reduction of 0.19 eV with respect to the work function value of a clean surface. The second step gives a further reduction of work function by a value of 0.35 eV, which is supposed to be corresponding to the formation of the dihydride phase. These reductions of work function are explained as a result of the elimination of surface asymmetric dimer after the hydrogen adsorption. The work function of clean Si (100) surface varies slightly with the temperature, but its temperature coefficient increases significantly after forming the surface monohydride phase. (8 refs.)

Electronic states in solution and charge transfer .... See Entry 108358

On the contact potential differences in Al-SiO_2-Si and Au-SiO_2-Si structures .... See Entry 108558

73.40B Static electrification

108523 Numerical computation of charge accumulation on insulators repeatedly contacted by a metal sphere. J.Lowell (Joint Lab. of Phys., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
J. Electrostat. (Netherlands), vol.14, no.2, p.149-63 (Aug. 1983).
Repeated contacts of a metal object to the same spot on the surface of an insulator generally cause a continuous build-up of the contact charge on the insulator surface. A possible explanation for this is that the insulator is slightly conducting, so that the contact charge moves away from the contact region in the time that elapses between successive contacts. Experiments on 'insulators' with bulk conductivity have verified that this explanation does in fact hold in certain materials. In polymers, the characteristics of charge accumulation are markedly different, suggesting that charge accumulation in these materials is not due to bulk conduction. The authors discuss calculations of charge accumulation on insulators with surface conduction, carried out to determine whether surface conduction can account for charge accumulation on polymers. They investigate nonohmic as well as ohmic conduction. Backflow of charge is also studied and is shown to be strongly dependent on the geometry of the contact. It appears that charge accumulation in polymers is probably not a result of surface conduction. (10 refs.)

The kinetics of electron-beam dispersion of polymers when obtaining coatings .... See Entry 107767

The role of impurity atoms in the formation of defect structure on quartz surfaces under the action of an electrostatic field .... See Entry 108135

73.40G Tunnelling: general

(see also 74.50 in superconductors)

108524 Scanning tunneling microscopy of semiconductor surfaces. A.Baratoff, G.Binnig, H.Rohrer (IBM Zurich Res. Lab., Ruschlikon, Switzerland).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.703-4 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Summary form only given. Operations of the STM consists essentially in scanning a sharp metal tip over the surface to be investigated, close enough for a measurable tunnel current to be able to flow, i.e. at a distance of some 10 Å. The high spatial resolution of the STM, a few Å laterally and about 0.1 Å vertically, rests on the extreme sensitivity of the tunnel current J_T to the separation S of the electrodes. Together with local I-V characteristics (spectroscopy), scanning tunneling microscopy should ultimately provide a detailed mapping of wavefunctions just outside the sample surface with atomic resolution in space and in energy. A particularly appealing aspect is the conceptually simple experimental procedure: the wave-function overlap contours are selected spatially by adjusting the tunnel current, and energetically via the applied voltage. (7 refs.)

Surface imaging by scanning tunnelling microscopy .... See Entry 105440

Methyl rotation in 1,2,4,5-tetramethylbenzene and tetramethylpyrazine in the solid state. Tunneling spectra by proton NMR .... See Entry 108799

73.40J Metal-to-metal contacts

108525 Effect of lubricants on frictional polymerization of palladium electrical contacts. M.Antler (Bell Telephone Labs., Inc., Columbus, OH, USA).
ASLE Trans. (USA), vol.26, no.3, p.376-80 (July 1983).
The fretting of palladium contacts was studied at conditions similar to those which occur in separable electronic connectors. It was found that frictional polymers which form on their surfaces in ordinary room air can cause contact resistance to increase to unacceptable levels. The effect is dependent on wipe distance, becoming greater with increasing length, and is especially bad at the ends of the wear track. Contact resistance is less variable when fluid contact lubricants are used. Although the volume of polymer which forms increases when lubricant is present, the polymers are nonadherent and tend to be dispersed even when small amounts of fluid are used. A solid lubricant was found to be ineffective in stabilizing contact resistance. Fluid lubricant coatings, therefore, may provide some relief from the contact resistance problems of frictional polymerization when palladium and other catalytically active materials are used in sliding applications. (14 refs.)

Silver coatings obtained using a wire spraying technique .... See Entry 109146

Investigation and analysis of corrosion phenomena in coated precious metal contact materials .... See Entry 109601

73.40L Semiconductor-to-semiconductor contacts, p-n junctions, and heterojunctions

108526 Two-dimensional electron gas in a selectively doped $InP/In_{0.53}Ga_{0.47}As$ heterostructure grown by chloride transport vapor phase epitaxy. M.Takikawa, J.Komeno, M.Ozeki (Fujitsu Labs. Ltd., Atsugi, Japan).
Appl. Phys. Lett. (USA), vol.43, no.3, p.280-2 (1 Aug. 1983).
A selectively doped $InP/In_{0.53}Ga_{0.47}As$ heterostructure has been prepared by chloride transport vapor phase epitaxy. Hall and Subnikov-de Haas measurements revealed the existence of a high mobility, two-dimensional electron gas at the interface of this heterostructure. Enhanced electron mobilities were as high as 106000, 71200, and 9400 cm^2/Vs at 4.2, 77, and 300K, respectively. These indicate the excellent interface properties of the selectively doped $InP/In_{0.53}Ga_{0.47}As$ heterostructure grown by chloride transport vapor phase epitaxy. (6 refs.)

108527 High magnetic field studies of the two-dimensional electron gas in GaInAs-InP superlattices. J.C.Portal (INSA Lab. de Phys. des Solides, Toulouse, France), R.J.Nicholas, M.A.Brummell, M.Razeghi, M.A.Poisson.
Appl. Phys. Lett. (USA), vol.43, no.3, p.293-5 (1 Aug. 1983).
Reports the observation of Shubnikov-de Haas oscillations in superlattices of GaInAs and InP, showing evidence of two-dimensional behavior. The electron g factor is deduced from both the criteria for resolution of a spin splitting by comparison with the broadening parameter Γ, and from the tilted field method, and is shown to increase with increasing resolution of the Landau levels in a manner consistent with the theory of Ando and Uemura (1974). In the ultraquantum limit, structure at $\nu=1/2$ and $\nu=1/3$ is observed. (24 refs.)

108528 Internal photoemission from quantum well heterojunction superlattices by phononless free-carrier absorption. L.C.Chiu, J.S.Smith, S.Margalit, A.Yariv (California Inst. of Technol., Pasadena, CA, USA).
Appl. Phys. Lett. (USA), vol.43, no.4, p.331-2 (15 Aug. 1983).
The possibility of phononless free-carrier absorption in quantum well heterojunction superlattices was investigated. Order of magnitude calculation showed that the absorption coefficient was significantly enhanced over the phonon-assisted process. Important aspects of the enhyancement in the design of infrared photodetectors are discussed. (4 refs.)

108529 Transport characteristics of L-point and Γ-point electrons through GaAs-$Ga_{1-x}Al_xAs$-GaAs (111) double heterojunctions. C.Mailhiot, D.L.Smith, T.C.McGill (Thomas J. Watson, Sr., Lab. of Appl. Phys., California Inst. of Technol., Pasadena, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.637-42 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Presents a study on the transport characteristics of L-point and Γ-point derived electrons through abrupt GaAs-$Ga_{1-x}Al_xAs$-GaAs(111) double heterojunctions. The use of complex-**k** band structures in the tight-binding approximation and transfer matrices provide a reasonably accurate description of the wave function at the GaAs-$Ga_{1-x}Al_xAs$ interface. A representation of the wave function in terms of bulk complex-**k** Bloch states is used in the GaAs regions where the potential is bulklike. A representation of the wave function in terms of planar orbitals is used in the central $Ga_{1-x}Al_xAs$ region where the potential deviates from its bulk value (i.e. interfacial region). Within this theoretical framework, realistic band structure effects are taken into account and no artificial rules regarding the connection of the wave function across the interface are introduced. The ten-band tight-binding model includes admixture in the total wave function of states derived from different extrema of the GaAs conduction band. States derived from the same extremum of the conduction band appear to couple strongly to each other, whereas states derived from different extrema are found to couple weakly. Transport characteristics of incoming L-point and Γ-point Bloch states are examined as a function of the energy of the incoming state, thickness of the $Ga_{1-x}Al_xAs$ barrier, and alloy composition x. Transmission through the $Ga_{1-x}Al_xAs$ barrier is either tunneling or propagating depending on the nature of the Bloch states available for strong coupling in the alloy. Since Bloch states derived from different extrema of the conduction band appear to couple weakly to each other, it seems possible to reflect the low velocity L-point component of the current while transmitting the high velocity Γ-point component. (19 refs.)

108530 Effects of compositional grading on GaAs-$Ga_{1-x}Al_xAs$ interface and quantum well electronic structure. J.N.Schulman (Dept. of Phys. & Astron., Univ. of Hawaii, Honolulu, HI, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.644-7 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The electronic structure of the abrupt GaAs-$Ga_{1-x}Al_xAs$(001) heterojunction is compared with that of the heterojunction in which the transition from GaAs to GaAs-$Ga_{1-x}Al_xAs$ occurs over several atomic layers across the interface. The effects of varying the width of the compositionally graded region on interfacial boundary conditions and on quantum well energy levels are studied using the tight-binding method. The compositional grading is modeled in the virtual crystal approximation. Substantial shifts in quantum well energies are found. For example, the ground state energy for a quantum well with 15 central GaAs layers and bounded by AlAs increases by 30% for graded region widths of six alloy layers. The effects of grading on the electronic wave function at the interface are studied by expanding it in terms of bulk states with complex wave vector values. The relative contribution of the bulk states from the neighborhood of the Γ and X points to typical conduction band states are determined. It is found that grading the interface over a small number of layers (two or three) effectively eliminates the X-point state contribution. Thus, the effective mass approximation, which includes Γ-point related bulk states only, is shown to be better justified for slightly graded interfaces. (16 refs.)

108531 Characterization of GaAs:O-Ge and ZnSe:O-Ge heterointerfaces grown on oxygen-exposed GaAs and ZnSe substrates. F.C.Jain (Electrical Engng. & Computer Sci. Dept., Univ. of Connecticut, Storrs, CT, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.661-7 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The electronic behavior of *p-n* and isotype heterojunctions is shown to be significantly different when a chemisorbed oxygen/oxide layer is present at the heterointerface. Specifically, the characteristics of *n*GaAs:O-*n*Ge and *n*ZnSe:O-*p*Ge devices are described. In *n*GaAs:O-*n*Ge devices, the author has observed under dark and illuminated conditions a polarity inversion in *V-I* characteristics not normally expected of conventional *n*GaAs-*n*Ge heterojunctions. The polarity inversion and other aspects of *V-I* and *C-V* characteristics of GaAs:O-Ge devices are consistently explained by a new band model involving the presence of localized inversion and/or accumulation layers at the heterointerface. The novel features in the *V-I* and *C-V* characteristics of *n*ZnSe-*p*Ge heterojunctions resulting from the presence of interfacial oxygen are also presented. (26 refs.)

108532 Electrical measurements of the conduction band discontinuity of the abrupt Ge-GaAs $\langle 100 \rangle$ heterojunction. J.M.Ballingall (McDonnell Douglas Res. Labs., St. Louis, MO, USA), C.E.C.Wood, L.F.Eastman.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.675-81 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Current-voltage (*I-V*) measurements are used to measure the conduction band discontinuity of the *n-n*$\langle 100 \rangle$ Ge-GaAs heterojunction grown by molecular beam epitaxy. All of the heterojunctions were grown at 300°C to ensure abrupt interfaces. The free electron concentrations were varied on both sides of the heterojunctions by controlled doping of the Ge and GaAs epitaxial films. The current-voltage characteristics vary systematically with doping, temperature, and postgrowth heat treatments. The electrical barrier at the heterojunction is measured to be 80 ± 10 meV. This value is considerably smaller than values obtained with vapor-phase-grown $\langle 100 \rangle$ *n-n* heterojunctions. The 80 meV value is in excellent agreement with theoretical predictions for the conduction band discontinuity at the abrupt, unreconstructed $\langle 100 \rangle$ interface. Postgrowth heat treatments show a decrease in the electrical barrier which is consistent with an interdiffusion model for the atomic species at the interface and contrary to previous anomalous results. The differences between the electrical barriers obtained with molecular beam and vapor phase epitaxial heterojunctions are apparently due to differences in substrate preparation procedures and results as well as the inherent differences in the two growth processes. (36 refs.)

108533 Band discontinuities and interface Fermi-level positions in Ge-GaAs (110) heterojunctions. S.P.Kowalczyk, R.W.Grant, J.R.Waldrop, E.A.Kraut (Microelectronics Res. & Dev. Center, Rockwell Internat., Thousand Oaks, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.684-6 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
X-ray photoelectron spectroscopy (XPS) measurements were performed on (*p*)Ge-(*p*)GaAs(110) and (*p*)Ge-(*n*)GaAs(110) heterojunctions to investigate the possible influence of interface defect levels on valence-band discontinuities ΔE_v. These XPS experiments indicate that ΔE_v is independent of GaAs dopant type. Comparison of the present results with results from previous work shows that ΔE_v is independent of the GaAs(110) surface preparation method (thermal, sputter and annealed, or cleavage) and Ge dopant type. No evidence is found for the presence of an intrinsic dipole layer associated with interface defect levels. (19 refs.)

108534 Optical investigation of MQW system InP-InGaAs-InP. K.Kodama, M.Ozeki, J.Komeno (Fujitsu Labs. Ltd., Atsugi, Japan).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.696-9 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
A new multiquantum well system, InP-InGaAs-InP, has been grown by the chloride transport vapor phase epitaxy. The Auger measurements show that a very sharp InGaAs-InP heterointerface (less than 30 Å) can be obtained by the present growth system. Optical absorption and photoluminescence measurements give the evidence for the formation of the quantum wells in InGaAs layers. Temperature dependence of photoluminescence indicates that the dominant emission at low temperatures is interpreted as the band-to-acceptor transition. It also shows that temperature dependence of the transition energy from hole subband to electron subband is apparently affected by the thickness of the quantum well. Two models are presented for this. One takes into account the localized phonons in the InGaAs-InP heterointerface region whose frequency is higher than that in the bulk samples. The other considers the difference in the thermal expansion coefficients of InGaAs and InP, which reduces a shift of the [000], conduction band minimum of the InGaAs quantum well layer toward higher energy with decreasing temperature. (18 refs.)

108535 Electron scattering processes at modulation-doped GaAs-(AlGa)As interfaces. H.L.Stormer (Bell Labs., Murray Hill, NJ, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.702 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Summary form only given. A review of transport in the high mobility two-dimensional electron gas at the interface of modulation-doped GaAs-(AlGa)As heterostructures is presented. Mobility enhancement results from a spatial separation of mobile carriers from their ionized parent impurities. This is achieved at a heterojunction interface where carriers from the wide gap material transfer across the interface populating the low lying conduction band states of the narrow gap material. Those carriers form a two-dimensional electron gas bound to the heterojunction via the Coulomb forces of their parent impurities across the interface but spatially separated from the strong part of the scattering potential of these ionized donors. (11 refs.)

108536 Optoelectronic instruments based on p-n Si carbide junctions obtained by various methods. A review. S.I.Vlaskina, K.D.Demakov, S.V.Svechnikov, O.T.Sergeev.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.1, p.74-81 (1982). In Russian.
Information published since 1970 is discussed under the headings: diffusional p-n junctions; ionic implantation p-n junctions; basic character of p-n junctions obtained by diffusion and ion implantation of impurities; and optoelectronic instruments. It is concluded that the results of studying various methods of establishing p-n junctions, and contacts for Si carbide crystals of optoelectronic instruments for various purposes are in good agreement with the parameters of integrated circuits produced by batch production. (13 refs.) *N.F.S.*

108537 Electrical and photoelectrical properties of three-layer heterostructures *n*-$Al_{0.3}Ga_{0.7}As$-*p*-$Al_{0.1}Ga_{0.9}As$-*p*-GaAs and *p*-$Al_{0.65}Ga_{0.35}As$-*n*-GaAs-*n*-GaAs. D.D.Askerov, A.M.Agaev, T.D.Dzhafarov, I.E.Maronchuk.
Izv. Akad. Nauk Az. SSR Ser. Fiz.-Tekh. & Mat. Nauk (USSR), no.4, p.65-9 (1982). In Russian.
An investigation has been made of the electrical properties and spectral distribution of the photoconductivity of epitaxial *n*-$Al_{0.3}Ga_{0.7}As$-$Al_{0.1}Ga_{0.9}As$-*p*-GaAs and *p*-$Al_{0.65}Ga_{0.35}As$-*n*-GaAs-*n* GaAs heterostructures (*n-p* and *p-n*-heterostructures, respectively). *P-n* heterojunction is established to show a wider range of photoconductivity ($h\nu=1.35$-2.4 eV) compared to *n-p* heterojunctions ($h\nu=1.30$-1.75 eV). Short circuit photocurrent density (I_{sc}), open-circuit voltages (U_{oc}) and effectiveness (η) of the photoelements in question at illumination intensity 140 mW/cm^2 are shown to be as follows: $I_{sc}=3$ mA/cm^2, $U_{OC}=0.95$ V, $\eta=1.5\%$ (for *n-p* heterojunction) and $I_{sc}=7$ mA/cm^2, $U_{OC}=0.83$ V, $\eta=2.1\%$ (for *p-n* heterojunction). Energy band diagram of the heterojunctions adequately describing the experimental data has been constructed. (7 refs.)

108538 Electronic characteristics of Ge-GaAs interface having chemisorbed oxygen at the GaAs surface. F.C.Jain (Univ. of Connecticut, Storrs, CT, USA).
Phys. Scr. (Sweden), vol.T4, p.183-8 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).
The electronic behaviour of GaAs:O-Ge structures having chemisorbed oxygen at the interface is shown to be significantly different from that expected in a conventional GaAs-Ge heterointerface. The presence of oxygen at the interface has been detected by performing depth-compositional analysis using Auger Electron Spectroscopic technique in conjunction with the Ion Milling. In addition, in *n*GaAs:O-*p*Ge samples interfacial oxygen bonding to arsenic atoms was also confirmed by ESCA studies which reproducibly revealed a chemical shift of about 4.4 eV in the arsenic 3*d* peak. A novel features observed in the electronic transport characteristics of GaAs:O-Ge devices is the inversion of *V-I* and *C-V* characteristics. Theoretically, observed *V-I* and *C-V* characteristics are explained by a new model involving the presence of inversion and/or accumulation layers localized at the heterointerface. (21 refs.)

108539 Determination of the discrete 'surface' energy level in semi-infinite superlattice structures. V.Milanovic (Faculty of Electrical Engng., Univ. of Belgrade, Belgrade, Yugoslavia).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.181-6 (1983).
Taking into account that a one-dimensional structure is periodic only in one direction (being unperiodic in the opposite direction) and applying the corresponding boundary conditions, the relation is given wherefrom the energy of the discrete 'surface' levels is determined. Analyzing the expression for the wave function corresponding to the discrete levels, it was shown that the states are localized in the vicinity of the 'interface'. The wave functions extend deeper in the periodic part of the structure, if the energies are nearer to the top of the corresponding forbidden band. Numerical calculations are given for the structure (already experimentally realized) consisting of $Al_xGa_{1-x}As$-GaAs superlattice, of the GaAs layer of a finite thickness as well as of a semi-infinite layer of $Al_yGa_{1-y}As$ $(y>x)$. Varying the thickness of the GaAs layer, it was shown that with the increase of the thickness the number of discrete ('surface') states increases. For small values of thickness there is a region for which the discrete states in all forbidden bands disappear. (9 refs.)

108540 Self-consistent evaluation of nonuniform superlattice parameters by the harmonic method. V.Milanovic, D.Tjapkin (Faculty of Electrical Engng., Belgrade, Yugoslavia).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.187-92 (1983).
Starting from the fact that in superlattice structures the spatial dependence of effective mass is present, the self-consistent procedure based on the representation of all periodic quantities in the form of complex Fourier series is given. It was shown that the determination of the allowed energy values reduces to the determination of the eigenvalue of an infinite symmetric matrix. The analysis of off-diagonal elements of this matrix leads to the important conclusion that the energy spectrum has band structure, if either the potential energy or the effective mass is spatially dependent. The solution of the Poisson equation (more exactly the first Maxwell field equation) reduces to the solution of an infinite system of linear equations where the Fourier coefficients of potential energy appear as unknown. (no refs.)

108541 Microscopic study of semiconductor heterojunctions: photoemission measurement of the valence-band discontinuity and of the potential barriers. A.D.Katnani, G.Margaritondo (Dept. of Phys., Univ. of Wisconsin, Madison, WI, USA).
Phys. Rev. B (USA), vol.28, no.4, p.1944-56 (15 Aug. 1983).
The authors report on synchrotron-radiation photoemission measurements of the valence-band discontinuity and of the Fermi-level position for 25 different interfaces involving group IV, III-V, and II-VI semiconductor substrates and Ge or Si overlayers. A comparison is made between measured discontinuities and the predictions of current theoretical models. They find the best agreement with empirically corrected versions of the models of Harrison (1977) and of Frensley and Kroemer (1977). However, they present a new empirical rule based on present results and on those of other authors which yields even more accurate predictions of band discontinuities. The measured Fermi-level-pinning position of each substrate is the same for both Ge and Si overlayers. This result is discussed in terms of the 'defect model' of Fermi-level pinning, originally developed for Schottky barriers. (41 refs.)

108542 Observation of a fractional quantum number. D.C.Tsui (Dept. of Electrical Engng. & Computer Sci., Princeton Univ., Princeton, NJ, USA), H.L.Stormer, J.C.M.Hwang, J.S.Brooks, M.J.Naughton.
Phys. Rev. B (USA), vol.28, no.4, p.2274-5 (15 Aug. 1983).
New experiments on the two-dimensional electrons in GaAs-$Al_{0.3}Ga_{0.7}As$ heterostructures at $T\sim0.14$K and $b\leq190$ kG demonstrate that the quantum number of the quantized Hall resistance, close to $^1/_3$ filling of the last Landau level, is $^1/_3$ to better than 1 part in 10^4. (10 refs.)

108543 Logarithmic behavior in a new two-dimensional metal: HgTe-CdTe superlattice. N.P.Ong, G.Kote (Dept. of Phys., Univ. of Southern California, Los Angeles, CA, USA), J.T.Cheung.
Phys. Rev. B (USA), vol.28, no.4, p.2289-91 (15 Aug. 1983).
The resistance of a HgTe-CdTe superlattice of layer thickness 110 Å/220 Å shows logarithmic behavior with respect to temperature below 30K. The field-parallel and field-perpendicular magnetoresistance clearly distinguish between the orbital and spin-dependent scattering mechanisms, and confirm two-dimensional behavior. (19 refs.)

108544 Photovoltaic properties of sputtered *n*-CdO films on *p*-Cu_2O. L.Papadimitriou, N.A.Economou (Dept. of Phys., Univ. of Thessaloniki, Thessaloniki, Greece), D.Trivich.
Solid-State Electron. (GB), vol.26, no.8, p.767-9 (Aug. 1983).
The heterojunction CdO/Cu_2O was prepared by sputtering CdO films on Cu_2O at room temperature. The optical transmission of CdO films at a thickness of ~1000 Å was ~85%. The analysis of the I-V characteristics at

different temperatures gave information on the carrier transport mechanism at the junction. The forward and the reverse dark current is dominated by a tunneling process. Measurements of the open-circuit photovoltage resulted in a curve which indicates a sensitivity range from 2.25 to 2.48 eV, similar to that found in Cu_2O MIS solar cells. (8 refs.)

108545 Low field mobility of 2-d electron gas in modulation doped $Al_xGa_{1-x}As$/GaAs layers. K.Lee, M.S.Shur (Dept. of Electrical Engng., Univ. of Minnesota, Minneapolis, MN, USA), T.J.Drummond, H.Morkoc.
UGIM-83 Proceedings. 1983 University/Government/Industry Microelectronics Symposium, College Station, TX, USA, 25-27 May 1983 (New York, USA: IEEE 1983), p.173-7
Derives a simple analytical formula for the low field mobility which uses 2-d degenerate statistics for the 2-d electron gas. It also takes into account the finite width of the depletion layer in (Al,Ga)As (which affects primarily impurity scattering), scattering by the charged interface states and polar optical and acoustic phonon scattering. The maximum mobility for a given structure is determined by scattering by the interface charged states. The ultimate mobility which may be achieved is limited by acoustic phonon scattering at about 8×10^6 cm^2/Vs for a 2-d electron gas density of $n_{so}\simeq4\times10^{11}$ cm^{-1}. The results agree very well with experimental data. (18 refs.)

10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces .... See Entry 105017

Apparatus for the investigation of deep level parameters in semiconductors .... See Entry 105332

Self-focusing and self-modulation of electromagnetic waves in semiconductor with superlattice .... See Entry 106832

Dipole driven diffusion across polar heterojunction interfaces .... See Entry 108076

Interface properties of *n*-ZnSe-*p*-Ge heterojunctions grown by organometallic chemical vapor deposition .... See Entry 108199

Some observations on Ge:GaAs(001) and GaAs:Ge(001) interfaces and films .... See Entry 108200

Charge-density excitations at the surface of a semiconductor superlattice: a new type of surface polariton .... See Entry 108306

Nonlinear interaction of electromagnetic and plasma waves in periodic semiconductor structures .... See Entry 108465

Barrier-layer photo-EMF under conditions of heating of charge carriers by light .... See Entry 108467

Photoelectric properties of nSiC-pSi heterojunctions .... See Entry 108468

The problem of the electron energy bands interconnection in abrupt semiconductor heterojunctions .... See Entry 108489

Interface formation at PbTe(100) surfaces: Ge, Al, and In overlayers .... See Entry 108492

Electron-beam-induced current measurements in silicon-on-insulator films prepared by zone-melting recrystallization .... See Entry 108578

Photoluminescence of GaAs-Al_xGa_{1-x}As multiple quantum well structure under high excitations .... See Entry 108988

Measurement of electroluminescence spectra of Ga phosphide p-n junctions with time resolution .... See Entry 109017

Modification of bulk band photoemission features by Ge overlayers .... See Entry 109093

Effect of pn coupling on open-circuit photovoltage decay in a silicon pn junction solar cell .... See Entry 109893

Transparent conducting tin oxide films for application in heterojunction solar cells .... See Entry 109900

73.40M Semiconductor-electrolyte contacts

108546 Characterization of intrinsic amorphous hydrogenated silicon as a thin-film photocathode material. Efficient photoreduction processes in aqueous solution. D.J.Harrison, G.S.Calabrese, A.J.Ricco (Dept. of Chem., MIT, Cambridge, MA, USA), J.Dresner, M.S.Wrighton.
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4212-19 (29 June 1983).
Intrinsic amorphous hydrogenated silicon, a-Si:H, has been characterized as a thin-film (8000 Å) a-Si:H material. The intrinsic a-Si:H is deposited onto a 200-Å thick, heavily B-doped, layer of a-Si:H on stainless steel. The 200-Å p^+-a-Si:H layer ensures a back contact to the valence band to give as large a field across the 8000-Å intrinsic layer as possible when the intrinsic layer is contacted on the other side by an electrolyte solution containing a redox couple. The a-Si:H photocathodes give good photovoltages in aqueous and nonaqueous media, up to 855 mV, depending on the $E_{1/2}$ of the redox couple in contact with the electrode. A plot of photovoltage vs. $E_{1/2}$ shows a slope of only 0.42. A zero photovoltage is extrapolated to obtain for $E_{1/2}$ no more negative than +0.9 V vs. SCE; the photovoltage is constant for $E_{1/2}$ more negative than ~−0.8 V vs. SCE. The slope of less than 1.0 suggests a deleterious role for states situated between the valence and conduction bands of a-Si:H. The surface of a-Si:H can be derivatized with an *N,N′*-dialkyl-4,4′-bipyridinium reagent followed by deposition of Pd or Pt to effect H_2 evolution at an electrode potential up to ~700 mV more positive than on a conventional electrode. (33 refs.)

108547 The semiconductor-electrolyte interface: optical transitions in CdMnTe alloys. P.Lemasson (Lab. d'Electrochimie Interfaciale, CNRS, Meudon, France), Bing-Liang Wu, R.Triboulet, J.Gautron.
Solid State Commun. (USA), vol.47, no.9, p.669-71 (Sept. 1983).
The junction p-$Cd_{1-x}Mn_xTe$-electrolyte is studied under monochromatic illumination for the alloy composition range $0\leq x\leq0.7$. Optical transitions in the semiconductor are evidenced by photocurrent measurements. In the composition range $0\leq x\leq0.45$, the nature of the fundamental transition appears to be the same as in CdTe (valence band $\Gamma_8\rightarrow$conduction band Γ_6). For $x>0.45$, the observed photocurrent peak, pinned at a constant energy value ca. 2.1 eV, may presumably be related to a transition $\Gamma_8\rightarrow d(Mn)$ level whereas the photocurrent edge associated to the former transition increases linearly with x. (14 refs.)

Characterization of deep levels in semi-insulating GaAs crystals by a spectroscopic photoelectrochemical current .... See Entry 108331

Numerical simulation of the long-term performance and corrosion of photoelectrochemical cells .... See Entry 109548

Electroreflectance and photoinduced charge separation in electrochemically doped trans-polyacetylene liquid junction device .... See Entry 109889

73.40N Metal-nonmetal contacts

108548 On the mechanism of self-lubrication in metal-polymer electrical contacts. A.I.Sviridyonok, V.V.Meshkov (Inst. of Mech. of Metal-Polymer Systems, Acad. of Sci., Gomel, Byelorussian SSR).
ASLE Trans. (USA), vol.26, no.3, p.311-16 (July 1983).
It is shown that when metal-polymer materials are used as contacts, the contact behavior depends on the processes of generation and regeneration of transfer films. A new technique, designed and applied for the examination of surface layers of the materials, together with known procedures allowed a comparison of surface properties, such as electrophysical and topographic, of the metal-polymer friction transfer films with those formed by conventional compounds. The kinetics of the metal-polymer film formation owing to friction transfer is described and a self-lubrication mechanism is suggested for metal-polymer electrical contacts. (15 refs.)

108549 Contact resistance of Al/Si ohmic electrodes formed by rapid lamp sintering. T.Hara, H.Suzuki, M.Furukawa, K.Amemiya (Electrical Engng., Hosei Univ., Tokyo, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.6, p.L340-2 (June 1983).
Reduction of contact resistance was achieved in Al/Si ohmic electrodes sintered by halogen lamp rapid heating. Contact resistance measurements were made for the electrodes formed on highly doped shallow *p*-Si layers, where lamp sintering was performed at 450°C. The contact resistance was low and uniform within a wafer when compared with that for conventional furnace sintering. A specific contact resistance of 4.0×10^{-6} Ohm-cm^2 was achieved for p^+ layers. The Al spikes and Si precipitates could be markedly reduced in this short time sintering. (10 refs.)

108550 Fermi-level pinning energy and chemistry at InP (100) interfaces. J.R.Waldrop, S.P.Kowalczyk, R.W.Grant (Microelectronics Res. & Dev. Center, Rockwell Internat., Thousand Oaks, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.628-9 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Summary form only given. X-ray photoemission spectroscopy (XPS) has been used to correlate the interface Fermi-level pinning energy E_F^i and the corresponding interface chemistry for *n*-and *p*-type InP(100) samples simultaneously subjected to a series of surface treatments. Metals (Al and Au) were evaporated in a sequence of thin deposits onto both chemically etched and thermally cleaned surfaces. The interface chemistry was primarily observed from the chemical shifts associated with In 3*d*, P 2*p*, Al 2*p*, and Au 4*f* XPS core-level spectra. The value of E_F^i at an interface was found by measuring the potential shift in binding energy of the P 2*p* core level in InP that occurred as a result of a given surface treatment. (7 refs.)

108551 Ohmic contacts to GaAs and $Ga_xAl_{1-x}As$. N.Braslau (IBM Watson Res. Center, Yorktown Heights, NY, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.700-1 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Summary form only given. The increasing performance and decreasing size of III-V semiconducting devices have called attention to the less than satisfactory nature of ohmic contacts in these structures. The author finds them contributing unwanted parasitic resistance, difficult to fabricate reproducibly, and are the major source of poor aging characteristics. Present device technology calls for such contacts to be linear with applied voltage, noninjecting, stable with time, and with fabrication compatible with other processing steps, all for a five decade range of semiconductor doping. The major source of difficulty is the presence of surface depletion layers due to Fermi level pinning by surface states near midgap which are normally present on polished and chemically cleaned wafers. (18 refs.)

108552 A study of tunnel-thermoemission currents through metal-semiconductor structures with a gap. A.N.Zyuganov, P.S.Smertenko.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.1, p.87-92 (1982). In Russian.
The study is aimed at determining the behaviour of a mean transparency factor in the region of fields up to the beginning of strong autoelectronic emission of carriers from the metal and the formulation on this basis of main approximations on the theory of metal-semiconductor contacts with a tunnel-emission mechanism of passage through a barrier. It is shown that with wide gaps, but not exceeding 10^{-6} cm, the mean transparency factor is equal to the transparency factor at an energy level equal to the height of the precontact barrier, and an expression is defined for the transparency factor in a quasiclassical approximation. The height of the barrier at the In-CdS interface approximation is determined from the volt-ampere characteristic for the In-CdS-In structure. It is shown that the electron affinity in CdS can be determined from the value of the transparency factor. (13 refs.) *N.F.S.*

108553 A complex impedance study of Pt|NaCl and C|NaCl interfaces. S.Lanyi (Inst. of Phys., Slovak Acad. of Sci., Bratislava, Czechoslovakia), K.Hricovini.
J. Phys. & Chem. Solids (GB), vol.44, no.9, p.905-12 (1983).
The AC impedance of Pt|NaCl|Pt and C|NaCl|C cells was measured in the frequency range from 10^{-3} to 10^3 Hz. Two contributions to the interface impedance could be distinguished, hindered charge transfer and an adsorption/desorption or slow reaction contribution, the latter being the rate determining step in the frequency range studied. An approximately symmetric nonlinear dependence of both the capacitance and the conductance on overvoltage was found at the lowest frequencies, indicating that the crystal/electrode interface is in a state which can be characterized as close to equilibrium. It should be ensured by two electrochemical reactions of approximately equal rates. The concept of a temporarily reversible electrode is introduced. It is a result of the ability of ions to discharge at the interface and to produce a finite reservoir of adsorbed or absorbed reaction products. An external voltage increases or reduces this reservoir, and therefore only a transient electric current may be carried by a backward reaction. (39 refs.)

108554 Fermi-level position at a semiconductor-metal interface. A.Zur, T.C.McGill, D.L.Smith (Thomas J. Watson, Sr. Lab. of Appl. Phys., California Inst. of Technol., Pasadena, CA, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2060-7 (15 Aug. 1983).
The authors investigated the phenomenon of Fermi-level pinning by charged defects at the semiconductor-metal interface. Two limiting cases were investigated. In the first case they modeled an infinitely thick metallic coverage. In the second case they modeled a submonolayer coverage by using a free semiconductor surface containing defects. In both cases they assumed that most of the defect-induced interface states are localized inside the semiconductor, not more than a few angstroms away from the metal. Under these conditions they have estimated the difference in Fermi-level position between *n*- and *p*-type semiconductors to be less than 0.05 eV in the case of a thick metallic coverage. This difference was shown to be the maximum possible one, and it occurs only when there is no pinning. When there is pinning, this difference is

even smaller. No such upper bound on the difference in Fermi-level position exists in the case of submonolayer coverage. They have also found that the defect density required to pin the Fermi level is $\sim 10^{14}$ cm^{-1} in the case of a thick metallic coverage, but only $\sim 10^{12}$ cm^{-1} in the case of a submonolayer coverage. (15 refs.)

108555 Properties of metal semiconductor contacts. I. Voltage-current characteristics of contacts on intrinsic semiconductors. J.-C.Manifacier, Y.Moreau, H.K.Henisch (Dept. of Phys. & Materials Res. Library, Pennsylvania State Univ., University Park, PA, USA).
Solid-State Electron. (GB), vol.26, no.8, p.795-9 (Aug. 1983).
In the general case (two carriers, arbitrary lifetime, arbitrary dielectric relaxation time), the transport equations relating to barrier characteristics have to be solved by numerical methods. The single-carrier case is already (abundantly) familiar, but the two-carrier case can also be solved explicitly. However, the solution is simple only for contacts on high lifetime intrinsic material. Such a solution is here obtained by conventional analytic methods, based on the diffusion theory and resonable approximations, and is compared with computed results obtained on the complete (unapproximated) system. Analysis and computation lead to new and hitherto unrecognized dependence of the current on the applied voltage across the barrier in accordance with $\exp[2qV_a/kT]$, instead of the more familiar $\exp[qV_a/kT]$. (17 refs.)

10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces ....See Entry 105017

Solubility of GaAs in Au-Ge eutectic melts [ohmic contacts] ....See Entry 107959

Initial reactions at the interface of Pt and amorphous silicon ....See Entry 108069

Similarities in chemical intermixing at the Cu/InP and Cu/Si interfaces ....See Entry 108071

Auger depth profiling studies of interdiffusion and chemical trapping at metal-InP interfaces ....See Entry 108072

Room temperature exchange reaction at the Al-InP (110) interface: soft X-ray photoemission studies ....See Entry 108073

Palladium on GaAs: a reactive interface ....See Entry 108217

Electronic structure of metal-semiconductor interfaces ....See Entry 108491

Interface formation at PbTe(100) surfaces: Ge, Al, and In overlayers ....See Entry 108492

The effect of surface oxygen on the intermixing and Schottky barrier at GaAs(110)-Au interfaces ....See Entry 108493

The effect of doping on Fermi level position at a semiconductor-metal interface ....See Entry 108494

Schottky barrier formation and the initial metal-atom bonding state: InP(110)-Al vs GaAs(110)-Al ....See Entry 108495

Interface states at Ni/c-Si(111) and Ni silicide/c-Si(111) ......See Entry 108500

DLTS determination of the Mo acceptor level in Mo-GaAs$_{0.6}$P$_{0.4}$ Schottky diodes ....See Entry 108508

Study of the GaAs-Au and Si-SiO$_2$ interface formation by the Kelvin method ....See Entry 108510

The dependence of Al Schottky barrier height on surface conditions of GaAs and AlAs grown by molecular beam epitaxy ....See Entry 108511

Schottky barrier formation of Ag on GaAs(110) ....See Entry 108512

Schottky barrier formation and intermixing of noble metals on GaAs(110) ....See Entry 108513

Barrier height and leakage reduction in n-GaAs-platinum group metal Schottky barriers upon exposure to hydrogen ....See Entry 108514

On the dependence of Schottky barrier height and interface states upon initial semiconductor surface parameters in GaAs {001}/Al junctions ....See Entry 108515

Silicon-nickel silicide Schottky barriers formed by ion mixing ....See Entry 108517

Schottky barriers on single-crystal indium telluride ....See Entry 108518

73.40Q Metal-insulator-semiconductor structures

(inc. semiconductor-to-insulator)

108556 Experimental verification of electron-hole recombination theory for Si-SiO$_2$ interface traps with nonequilibrium, steady-state, admittance measurements. A.K.Agarwal, F.M.Rhodes, M.H.White (Shermann Fairchild Lab., Lehigh Univ., Bethlehem, PA, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.465-7 (1 Sept. 1983).
An analytical and experimental study of deep level Si-SiO$_2$ interface traps is presented for small-signal, admittance measurements on a gated-diode structure. This technique eliminates the minority-carrier capture process and allows the competing emission process to dominate near the middle of the Si band gap. First-order rate kinetics has been employed to predict the behaviour of the nonequilibrium, steady-state, occupancy function and 'trap conductance' for states in the midgap region. Theory predicts and experimental measurements verify a sudden decrease or 'pinning' of the trap conductance. Their ratio of electron to hole capture cross sections, $R=\sigma_n/\sigma_p$, has a pronounced influence on the trap energy associated with the onset of 'pinning', $U_{TP}={}^1/_2\ln(R)$. (6 refs.)

108557 Measurements of capture cross section of traps in insulating films by photoinjection current decay. Shi Changxin, Gu Weifang (Shanghai Inst. of Metallurgy, Acad. Sinica, Beijing, China).
Chin. J. Semicond. (China), vol.4, no.4, p.383-8 (July 1983). In Chinese.
The external circuit current of photoinjection in MOS structures is closely related to the capture cross section of traps. The dependence of external circuit current decay on time is given. Therefore, the capture cross section of traps can be measured easily. This method can be used in metal-insulator-metal (MIM) structures without silicon substrate. (7 refs.)

108558 On the contact potential differences in Al-SiO$_2$-Si and Au-SiO$_2$-Si structures. Lu Deren (Shanghai Inst. of Metall., Acad. Sinica, Beijing, China).
Chin. J. Semicond. (China), vol.4, no.4, p.399-402 (July 1983). In Chinese.
The contact potential difference of the MOS-system with aluminium field plates and gold probe electrode is measured by the MOS-capacitance-voltage technique for (100) and (111) oriented n-type as well as p-type silicon slices with thermal SiO$_2$. It can be seen that the contact potential differences measured in this work are about 0.35 V more positive than the values measured by the photoemission technique. It is suggested that the value measured by the MOS-capacitance-voltage technique should be used when the electrical phenomena without light in MOS-system are investigated. (7 refs.)

108559 Native oxide formation and electrical instabilities at the insulator/InP interface. J.F.Wager (Hughes Res. Labs., Malibu, CA, USA), K.M.Geib, C.W.Wilmsen, L.L.Kazmerski.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.778-81 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
A variety of surface analytical techniques have been employed in an attempt to correlate the chemistry of InP native oxides with electrical interface instabilities observed in InP MIS devices. The native oxides examined were predominantly InPO$_4$ but upon closer examination had small amounts of In$_2$O$_3$ incorporated into the outer oxide surface. The band gap of InPO$_4$ was estimated to be about 4.5 eV, although several observations indicate that this may be only a lower limit. It is suggested that tunneling of electrons from InP through the InPO$_4$ into In$_2$O$_3$ may account for electrical interface instabilities observed in InP MIS devices. (17 refs.)

108560 Surface and interfacial properties of Ga$_{0.47}$In$_{0.53}$As-Al$_2$O$_3$ MIS structures. D.P.Mullin (Electronic Material Sci. Div., Naval Ocean Systems Center, San Diego, CA, USA), H.H.Wieder.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.782-6 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Field-effect-controlled electrical and galvanomagnetic measurements have been made on transistor like five-terminal metal insulator semiconductor (MIS) structures using n-type 0.25 μm thick Ga$_{0.47}$In$_{0.53}$As epitaxial layers grown on semi-insulating InP substrates. These layers have an electron density $n=3.5\times10^{16}$ cm^{-3} and a mobility $\mu_n=7.5\times10$ cm^2/V-s; 0.13 μm thick Al$_2$O$_3$ dielectric layers, grown by a RF plasma-assisted low temperature chemical-vapor deposition (CVD) process were employed as gate insulators under 0.01 cm^2 vacuum-deposited aluminum gates. Hall effect and resistivity measurements were made on such structures and the experimentally observed gate voltage dependent change in resistivity and Hall coefficient of the conducting channel under the gate have been related to the corresponding change in the depletion depth of the surface space charge region. The data were used to derive the density of the surface states and their position within the fundamental band gap of Ga$_{0.47}$In$_{0.53}$As. The authors find that the surface Fermi level F_F* of virgin MIS structures is pinned $\sim$0.2 eV below the conduction band minimum (0.55 eV above the valence band maximum) of Ga$_{0.47}$In$_{0.53}$As, in agreement with the experimentally measured and theoretically calculated barrier height of metal Ga$_{0.47}$In$_{0.53}$As diodes. (17 refs.)

108561 The effect of low pressure plasma on Si-SiO$_2$ structures and GaAs substrates. Y.Chung, C.Y.Chen (Universal Energy Systems Inc., Dayton, OH, USA), D.W.Langer, Y.S.Park.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.799-802 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The degradation of insulating films and GaAs substrates by exposure to low pressure plasma is investigated. In Si-SiO$_2$ structures, the increased density of fast surface states and the nonuniform storage of positive trapped charges within the oxide layer is responsible for the degradation of MOS devices exposed to low pressure plasma. The charge carrier reduction due to the creation of compensating defects during the hydrogen plasma treatment of n-GaAs is reported. (14 refs.)

108562 Surface roughness scattering at the Si-SiO$_2$ interface. S.M.Goodnick, R.G.Gann, J.R.Sites, D.K.Ferry, C.W.Wilmsen (Colorado State Univ., Fort Collins, CO, USA), D.Fathy, O.L.Krivanek.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.803-8 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Scattering of inversion layer electrons at the oxide semiconductor interface is a major source of mobility degradation in MOSFETs. The authors have studied, on the same sample, high resolution TEM cross sections of the Si-SiO$_2$ interface and detailed temperature dependent electronic and magnetic transport measurements. The experimental mobility data are compared to a model containing terms for surface roughness and impurity scattering including carrier screening. The statistical properties of the interface fluctuations appear as parameters which are adjusted to fit the transport data. While the TEM pictures indicated an interfacial boundary which deviated by only one atomic layer, an assumed peak-to-peak deviation of approximately five atomic layers is required to fit the experimental mobility. Thus, while the overall comparison of the surface parameters suggests that roughness scattering is a plausible mechanism, close agreement between the theory and experiment is not obtained. (19 refs.)

108563 Nature of radiation effects in laminated MOS structures. A review. V.G.Litovchenko.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.1, p.27-35 (1982). In Russian.
Information published since 1968 is discussed under the heading: radiation effects in dielectric phases; interfaces and electrical parameters; and semiconductor layer adjacent to the interface. Diagrams are reproduced showing a schematic representation of surface radiation effects with distortion of the Si-O bond, formation of zones in amorphous SiO$_2$ on interaction of s and p orbitals of Si and O through formation of the SiO$_2$ molecule, and the Lorenz broadening parameter as a function of the coordinates normal to the surface obtained in layer by layer etching of Si implanted with ^{75}As, ^{31}P, and ^{11}B ions. (29 refs.) *N.F.S.*

108564 Calculation of the volt-Faraday characteristics of MOS structures with a Si field electrode. A.V.Nabok, O.S.Frolov.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.1, p.61-6 (1982). In Russian.
It is shown that allowance for the semiconductor properties of a polysilicon field electrode in the calculation of volt-Faraday characteristics of MOS structures leads to a decrease in the maximum capacity of the structure and a displacement of the C-V curves, this displacement increasing with decrease in the concentration of doping impurities in the polycrystalline Si. It is suggested that this could have a significant effect on the operation of instruments based on structures with Si gates, especially at low temperatures, high frequencies of the control signal, and low concentrations of impurities in the polysilicon. (4 refs.) *N.F.S.*

108565 Effects of radiation-thermal factors on the characteristics of semiconductor structures. V.G.Litovchenko, V.Ya.Kiblik, R.O.Litvinov.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.1, p.69-73 (1982). In Russian.
Studies aimed at decreasing the concentration of defects and decreasing the carrier recombination losses in the surface region of Si by means of radiation-thermal methods, and which provide a means of increasing transistor amplification factors over a wide range of collector currents are described. The structures studied are MOS and dielectric semiconductor structures based on p-type Si, and also planar, bipolar high frequency transistors using irradiation with γ rays from a ^{60}Co source or electrons of various energy at 300K.

In the case of the MOS structures the density of surface states in the centre of the forbidden zone $N_{ts}(-u_v)$, the rate of surface generation, S_g, and the generation lifetime of the minority charge carriers t_g are measured. The data lead to the important result that the values of the above three parameters decrease below the initial values, at temperature below 250° in the case of $N_{ys}(-u_v)$ and s_g, and at temperature not less than 300°C in the case of $1/t_g$. The results obtained with MOS are confirmed with low and high power high frequency transistors. (14 refs.) *N.F.S.*

108566 Electrophysical properties of MIS (MOSFET) structures based on indium arsenide. A.A.Shirokov, E.A.Markova, I.S.Zakharov.
Inorg. Mater. (USA), vol.18, no.9, p.1243-7 (Sept. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.9, p.1459-63 (Sept. 1982). [received: Sept. 1983]
Metal-insulator-semiconductor structures based on single-crystalline and epitaxial InAs have been obtained using the method of anodic oxidation. It was found that for any of the anodization regimes studied, a positive charge is present in the oxide. The voltage-capacitance characteristics exhibit injection-type hysteresis. The voltage-capacitance characteristics, measured with a bias voltage scanning rate exceeding 0.015 V/sec, are nonequilibrium characteristics. In the depletion region, the capacitance of the structures depends strongly on the light intensity. (5 refs.)

108567 Quasi-classical quantization for potentials with an infinite surface barrier. Subbands in inversion layers. G.Paasch (Tech. Hochschule Ilmenau, Wissenschaftsbereich Phys., Ilmenau, Germany), T.Fiedler, M.Kolar, I.Bartos.
Phys. Status Solidi b (Germany), vol.118, no.2, p.641-52 (1 Aug. 1983).
Quasi-classical quantization schemes are investigated, for potentials with a high surface barrier, WKB and other previous approximations provide good results for the lower eigenvalues in special cases only. Here a modified local density approximation is used for the calculation of the density of states. From the integral density of states a quantization expression is derived where the ground state constant depends explicitly on the shape of the potential. It yields the whole eigenvalue spectrum very precisely for quite different potentials with a surface barrier. The application to subband energies in inversion layers is discussed. (19 refs.)

108568 DLTS investigations of Si-SiO$_2$ interface states of electron-beam irradiated MOS structures. K.Hubner (Sektion Phys., Wilhelm-Pieck-Univ. Rostock, Rostock, Germany), H.Koster,Jr., B.Derlich, W.Ecke.
Phys. Status Solidi b (Germany), vol.118, no.2, p.K133-6 (1 Aug. 1983).
The constant-capacitance DLTS (CC-DLTS) can be used to get very direct information about semiconductor-insulator interface states of metal-oxide-semiconductor (MOS) structures. The authors present results of CC-DLTS investigations of MOS structures, which show the influence of electron-beam irradiation on the spectrum of interface states in the silicon gap at the Si-SiO$_2$ interface. They lead to a clear identification of a special interface state as a radiation induced one. (9 refs.)

108569 Nonstoichometric germanium nitride. A new insulating material for MIS microelectronics. II. Composition, properties, and the interface with a semiconductor. G.D.Bagratishvili, R.B.Dzhanelidze, D.A.Jishiashvili (Inst. of Cybernetics, Acad. of Sci., Tbilisi, Georgian SSR).
Phys. Status Solidi a (Germany), vol.78, no.2, p.391-400 (16 Aug. 1983).
For pt.1 see ibid., vol.78, p.118 (1983). The optical and electrical properties of nonstoichiometric germanium oxynitrides and their interfaces with a semiconductor are discussed depending on their composition. The band gap, dielectric constant, and refractive index of the films obtained are shown to depend linearly on the oxygen content. The nonstoichiometric germanium oxynitride-semiconductor (GaAs, Si, Ge) interface is characterized by a low surface state density, lack of hysteresis, and frequency dispersion of the *C-U* characteristics and a high stability to the bias-temperature treatment. (18 refs.)

108570 Two-dimensional versus three-dimensional motion of inversion electrons in a magnetic field. J.H.Crasemann, U.Merkt, J.P.Kotthaus (Inst. fur Angewandte Phys., Univ. Hamburg, Hamburg, Germany).
Phys. Rev. B (USA), vol.28, no.4, p.2271-3 (15 Aug. 1983).
The infrared absorption of inversion electrons on InSb is measured in a magnetic field parallel to the inversion layer. The experimental results are explained by a simple model of surface electrons in crossed electric and magnetic fields. The dependence on resonance magnetic field and electron density shows a transition from two-dimensional- (2D) to 3D-like motion of the electrons. (17 refs.)

108571 Non-equilibrium properties of MIS capacitor under illumination conditions. S.Krawczyk (Politech. Warsaw, Warsaw, Poland).
Rozpr. Electrotech. (Poland), vol.28, no.1-2, p.219-31 (1982). In Polish. [received: Aug. 1983]
A qualitative and quantitative analysis of non-equilibrium properties of MIS capacitor under illumination conditions is presented. (16 refs.)

108572 Rapid interface parameterization using a single MOS conductance curve. J.R.Brews (Bell Labs., Murray Hill, NJ, USA).
Solid-State Electron. (GB), vol.26, no.8, p.711-16 (Aug. 1983).
Figures are presented for finding interface trap density D_{it}, capture probability c_p, and interfacial broadening σ_s, from a single curve of small-signal MOS interface trap conductance G_{it}/ω vs. either band bending v_s, or frequency $f[\omega=2\pi f]$. Almost no computation is necessary. An additional figure allows the depletion layer capacitance to be determined if the oxide capacitance and the measured capacitance at the maximum value of G_{it}/ω are known. The extension to G_{it}/ω vs. v_s curves is a convenience. Parameters throughout the bandgap can be obtained from measurements at fewer frequencies than are needed for construction of accurate G_{it}/ω vs. f curves. Economy also results because data usually are obtained by sweeping gate bias at selected frequencies. Construction of G_{it}/ω vs. v_s curves from the data is simpler than G_{it}/ω vs. f, particularly if v_s is measured directly. The information needed from the G_{it}/ω curve is the maximum value of G_{it}/ω and the width of the peak at an arbitrary fraction of its maximum value, f_w. In addition, for capture probability only, the frequency and band bending at the peak maximum are needed, as well as the bulk doping. The method assumes validity of the Gaussian approximation to broadening of the conductance peak. Comparison of the parameters obtained for several choices of f_w allows a check of this assumption, which usually is valid for MOS devices. (11 refs.)

108573 Low-intensity differential photocapacitance of MOS structures. M.M.Chandra, G.Suryan (Dept. of Phys., Indian Inst. of Sci., Bangalore, India).
Solid-State Electron. (GB), vol.26, no.8, p.731-7 (Aug. 1983).
Some new observations on the phenomenon of photocapacitance on *n*-type silicon MOS structures under low intensities of illumination are reported. The difference between the illuminated and dark C-V characteristics is automatically followed as a function of the applied bias thereby obtaining the differential photocapacitance and the resulting characteristics has been termed as the Low Intensity Differential Photocapacitance (LIDP). For an MOS capacitor, the LIDP characteristics is seen to go through a well defined maximum. The phenomenon has been investigated under different ambient conditions like light intensity, temperature, dependence of the frequency of the light etc., and it has been found that the phenomenon is due to a band to band excitation. In this connection, a novel sensitive technique for the measurement of the capacitance based upon following the frequency changes of a tank circuit is also described in some detail. It is also shown that the phenomenon can be understood by a simple theoretical model. (13 refs.)

Microfabrication as a scientific tool ....See Entry 105316

Si-SiO$_2$ interface structures on Si (100), (111), and (110) surfaces ....See Entry 108194

Study of the GaAs-Au and Si-SiO$_2$ interface formation by the Kelvin method ....See Entry 108510

Electron-beam-induced current measurements in silicon-on-insulator films prepared by zone-melting recrystallization ....See Entry 108578

Silicon MDS and SDS solar elements ....See Entry 109886

73.40R Metal-insulator-metal structures

108574 Squeezable electron tunneling junctions. J.Moreland, S.Alexander, M.Cox, R.Sonnenfeld, P.K.Hansma (Dept. of Phys., Univ. of California, Santa Barbara, CA, USA).
Appl. Phys. Lett. (USA), vol.43, no.4, p.387-8 (15 Aug. 1983).
Reports a versatile new technique for constructing electron tunneling junctions with mechanically adjusted artificial barriers. *I-V* curves are presented for tunneling between Ag electrodes with vacuum, gas, liquid, or solid in the barrier. An energy gap is apparent in the measured *I-V* curve when tunneling occurs between superconducting Pb electrodes. (12 refs.)

Measurements of capture cross section of traps in insulating films by photoinjection current decay ....See Entry 108557

Electrical breakdown studies in didymium oxide thin films ... See Entry 108874

73.40S Metal-semiconductor-metal structures

108575 Electrical properties of Pd-CdTe-Pd structures. H.Meczynska, W.Bala (Inst. of Phys., Nicholas Copernicus Univ., Torun, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.2, p.167-76 (Aug. 1983).
The current-voltage, capacitance-voltage and resistivity-voltage characteristics of metal-semiconductor-metal structures are studied. Experimental Pd-CdTe-Pd structures are made of *p*-type CdTe doped with phosphorus. A theoretical treatment of the current transport in the structures based upon the application of the double Schottky diode model is given. Good agreement is obtained between the experimental results and theoretical predictions. (26 refs.)

A study of the electrical characteristics, before electroforming, of thin SiO$_x$ films with laterally-spaced electrodes ....See Entry 108584

73.60 ELECTRONIC PROPERTIES OF THIN FILMS

Phase composition and electrophysical properties of EuS- and Sm-based films ....See Entry 108225

High conductive carbon films obtained by plasma CVD ....See Entry 109164

73.60D Metallic thin films

108576 Surface plasmons studies of oxidized Ba films. J.W.Gibson, R.E.Thomas (US Naval Res. Lab., Washington, DC, USA).
Appl. Surf. Sci. (Netherlands), vol.16, no.1-2, p.163-80 (May-June 1983). (3rd Tri-Service Cathode Workshop, Fort Monmouth, NJ, USA, 23-26 March 1982).
Electron loss spectroscopy studies of both monolayer and thick ($\geq$40 Å) Ba films on W and Ir show that the different states of oxidation of these films can be characterized by the energy of the Ba surface plasmon loss peak. Consistent with other studies of the surface plasmons of alkali metal films, the reduction in energy upon oxidation is interpreted as a removal of free electrons from the surface Ba to localized oxygen bonds. Although the Ba surface plasmon is lost with heavy oxidation, it still exists on both well activated thick oxide and dispenser cathodes, indicating that the surface Ba on these cathodes remains partially metallic. Using free electron theory to estimate the Ba-O charge transfer a semiquantitative evaluation of the Ba-O dipole is made, assuming the Helmholtz equations applies. The results imply that the plane of the surface Ba is $\leq$0.1 Å above the plane of the oxygen on the surface for both dispenser and oxide cathodes. This is contrary to recent interpretations of angle dependent Auger measurements on dispenser cathodes which suggest that Ba lies significantly above the oxygen on these surfaces. In general, it is demonstrated that the surface plasmon technique provides a means of evaluating the surface chemistry of cathodes that is much more surface sensitive than other electron spectroscopy methods commonly used. (23 refs.)

108577 Poly(1,6-heptadiyne), a free-standing polymer film dopable to high electrical conductivity. H.W.Gibson, F.C.Bailey, A.J.Epstein, H.Rommelmann (Webster Res. Center, Xerox Corp., Webster, NY, USA), S.Kaplan, J.Harbour, X.-Q.Yang, D.B.Tanner, J.M.Pochan.
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4417-31 (29 June 1983).
Polymerization of 1,6-heptadiyne on the surfaces of concentrated solutions of homogeneous Ziegler-Natta catalysts leads to insoluble, free-standing films with metallic luster. 'Doping' of these films by treatment with acceptors results in conductivities up to 1 S/cm. The polymer has been characterized in terms of its molecular structure, its solid-state structure and physical properties, the nature of the doping process, and its thermal and oxidative stability. Poly(1,6-heptadiyne) provides a number of contrasts to polyacetylene in its molecular and solid-state structure which yield some information about the requirements for conductive polymers. (50 refs.)

Features of structural changes accompanying the metal-semiconductor phase transition in an oxidized vanadium foil ....See Entry 107908

Nature of group Ib metal films deposited on polymer surfaces photooxidised with far-ultraviolet (185 nm) radiation ....See Entry 108234

On the metallic temperature dependence of the conductivity of doped polyacetylene ....See Entry 108403

A mechanism for 1/*f* noise in metals ....See Entry 108483

73.60F Semiconductor films

108578 Electron-beam-induced current measurements in silicon-on-insulator films prepared by zone-melting recrystallization. E.W.Maby, H.A.Atwater, A.L.Keigler (MIT, Cambridge, MA, USA), N.M.Johnson.
Appl. Phys. Lett. (USA), vol.43, no.5, p.482-4 (1 Sept. 1983).
Enhanced diffusion of arsenic along grain boundaries and subboundaries in zone-recrystallized silicon-on-insulator films has been measured by electron-beam-induced current analysis of lateral *pn* junctions fabricated in the films. A four-hour diffusion at 1100°C resulted in protrusions of arsenic at the junction edges which measured approximately 3-5 μm along the grain boundaries and only 1-2 μm along the subboundaries. The results suggest that under more ordinary thermal processing conditions, field-effect transistors with channel lengths greater than about 1.5 μm can be randomly positioned with respect to the more numerous subboundaries, but grain boundaries should be avoided. (15 refs.)

108579 Properties and ion implantation of $Al_xGa_{1-x}N$ epitaxial single crystal films prepared by low pressure metalorganic chemical vapor deposition. M.R.Kahn, R.A.Skogman, R.G.Schulze (Honeywell Corp. Technol. Center, Bloomington, MN, USA), M.Gershenzon.
Appl. Phys. Lett. (USA), vol.43, no.5, p.492-4 (1 Sept. 1983).
High quality single crystal films of $Al_xGa_{1-x}N$ have been grown on sapphire substrates using low pressure metalorganic chemical vapor deposition at 915°C over the entire range of x. Electrical and optical properties of the layers were measured. Electrical compensation by Be^+ and N^+ implants in the layers was studied. Schottky barriers were fabricated and their current-voltage characteristics were studied. The authors also report some initial results of a study of GaN growth kinetics. (8 refs.)

108580 Epitaxial layers of iron-doped gallium arsenide. N.A.Chernov, N.N.Bakin, M.D.Vilisova.
Inorg. Mater. (USA), vol.18, no.9, p.1237-40 (Sept. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.,* vol.18, no.9, p.1452-5 (Sept. 1982). [received: Sept. 1983]
The results obtained reveal that epitaxial GaAs layers, which were produced in a $Ga\text{-}AsCl_3\text{-}H_2$ system with an Fe+HCl dopant line, have semiconducting properties controlled by the inclusion of iron impurity in the growing layers. When growth of epitaxial gallium arsenide is carried out on a low resistance substrate with simultaneous tin and iron doping a π-ν transition occurs whose parameters are determined by properties of the transition region near the film-substrate boundary. (3 refs.)

108581 A study of the Hall coefficient and electrical conductivity of thin CdHgTe films subjected to laser irradiation. N.N.Vasyuk, A.A.Druzhinin, G.A.Ilchuk, R.V.Lutsiv, P.A.Pavlishin.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1218-20 (Aug. 1983). In Russian.
Temperature dependences of the Hall coefficient and electrical conductivity of $p\text{-}Cd_xHg_{1-x}Te$ $(0.18 \leq x \leq 0.35)$ thin films were experimentally investigated before and after laser treatment. Such dependences in irradiation samples are due to formation of the structure defects produced by short time annealing by laser pulses. (4 refs.)

108582 Electrical characteristics and device applications of zone-melting-recrystallized Si films on SiO_2. B.-Y.Tsaur, J.C.C.Fan, M.W.Geis, R.L.Chapman, S.R.J.Brueck, D.J.Silversmith, R.W.Mountain (Lincoln Lab., MIT, Lexington, MA, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.593-603
Device-quality Si films have been prepared by using graphite-strip heaters for zone melting poly-Si films deposited on SiO_2-coated substrates. The electrical characteristics of these films have been studied by the fabrication and evaluation of thin-film resistors, MOSFETs and MOS capacitors. High yields of functional transistor arrays and ring oscillators with promising speed performance have been obtained for CMOS test circuit chips fabricated in recrystallized Si films on 2-inch-diameter Si wafers. Dual-gate MOSFETs with a three-dimensional structure have been fabricated by using the zone-melting recrystallization technique. (17 refs.)

Adsorption and electrophysical properties of doped gallium arsenide .... See Entry 108165

Some observations on Ge:GaAs(001) and GaAs:Ge(001) interfaces and films .... See Entry 108200

Low compensation vapor phase epitaxial gallium arsenide .... See Entry 108208

High-resistivity ($>10^5$ Ω.cm) InP layers by liquid phase epitaxy .... See Entry 108210

Influence of source composition on the properties of flash-evaporated thin films in the Cu-In-Se system .... See Entry 108212

Mismatch and electron mobility in MBE $Ga_xIn_{1-x}As$ epitaxial layers on InP substrates .... See Entry 108213

Internal stress in evaporated tellurium films .... See Entry 108214

Instabilities of (110) III-V compounds grown by molecular beam epitaxy .... See Entry 108219

The anomalous strain resistor effect in $Bi_{2-x}Sb_xTe_3$ polycrystalline films .... See Entry 108247

Electron mobility of high purity VPE-GaAs and LPE-GaAs .... See Entry 108407

Transport properties of amorphous silicon films on quartz substrate .... See Entry 108409

Dark conductivity in amorphous undoped silicon film .... See Entry 108414

Magnetic conductivity of thin layers of semimetals in ultraquantum magnetic fields .... See Entry 108453

Energy distribution of photoelectrons from epitaxial $Ga_{0.82}In_{0.18}As$ layers .... See Entry 108476

Dielectric and electrical properties of SnO_2, Sb_2O_3, and their mixed films .... See Entry 108870

A study of the luminescent and electrical characteristics of films of ZnS doped with Mn .... See Entry 109018

Optical and electrical properties of laser-synthesized CdTe .... See Entry 109033

A new method for the fabrication of submicron thick gallium arsenide membranes .... See Entry 109145

High-quality ZnSe thin films grown by molecular beam epitaxy .... See Entry 109153

Hydrogenated amorphous silicon produced by laser induced chemical vapor deposition of silane .... See Entry 109158

AsH_3 to $Ga(CH_3)_3$ mole ratio dependence of dominant deep levels in MOCVD GaAs .... See Entry 109160

Transparent conducting tin oxide films for application in heterojunction solar cells .... See Entry 109900

73.60H Insulating thin films

108583 On the a.c. conduction in evaporated SiO films. A.Kondo, K.Shimakawa, Y.Inagaki (Dept. of Electronics, Gifu Univ., Gifu, Japan).
J. Phys. C (GB), vol.16, no.26, p.5211-16 (20 Sept. 1983).
It is now well established that the intrinsic bonding defects in amorphous SiO_2 are normally charged (C_1^- with negative correlation energy and C_3^+ with positive correlation energy) and that they are different from those for amorphous chalcogenides. Intrinsic defects similar to those in amorphous SiO_2 are expected to exist and contribute to a.c. conduction in amorphous SiO films. It is proposed here that the a.c. conduction in evaporated SiO films can be interpreted, using this model based on intrinsic bonding defects, in terms of correlated barrier hopping by single polarons (i.e. one-hole hopping between neutral and negatively charged defects). The expression obtained for the a.c. conductivity agrees with the experimental results. The densities of the defects are estimated from the model, and the results are supported by results from studies using ESR signals. (17 refs.)

108584 A study of the electrical characteristics, before electroforming, of thin SiO_x films with laterally-spaced electrodes. S.A.Y.Al-Ismail, C.A.Hogarth (Dept. of Phys., Brunel Univ., Uxbridge, England).
J. Mater. Sci. (GB), vol.18, no.9, p.2777-84 (Sept. 1983).
The sample structure comprises two laterally-spaced electrodes joined by a thin dielectric film. The electrodes make a blocking contact to the dielectric with a barrier height ~0.75 eV. The voltage-current characteristic is studied between 213 to 413K. Below room temperature the effect of hopping conduction on such contacts is explained. At room temperature and at high fields where hopping conduction is expected to be less effective, the conduction is controlled by the contact. Above room temperature and at low fields localized state conduction (hopping) becomes effective again with activation energy ~0.07 eV and an estimated charge carrier mobility of 1.3×10^{-2} cm^2 V^{-1} sec^{-1}. The density of ionizable impurities is estimated to be in the range 1 to 6×10^{18} cm^{-3} and the density of surface states is of the order of 1×10^{13} cm^{-2}. (15 refs.)

108585 Study of the surface potential decay characteristics in cellulose acetate films. A.Kumar, R.Nath (Dept. of Phys., Univ. of Roorkee, Roorkee, India).
J. Electrostat. (Netherlands), vol.14, no.2, p.201-8 (Aug. 1983).
The surface potential decay characteristics of corona charged cellulose acetate films have been investigated as a function of charging time, initial surface potential, thickness and voltage polarity. Some of these studies have also been performed on iodine doped (2%wt/wt) cellulose acetate films. The carrier mobility has been calculated from these measurements and comes out to be 1.96×10^{-9} cm^2 V^{-1} s^{-1} for pure cellulose acetate films. It has been found that the carrier mobility increases to 6.0×10^{-6} cm^2 V^{-1} s^{-1} by iodination. (18 refs.)

Measurements of capture cross section of traps in insulating films by photoinjection current decay .... See Entry 108557

Dielectric and electrical properties of SnO_2, Sb_2O_3, and their mixed films .... See Entry 108870

73.60K Superconducting films

Effect of some preparation conditions upon properties of sputtered Nb_3Ge films .... See Entry 108588

Fabrication of NbN films by DC bias sputtering and their application to superconducting bridges .... See Entry 108589

Superconducting properties of disordered films of Zn .... See Entry 108592

Superconducting transition temperature in anodized aluminum .... See Entry 108596

Metal-nonmetal transition and superconductivity in frozen tin-hydrogen films .... See Entry 108598

Electrophysical properties of Nb and Nb nitride deposited in a getter magnetron discharge device .... See Entry 108605

Upward curvature of the temperature dependence of upper critical magnetic field perpendicular to superconducting aluminum films .... See Entry 108608

Multilayer thermally cyclable film [PbInAu] .... See Entry 108611

74.00 SUPERCONDUCTIVITY

74.10 OCCURRENCE, CRITICAL TEMPERATURE

108586 A study on the superconductivity of fast quenched Al-Si-Ge alloy. Chen Xi-chen, Guan Wei-yan, Yi Sun-sheng, Wang Zu-lun, Lin Ying (Inst. of Phys., Acad. Sinica, Peking, China).
Acta Phys. Sin. (China), vol.32, no.4, p.446-59 (April 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)* [received: Sept. 1983]
The effect of heat treatment on the microstructure and superconducting properties of the alloy Al-8.3 at.% Si-8.5 at.% Ge prepared by the splat quenching technique has been studied. The results of structure analyses indicate that the rapidly cooled alloy consists of two phases: a supersaturated α-Al (Si, Ge) solid solution (matrix) and amorphous Al-Si-Ge spheres, these spheres connect with each other and form a continuous canal. After annealing at 100°C for 50 h the spheres decrease in size, the continuous canal disappears and some dispersive Si (Ge) granules separate out from the amorphous phase. Two superconducting-normal transitions have been found in the resistance-temperature and resistance-magnetic field curves of the sample after annealing at 100°C for 50 h. These results can be interpreted by the existence of two superconducting phases in this sample. (9 refs.)

108587 The research of superconductivity in the Ti-Pd system. Luo Qi-guang, Jin Duo, Liu Zhi-yi, Ran Qi-ze, Jin Zuo-wen, Ma Ming-rong, Zhao Zhong-xian, Ni Yong-ming (Inst. of Phys., Acad. Sinica, Peking, China).
Acta Phys. Sin. (China), vol.32, no.4, p.534-8 (April 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)* [received: Sept. 1983]
This paper gives the relationship between the superconductive critical temperature and the composition of the alloys in Ti-Pd system, and discusses it in connection with the Ti-Pd phase diagram. It is pointed out that the supercon-

ductivity in the Ti-Pd system is due to the contribution of the titanium-palladium solid solution. It is also suggested that the limit of the palladium solubility in Ti-Pd system should be relatively large. (13 refs.)

108588 Effect of some preparation conditions upon properties of sputtered Nb_3Ge films. M.Jergel (Electrotech. Inst., Czechoslovak Acad. of Sci., Bratislava, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.9, p.1035-43 (1983).
Influence of some parameters of preparation upon properties of Nb_3Ge films has been investigated. The results concerning the influence of substrate temperature, oxygen content and initial amorphous interlayer upon T_c values are shown. The importance of the initial amorphous state is emphasized. (15 refs.)

108589 Fabrication of NbN films by DC bias sputtering and their application to superconducting bridges. T.Goto, P.Anprung (Univ. of Electro-Communications, Tokyo, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.6, p.955-9 (June 1983).
NbN thin films have been prepared by the double cathode DC reactive sputtering method. The effect of the substrate bias and the nitrogen partial pressure on the films' resistivity and superconducting transition temperature were investigated. A high critical temperature of around 16K was obtained for 300 nm films made at about −80 V substrate bias voltage and suitable nitrogen partial pressure. The thickness dependence of the films' critical temperature was determined for film thickness down to 5 nm. NbN variable thickness bridges with length of about 0.2 μm were fabricated and shown to be feasible for use as Josephson devices. Microwave induced steps were observed over the bridges' *I-V* characteristics over rather narrow temperature ranges. (19 refs.)

108590 Superconductivity of gallium nitride. V.S.Kravchenko, M.Z.Graifer, M.A.Starikov, A.G.Klimenko (Inst. of Inorganic Chem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1105-8 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1308-11 (Aug. 1982).
Magnetic measurements, X-ray diffraction analysis, and electron microscopy indicates that the previously discovered superconductivity of gallium nitride synthesised at high temperatures is due to the presence of finely dispersed metallic gallium inclusions. Dispersed gallium in samples of the Ga-GaN system was found to exhibit up to three superconducting transitions (6.2, 7.3, and 7.7K) corresponding to its metastable modifications. Pure gallium nitride at normal pressure showed no superconductivity down to 1.5K. (21 refs.)

108591 Coexistence of antiferromagnetism and superconductivity in CrRe alloys. Y.Nishihara, Y.Yamaguchi, S.Waki, T.Kohara (Electrotech. Lab., Ibaraki, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2301-3 (July 1983).
Magnetic susceptibility, electrical resistivity and nuclear magnetic resonance measurements strongly suggest that itinerant-electron antiferromagnetism and superconductivity coexist in non-annealed (strained) BCC CrRe alloys with Re concentration of more than 17%. The Neel temperature is ~160K and the superconducting transition temperature is typically ~3K. (7 refs.)

108592 Superconducting properties of disordered films of Zn. S.Okuma, F.Komori, Y.Ootuka, S.Kobayashi (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2639-41 (Aug. 1983).
The superconducting transition temperature T_c and the critical magnetic field H_c of thin Zn films were measured. T_c decreases almost linearly as the normal-state sheet resistivity increases. $H_c(T)$ is enhanced compared with the conventional value for dirty superconductors. These results are explained by the localization and electron-electron interaction theories for two-dimensional disordered superconductors. (5 refs.)

108593 Ferromagnetism and superconductivity down to 0K in b.c.t. $ErRh_4B_4$. J.L.Genicon, A.Sulpice, R.Tournier (Centre de Recherches sur Les Tres Basses Temperatures, CNRS, Grenoble, France), B.Chevalier, J.Etourneau.
J. Phys. Lett. (France), vol.44, no.17, p.L725-32 (1 Sept. 1983).
The authors have prepared $ErRh_4B_4$ compounds with the body centred tetragonal structure (b.c.t.) of $LuRu_4B_4$ type using carbon doping. The superconductivity exists from 7.5K down to 0K. The simultaneous presence of ferromagnetism is shown by a jump in the thermal variation of the frozen flux obtained after decreasing the magnetic field from above H_{c2} and by the rectangular shape of the magnetization hysteresis. These effects give some new investigative tools for finding new ferromagnetic superconductors. (16 refs.)

108594 Phase transitions in compounds of rare-earth metals. A.V.Vedyaev, M.A.Savchenko, L.V.Panina (Dept. of Magnetism, Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.5, p.23-8 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.5, p.22-7 (1982).
The structure of the heterogeneous superconducting state is investigated on the basis of the Yang-Mills gauge-field theory. Taking magnetic fluctuations into account leads to an eddy structure different from the structure in usual superconductors of the second type. The flux quantum of this eddy is calculated. In the system, phase transitions from one heterogeneous superconducting state to another are possible; these are found to be phase transitions of the first type, close to the second type. (9 refs.)

108595 Superconductivity and magnetism in ternary rare-earth compounds. H.A.Mook, O.A.Pringle (Oak Ridge Nat. Lab., Oak Ridge, TN, USA), S.Kawarazaki, S.K.Sinha, G.W.Crabtree, D.G.Hinks, M.B.Maple, Z.Fisk, D.C.Johnston, L.D.Woolf, H.C.Hamaker.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.197-201 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Superconductivity and magnetism are two types of order that can take place in materials at low temperatures. When the magnetic order is ferromagnetic a competition exists between magnetism and superconductivity. Neutron scattering has been used to measure the interaction of magnetism and superconductivity in a series of ternary rare-earth alloys. A wide range of behavior is found near the magnetic transition including mean-field magnetic ordering, first-order transitions between magnetism and superconductivity, and coexistence of ferromagnetism and superconductivity with a sinusoidally-modulated magnetic phase. (15 refs.)

108596 Superconducting transition temperature in anodized aluminum. C.Leemann, J.H.Elliott, G.Deutscher, R.Orbach (Dept. of Phys., Univ. of California, Los Angeles, CA, USA), S.A.Wolf.
Phys. Rev. B (USA), vol.28, no.3, p.1644-5 (1 Aug. 1983).
The authors have measured the superconducting transition temperature of anodized aluminum films of grain sizes ranging from less than 100 to 3000 Å. The transition temperature is 1.8K for films of grain size 100 Å and decreases monotonically with increasing grain size to 1.2K for 3000-Å grains. The effect depends only on the volume of the grains. (7 refs.)

108597 Transition temperature in sodium tungsten bronzes. R.Salchow, R.Liebmann, J.Appel (I Inst. Theoretische Phys., Univ. Hamburg, Hamburg, Germany).
Solid State Commun. (USA), vol.47, no.9, p.727-9 (Sept. 1983).
The superconduction transition temperature $T_c(x)$ in the tetragonal I-phase of sodium tungsten bronzes, Na_xWO_3, is explained in terms of the x-dependence of a simple model dielectric-constant. (7 refs.)

108598 Metal-nonmetal transition and superconductivity in frozen tin-hydrogen films. R.Ludwig, H.Micklitz (Inst. fur Experimentalphys. IV, Ruhr-Univ. Bochum, Bochum, Germany).
Solid State Commun. (USA), vol.47, no.10, p.851-4 (Sept. 1983).
The authors have studied the DC-conductivity σ and the superconducting transition temperature T_c frozen mixtures of Sn and molecular H_2 (Sn-H_2) or atomic H(Sn-H). The samples were prepared by co-deposition of Sn and H_2 (H) onto a sapphire substrate held at temperature of about 5K. Both systems show quite different behaviour. While the Sn-H_2 system exhibits a metal-insulator transition at $c(H_2)=0.6$ which agrees well with percolation theory, the Sn-H samples show a metal-semiconductor transition already at $c_H \simeq 0.32$. Both systems have an increased T_c in the metallic region. H_2 seems to be mobile in Sn-H_2 films even down to 5K after annealing of the samples at 10K. Atomic H, on the other hand, is bound up to $T \simeq 200K$. (16 refs.)

Structure and electrical properties of new ternary silicides YIr_2Si_2 and $LaIr_2Si_2$ .... See Entry 107612

The impurity effect on the phase transitions in quasi-one-dimensional conductors .... See Entry 108398

The appearance of the many-body resonance at the Fermi level in Kondo-lattices .... See Entry 108405

Investigation of the magnetic and superconducting properties of $(Er_{1-x}Ho_x)Rh_4B_4$ .... See Entry 108689

Local and itinerant magnetism and superconductivity in R Rh_2Si_2 (R=rare earth) .... See Entry 108691

Dilemma of $EuMo_6X_8$ (X=S,Se) and possible solution of resistance anomaly [ESR study] .... See Entry 108778

The effect of superconducting transition on slipping and twinning in indium and its alloys .... See Entry 109394

74.20 THEORY

108599 Remarks on the stability conditions in a superconducting system. R.Gonczarek (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.2, p.225-37 (Aug. 1983).
The universal properties of the autocorrelation functions are given and discussed with respect to the stability of the system. It has been checked that the obtained conditions are always fulfilled by density, transverse current and spin density autocorrelation functions of the superfluid systems. (14 refs.)

108600 Numerical analysis for nonlinear equation of evolution in nonequilibrium systems—diffusive instability of quasiparticles and their time evolution in nonequilibrium superconductors. F.Takayama, H.Akoh, K.Kajimura (Electrotech. Lab., Ibaraki, Japan).
Bull. Electrotech. Lab. (Japan), vol.47, no.4, p.225-49 (1983). In Japanese.
Inhomogeneous states in a one-dimensional nonequilibrium superconductor have been studied by numerical analysis for the modified Rothwarf-Taylor equation combined with a phenomenological μ^* model. In order to analyze the time evolution of equation under a one-dimensional periodic boundary condition, suitable difference schemes for calculation time, accuracy, and stability are proposed. Using these schemes of the equations, two analyses are carried out for lead as a physical material. The first analysis involves the solution of time evolution of equation for various injection levels of quasiparticles in the superconductor. The results show that an initial cosine perturbation with unstable wave numbers for which an eigenvalue is a positive maximum in a linear stability analysis, evolves with time, resulting in the inhomogeneous steady state. On the other hand, an initial state with stable wave numbers for which an eigenvalue is a negative maximum, decays and converges to the characteristic solution of equation. (30 refs.)

108601 Phonon dynamics in superconductors. Y.Kurihara (Inst. de Fisica 'Gleb Wataghin', Univ. Estadual de Campinas, Campinas, Brazil).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2499-503 (July 1983).
A theory of phonon dynamics of superconductors is presented on the basis of a Hamiltonian which includes the bare Coulomb interaction term and the bare ion frequency term. A diagram method which corresponds to the random phase approximation is adopted. This theory can provide a basis for discussions of anomalies of the phonon structure. In connection with anomalous aspects of phonon dynamics there exist several works in which anomalies directly reflect the singular behavior of the proper polarization function of the density fluctuation in the superconducting case. These works are criticized through the present theory. (14 refs.)

108602 Microscopic two-fluid model in superconductivity theory. V.I.Yaroslavtsev (Dept. of Quantum Statistics & Field Theory, Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.5, p.63-7 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.5, p.56-60 (1982).
On the basis of an approach associated with the concept of Bogolyubov quasimeans, a model is proposed allowing the coexistence of normal and superconducting components in superconductors at subcritical temperatures to be described. The corresponding phase concentrations are determined in a self-consistent manner as a function of the temperature and the parameters of the interaction. In the approximation of strong-pairing and constant four-fermion interaction, expressions are obtained for the phase concentrations and order parameter. The difference from the standard BKSh theory is considered. (20 refs.)

108603 Anderson localization and energy gap in two-dimensional superconductors. H.Takagi, Y.Kuroda (Dept. of Phys., Nagoya Univ., Nagoya, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1677-85 (June 1983).
Effects of the Anderson localization on energy gap Δ in two-dimensional dirty superconductors are investigated theoretically. It is shown that Δ is suppressed by the interplay of the Coulomb repulsive interaction and impurity scattering. However, as long as the impurity scattering is weak, it is proved definitely that Δ remains finite at any temperature below the transition temperature, that is, the superconductivity is always stable against the Anderson localization. (10 refs.)

108604 Nonequilibrium superconductor. I.Iguchi.
Solid State Phys. (Japan), vol.18, no.5, p.245-54 (May 1983). In Japanese.
Nonequilibrium superconductivity induced by tunnel injection of quasiparticles is reviewed. Discussions are specially focused on problems of inhomogeneous gap states and branch imbalance. (44 refs.)

Speculation on a scaling law for superconductor-resistor mixture exponent *s* in a percolation system ....See Entry 108373

Charge imbalance due to thermoelectric effects in superconductors: A two fluid description ....See Entry 108606

74.30 GENERAL PROPERTIES

108605 Electrophysical properties of Nb and Nb nitride deposited in a getter magnetron discharge device. V.L.Noskov, I.V.Sereda, I.D.Voitovich, V.A.Komashko.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.1, p.54-7 (1982). In Russian.
The electrophysical properties of superconducting films of Nb and Nb nitride deposited with a flat cathode mounted in a vacuum chamber are studied by means of volt-ampere characteristics. With increase in magnetic induction the volt-ampere characteristic becomes steeper and is displaced into the low voltage region. Over the voltage range 400-800 V it shows linear sections. Above 800 V there is a tendency to saturation. An increase in induction of more than 0.1 T does not affect the volt-amp characteristic significantly, but results in focusing of the electrons in the substrate region. Films of Nb are obtained at $P_{ar}=0.04$ Pa and films of Nb nitride in a mixture of nitrogen and argon $P_{ar}/P_{N(2)}\approx 3$ at a total pressure of 1 Pa. (10 refs.) *N.F.S.*

74.30C Magnetization curves, Meissner effect, penetration depth

On the reduced diamagnetism in 2D superconductors by vortex-antivortex pair condensation ....See Entry 108618

74.30E Thermodynamic properties; thermal conductivity

108606 Charge imbalance due to thermoelectric effects in superconductors: A two fluid description. B.A.Mattoo, Y.Singh (Dept. of Phys., Univ. of Kashmir, Srinagar, India).
Pramana (India), vol.20, no.5, p.392-403 (May 1983).
Using a generalised two-fluid picture for the charge of a superconductor, the generation of charge imbalance by a temperature gradient under different conditions is studied. The voltage developed by a temperature gradient in the presence of supercurrent is estimated. The results agree with experiment. The results obtained for the generation of charge imbalance in the absence of imposed current agree with those obtained using other techniques. (18 refs.)

74.30G Response to electromagnetic fields, nuclear magnetic resonance, ultrasonic attenuation

108607 Superconducting contours for compensating inhomogeneities and instabilities of magnetic fields. V.I.Kurochkin, V.V.Sukhoi.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.5, p.59-62 (1983). In Ukrainian.
A technique is described for compensation of the magnetic field inhomogeneity and instability. Compensation is performed by closed superconducting loops of definite geometry. Equations for determining loop winding geometry are formulated and solved. (7 refs.)

Coexistence of antiferromagnetism and superconductivity in CrRe alloys ....See Entry 108591

74.40 FLUCTUATIONS AND CRITICAL EFFECTS

108608 Upward curvature of the temperature dependence of upper critical magnetic field perpendicular to superconducting aluminum films. B.Shinozaki, T.Kawaguti, Y.Fujimori (Coll. of General Education, Kyushu Univ., Fukuoka, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2297-300 (July 1983).
The temperature dependence of the electrical resistance of thin granular aluminum films shows the maximum far above the superconducting transition temperature due to both effects of thermodynamic fluctuations and electron localization, for the film with large normal-state sheet resistance R^N. The temperature dependence of the upper critical field of the film with $R^N\simeq 10^3$ $(\Omega/\square)$ shows an upward curvature. The results on the upper critical field are explained by a current theory of dirty superconductors including electron localization and electron-electron interactions.

Phase transitions in compounds of rare-earth metals ....See Entry 108594

74.50 PROXIMITY EFFECTS, TUNNELLING PHENOMENA, AND JOSEPHSON EFFECT

108609 Al-coated variable thickness Pb microbridge. M.Kobayashi, T.Musha (Dept. of Appl. Electronics, Tokyo Inst. of Technol. Nagatsuta, Yokohama, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.6, p.L361-3 (June 1983).
To make a thin-film Pb microbridge durable against heat cycles, the authors coated thin Al film over a variable thickness Pb microbridge. It showed no detectable change in its electrical properties, critical current or normal resistance after 20 heat cycles and preservation for 250 hours in a humid environment. (3 refs.)

108610 Bistability in a DC voltage biased Josephson junction. R.Bonifacio, P.Morra (Istituto di Sci. Fisiche, Univ. di Milano, Milano, Italy).
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.1089-96 (July-Aug. 1983).
Using a well-known theoretical model for a Josephson junction coupled to its own radiation field and to a DC potential, the authors demonstrate that the potential across the junction, the frequency and the intensity of the radiated field may show a discontinuous behaviour with a first-order-like phase transition hysteresis cycle as a function of the applied potential. (7 refs.)

108611 Multilayer thermally cyclable film [PbInAu]. E.I.Alessandri, J.H.Magerlein, M.Murakami (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.2, p.493-4 (July 1983).
Films prepared by depositing ten layers in a sequence lead-gold-indium...gold-indium-lead have smooth surfaces and resist the destructive effects of repeated thermal cycling between room temperature and liquid helium temperature. This film has application to Josephson junction devices as a counter electrode. (no refs.)

108612 Repulsive interaction between unipolar fluxons with Ohmic loss and bias current in infinitely long Josephson junction. K.Watanabe, C.Ishii (Dept. of Phys., Sci. Univ. of Tokyo, Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2304-7 (July 1983).
The effect of perturbations (constant bias current and Ohmic resistivity) on the motion of two fluxons with identical polarity is investigated by calculating the time evolution of soliton parameters which appear in the two-fluxon solution of the unperturbed sine-Gordon equation. It is demonstrated that a repulsive force significantly affects the short time behavior of the soliton parameters, and gives rise to a characteristic overshoot structure in this time region. It is also shown that the long time behavior of soliton parameters is dominated by the external perturbations and the relative velocity of the two fluxon peaks tends to zero in this limit. (14 refs.)

108613 Magnetic field behavior of a Josephson-junction array: two-dimensional flux transport on a periodic substrate. R.A.Webb, R.F.Voss, G.Grinstein, P.M.Horn (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Phys. Rev. Lett. (USA), vol.51, no.8, p.690-3 (22 Aug. 1983).
This Letter reports measurements down to 3 mK of the magnetic field dependence of the resistance and critical current of a weakly coupled periodic array of Josephson junctions. Below 700 mK the resistance is an oscillatory function of field. The temperature dependence of the resistance for integral numbers of flux quanta per cell suggests the existence of a Kosterlitz-Thouless transition involving the unbinding of defects in the flux lattice. (17 refs.)

108614 Fluxon propagation on a Josephson transmission line. A.Matsuda, T.Kawakami (Musashino Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Tokyo, Japan).
Phys. Rev. Lett. (USA), vol.51, no.8, p.694-7 (22 Aug. 1983).
Fluxon propagation profiles for Josephson transmission lines have been directly measured. Single-input-pulse dissociation into multifluxon as well as velocity-dependent wave forms have actually been observed. The experimental results agree well with the theoretical results if a large RF loss term is assumed. (11 refs.)

108615 On the conditional transition probabilities of the magnetic flux at low temperatures in a superconducting loop closed with a low-capacitance superconducting point contact. D.W.Bol, R.van Weelderen, R.de Bruyn Ouboter (Kamerlingh Onnes Lab., Rijksuniv. Leiden, Leiden, Netherlands).
Physica B & C (Netherlands), vol.122B+C, no.1, p.1-7 (Sept. 1983).
The conditional transition probabilities of the magnetic flux in a superconducting ring containing a weak link have been determined experimentally. The authors investigated the behaviour of the embraced magnetic flux as a function of the external magnetic field and time in situations in which the system could jump from a metastable flux state into another flux state and vice versa by classical thermal fluctuations over, or by quantum mechanical tunnelling through a potential barrier separating both flux states, depending on the temperature. For these low capacitance point contacts it was shown that stochastic, macroscopic quantum tunnelling could become dominant at lower temperatures. In order to investigate macroscopic quantum tunnelling in more detail they measured the conditional transition probabilities as a function of time for the devices and found an exponential phase incoherent behaviour, indicating that the phase relationship between the amplitudes for being on the different sides of the barrier can be neglected.

108616 Tunneling spectroscopic study on the superconductivity of $(TMTSF)_2ClO_4$ crystals. Y.Maruyama, R.Hirose, G.Saito, H.Inokuchi (Dept. of Chem., Ochanomizu Univ., Tokyo, Japan).
Solid State Commun. (USA), vol.47, no.4, p.273-4 (July 1983).
The authors observed the energy gap spectra for $(TMTSF)_2ClO_4$-Al_2O_3-Au junctions at 1.5K by measuring their tunneling current characteristics. The superconducting gap was estimated to be less than 2 meV ($T_c<6$K) which is much smaller than the previously reported value, 8 meV. (4 refs.)

Microfabrication as a scientific tool ....See Entry 105316

Squeezable electron tunneling junctions ....See Entry 108574

Fabrication of NbN films by DC bias sputtering and their application to superconducting bridges ....See Entry 108589

Nonequilibrium superconductor ....See Entry 108604

74.55 TYPE-I SUPERCONDUCTIVITY

Superconducting transition temperature in anodized aluminum ....See Entry 108596

Upward curvature of the temperature dependence of upper critical magnetic field perpendicular to superconducting aluminum films ....See Entry 108608

74.60 TYPE-II SUPERCONDUCTIVITY

74.60E Mixed state, H_{c2}, surface sheath

108617 Paraconductivity of V_3Ge in magnetic field. V.A.Marchenko, A.V.Nikulov.
Fiz. Nizk. Temp. (USSR), vol.9, no.8, p.816-22 (Aug. 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
An excess electrical conductivity as a function of magnetic field and temperature in V_3Ge has been investigated in the vicinity of and above the upper critical field. The measurements above are compared with the Ami-Maki theory (1978) and that derived in the Hartree approximation. The sharp deviation of the experimental dependence from the theoretical one in high magnetic fields is considered to be due to the transition from a one-dimension state to a mixed one. (13 refs.)

Superconducting properties of disordered films of Zn ....See Entry 108592

Ferromagnetism and superconductivity down to 0K in b.c.t. $ErRh_4B_4$ ....See Entry 108593

74.60G Flux pinning; fluxon-defect interactions

108618 On the reduced diamagnetism in 2D superconductors by vortex-antivortex pair condensation. G.Giaquinta, C.Di Mauro (Istituto di Fisica, Facolta di Sci., Univ. di Catania, Catania, Italy).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.15, p.533-8 (13 Aug. 1983).
The topological excitations, or vortex-antivortex pair condensation, in 2D superconductors are studied. The renormalised critical field is calculated, and compared with experimental data for dirty superconductors. (20 refs.)

Repulsive interaction between unipolar fluxons with Ohmic loss and bias current in infinitely long Josephson junction ....See Entry 108612

Critical current studies of Zr-based metallic glasses ....See Entry 108620

74.60J Critical currents

108619 Critical current anisotropy and peak effect mechanism in strained Nb-Mo alloy. L.Ya.Vinnikov, L.V.Ermolova.
Fiz. Nizk. Temp. (USSR), vol.9, no.8, p.804-15 (Aug. 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The critical currents in a single crystal of Nb-5.5% Mo alloy deformed at the temperature 77K were investigated. A critical current peak near the critical field was observed on the curves $J_c(H)$. The value of the magnetic field at a maximum current and the value of the maximum critical current varied under varying of the angle between the vortex and directions of screw dislocation clusters ⟨111⟩. Experimental results were compared with the microscopic theory of the peak effect proposed by Larkin and Ovchinnikov (1979). (19 refs.)

108620 Critical current studies of Zr-based metallic glasses. M.Tenhover (Standard Oil Co., Dept. of Res., Warrensville Heights, OH, USA), B.M.Clemens.
J. Phys. D (GB), vol.16, no.9, p.1761-5 (14 Sept. 1983).
Critical current and flux pinning measurements of a variety of Zr-based metallic glasses are reported. The measurements were performed as a function of temperature and applied magnetic field on as-quenched samples. A universal behaviour of the critical current density of flux pinning force density is observed for glasses of the form $Zr_{70}X_{30}$(X=Cu, Ni, Co and $Ni_{0.5}Fe_{0.5}$). This result is attributed to pinning due to quenched-in stress fields and edge pinning. (15 refs.)

Magnetic field behavior of a Josephson-junction array: two-dimensional flux transport on a periodic substrate ....See Entry 108613

A tensile test apparatus for measurement of strain effect in high current compound superconductors ....See Entry 109610

74.70 SUPERCONDUCTING MATERIALS

74.70D Material effects on T_c, K, critical currents

(see also 81.40R Electrical properties related to materials treatment)

Effect of some preparation conditions upon properties of sputtered Nb_3Ge films ....See Entry 108588

Critical current anisotropy and peak effect mechanism in strained Nb-Mo alloy ....See Entry 108619

74.70G Type-I superconductors (non transition metals)

Superconducting properties of disordered films of Zn ....See Entry 108592

Superconducting transition temperature in anodized aluminum ....See Entry 108596

Upward curvature of the temperature dependence of upper critical magnetic field perpendicular to superconducting aluminum films ....See Entry 108608

Multilayer thermally cyclable film [PbInAu] ....See Entry 108611

The effect of superconducting transition on slipping and twinning in indium and its alloys ....See Entry 109394

74.70L Type-II superconductors (transition metals, alloys and compounds)

The appearance of the many-body resonance at the Fermi level in Kondo-lattices ....See Entry 108405

A study on the superconductivity of fast quenched Al-Si-Ge alloy ....See Entry 108586

The research of superconductivity in the Ti-Pd system ....See Entry 108587

Effect of some preparation conditions upon properties of sputtered Nb_3Ge films ....See Entry 108588

Fabrication of NbN films by DC bias sputtering and their application to superconducting bridges ....See Entry 108589

Superconductivity of gallium nitride ....See Entry 108590

Coexistence of antiferromagnetism and superconductivity in CrRe alloys ....See Entry 108591

Ferromagnetism and superconductivity down to 0K in b.c.t. $ErRh_4B_4$ ....See Entry 108593

Phase transitions in compounds of rare-earth metals ....See Entry 108594

Superconductivity and magnetism in ternary rare-earth compounds ....See Entry 108595

Transition temperature in sodium tungsten bronzes ....See Entry 108597

Paraconductivity of V_3Ge in magnetic field ....See Entry 108617

Critical current anisotropy and peak effect mechanism in strained Nb-Mo alloy ....See Entry 108619

Critical current studies of Zr-based metallic glasses ....See Entry 108620

Investigation of the magnetic and superconducting properties of $(Er_{1-x}Ho_x)Rh_4B_4$ ....See Entry 108689

Local and itinerant magnetism and superconductivity in R Rh_2Si_2 (R=rare earth) ....See Entry 108691

Dilemma of $EuMo_6X_8$ (X=S,Se) and possible solution of resistance anomaly [ESR study] ....See Entry 108778

NMR study of $GdRh_4B_4$ and $SmRh_4B_4$ ....See Entry 108815

Composition and temperature dependence of the density of states at the Fermi level in vanadium-based A-15 compound systems [NMR study] ....See Entry 108826

The Nb-Ga-Cu phase diagram (superconducting compounds) ..See Entry 109231

Structure and properties of rapidly cooled (superconductive) Pb-Bi alloys ....See Entry 109232

Effect of disorder on the martensitic phase transformation in Nb_3Sn ....See Entry 109289

A tensile test apparatus for measurement of strain effect in high current compound superconductors ....See Entry 109610

74.70N Dirty superconductors

Superconducting properties of disordered films of Zn ....See Entry 108592

Anderson localization and energy gap in two-dimensional superconductors ....See Entry 108603

Upward curvature of the temperature dependence of upper critical magnetic field perpendicular to superconducting aluminum films ....See Entry 108608

On the reduced diamagnetism in 2D superconductors by vortex-antivortex pair condensation ....See Entry 108618

74.90 OTHER TOPICS IN SUPERCONDUCTIVITY

108621 Direct observation of Andreev reflection. P.A.M.Benistant, H.van Kempen, P.Wyder (Res. Inst. for Materials, Univ. of Nijmegen, Nijmegen, Netherlands).
Phys. Rev. Lett. (USA), vol.51, no.9, p.817-20 (29 Aug. 1983).
An experiment is presented which allows the direct observation of the reflection of conduction electrons in a normal metal at a normal-metal-superconductor interface (Andreev reflection). The experimental findings are in agreement with a change of the quasi-particle-excitation branch on reflection (electron-hole transition). The Andreev-reflection probability can be estimated from the experimental results. (12 refs.)

75.00 MAGNETIC PROPERTIES AND MATERIALS

(see also 81.40R Magnetic properties related to materials treatment; for galvanomagnetic effects, see 72.15G and 72.20M; for magneto-optical effects, see 78.20L)

Yamada Conference VI on Neutron Scattering in Condensed Matter ....See Entry 105020

75.10 GENERAL THEORY AND MODELS OF MAGNETIC ORDERING

(see also 05.50 Ising problems, 71.25 Nonlocalized single-particle electronic states, 71.70 Level splitting and interactions)

75.10D Crystal-field theory and spin Hamiltonians

108622 Method of the spin Hamiltonian diagonalization. V.L.Safonov (Kurchatov Inst. of Atomic Energy, Moscow, USSR).
Phys. Lett. A (Netherlands), vol.97A, no.4, p.164-7 (22 Aug. 1983).
A nonlinear unitary transformation is proposed which permits one to remove nondiagonal terms in the spin Hamiltonian. The diagonalization procedure is based on solution of linear differential equations with bonds. This method allows one to simplify the theoretical description of spin systems both in magneto-ordered and in paramagnetic states. It may be also employed for Bose and Fermi operators. (6 refs.)

108623 Integrable reductions of many component magnetic systems in (1,1) dimensions. V.G.Makhankov, O.K.Pashaev (Joint Inst. for Nuclear Res., LCTA, Dubna, USSR), A.Kundu.
Phys. Scr. (Sweden), vol.28, no.2, p.229-34 (Aug. 1983).
A generalized many component Heisenberg spin chain with phonon interaction is proposed. Some reductions of the proposed model leading to different real magnetic systems such as many chained magnetic crystals with nontrivial interchain couplings, a mixture of many chained ferro and antiferromagnets, a 'colour' generalized Pierels-Hubbard model, etc. are studied. It has been shown that the dynamics of all the above real models are close to some integrable systems and coincide with them in certain limits. Such integrable systems are the coupled generalised system of Yajima and Oikawa and $U(p,q)$ nonlinear Schrodinger equation, already well studied. (17 refs.)

75.10H Ising and other classical spin models

108624 Susceptibility of a quasi-one-dimensional magnet with the Ising interaction. M.A.Yurishchev.
Fiz. Nizk. Temp. (USSR), vol.9, no.8, p.851-7 (Aug. 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
A three-dimensional Ising model with the strong spatial anisotropy of the interaction is approximated by the ensemble of independent four-chain clusters for which an analytical formula of the parallel susceptibility has been derived. Along with the known expression for the perpendicular susceptibility of the linear Ising chain, the derived formula is used to describe the powder susceptibility of $CoCl_2.2NC_5H_5$. (11 refs.)

108625 A special-purpose processor for the Monte Carlo simulation of Ising spin systems. A.Hoogland, J.Spaa, B.Selman, A.Compagner (Lab. of Appl. Phys., Univ. of Technol., Delft, Netherlands).
J. Comput. Phys. (USA), vol.51, no.2, p.250-60 (Aug. 1983).
A description is given of a special-purpose computer for the study of static and dynamic properties of stochastic Ising-like systems of up to 4×10^6 spins. Elementary Monte Carlo steps are executed in the machine at a rate of 1.5 MHz. The first results are given, obtained as part of a testing procedure of the machine. (14 refs.)

108626 The gap exponent Δ for the spin-*s* Ising model on the FCC lattice. S.McKenzie (Dept. of Phys., King's Coll. London, London, England).
J. Phys. A (GB), vol.16, no.13, p.3133-8 (11 Sept. 1983).
High-temperature series expansions are presented for the magnetisation $M(K,h)$ of the spin-s Ising model on the face-centred cubic lattice. Series coefficients are derived to order 13 and 5 respectively in the variables $K=J/kT$ and $h=mH/kT$, for ${}^1/_2\leq s\leq{}^9/_2$. The data are analysed for $2\Delta-\gamma$, where Δ and γ denote the gap exponent and the susceptibility exponent respectively. The estimate $2\Delta-\gamma=1.890\pm0.003$ satisfies the data for all s. (13 refs.)

108627 Decorated Ising model with classical vector spins. T.Horiguchi (Dept. of Engng. Sci., Tohoku Univ., Sendai, Japan), L.L.Goncalves.
Physica A (Netherlands), vol.120A, no.1-2, p.600-8 (1983).
A decorated Ising model with classical vector spins on a square lattice is investigated in detail. The partition function is reduced to the one of the Ising model with effective exchange integrals. Three successive phase-transition

temperatures are obtained and four states, namely paramagnetic, antiferromagnetic, again paramagnetic and ferromagnetic states are realized as the temperature is decreased. For systems on other two- and three-dimensional loose-packed lattices, the situation is the same as the system on the square lattice. (15 refs.)

108628 The diluted spin 1/2 Ising model in the honeycomb lattice. P.R.Silva, F.C.Sabarreto (Dept. de Fisica, Univ. Federal de Minas Gerais, Belo Horizonte, Brazil).
Phys. Status Solidi b (Germany), vol.118, no.2, p.K93-7 (1 Aug. 1983).
In the case of the spin 1/2 diluted Ising model in the honeycomb lattice (the quenched diluted bond problem), the authors devised the possibility of combining the differential operator method applied to Callen's (1963) exact relation, jointly with the exact result for the spontaneous magnetization, in order to get the diluted spontaneous magnetization expression and the critical frontier which separates the ferromagnetic and the paramagnetic phases. (15 refs.)

Modulated structure of an Ising spin system on a triangular lattice. II. Complete devil's staircase ....See Entry 105255

A fast processor for Monte-Carlo simulation ....See Entry 105256

Hierarchical lattices: some examples with a comparison of intrinsic dimension and connectivity and Ising model exponents ....See Entry 105261

Site-bond disorder in the Ising model ....See Entry 105268

Spin-Peierls state vs. Neel state. I. Small Ising anisotropy ....See Entry 108629

A continued fraction expansion of thermodynamic quantities using high-temperature expansions ....See Entry 108715

Monte Carlo study of a triangular Ising lattice. II. Occurrence of the Kosterlitz-Thouless-like phase transition ....See Entry 108717

An approximate method for the free energy ....See Entry 108718

75.10J Heisenberg and other quantized localized spin models

108629 Spin-Peierls state vs. Neel state. I. Small Ising anisotropy. S.Inagaki, H.Fukuyama (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2504-13 (July 1983).
The ground state of the one-dimensional antiferromagnetic Heisenberg-Ising model coupled with the lattice distortion is determined based on the phase Hamiltonian defined by the boson representation of the spinless fermions. This phase Hamiltonian can describe properly the possible feature of the resonating valence bond proposed by Anderson. All the possible states, including the spin-Peierls state, the Neel state, and states with both lattice distortions and magnetic orderings, are examined within the self-consistent harmonic approximation by use of the treatment of Nakano and Fukuyama (1980, 1981) which extends the theory of spin-Peierls state of Cross and Fisher (1979). The phase boundary for small Ising anisotropy is determined which separates the spin-Peierls state and the Neel state, and it is found that the former state is stable in a wide region of parameters. (39 refs.)

108630 Competing interactions in Heisenberg quantum spin systems: ground-state calculations for finite clusters. J.Richter (Wissenschaftsbereich Phys., Hochschule fur Verkehrswesen Dresden, Dresden, Germany).
J. Phys. C (GB), vol.16, no.25, p.L913-18 (10 Sept. 1983).
Ground-state properties of spin $^1/_2$ Heisenberg systems are calculated for finite clusters up to nine spins. By a comparison of systems with different degrees of competition in the interactions, the frustration effects in the spin configuration of the ground state are investigated. A minimum value for the strength of the spin correlation $|<S_i.S_j>_0|$ of antiferromagnetically interacting spins i and j in systems without competition is estimated to be 0.25. The occurrence of values for $|<S_i.S_j<_0|$ lower than this minimum value indicates frustration. By varying the degreee of competition, abrupt changes in the ground state are found. Furthermore the competition for certain systems causes ground states with much lower symmetry than that of the Hamiltonian. (25 refs.)

108631 Perturbation of solitons in the classical continuum isotropic Heisenberg spin system. M.Daniel, M.Lakshmanan (Dept. of Phys., Bharathidasan Univ., Tamilnadu, India).
Physica A (Netherlands), vol.120A, no.1-2, p.125-52 (1983).
The dynamics of a one-dimensional classical continuum isotropic Heisenberg ferromagnetic spin system in the presence of a weak relativistic interaction, which causes damping of the spin motion, is considered. The corresponding evolution equation is identified with a damped nonlinear Schrodinger equation in terms of the energy and current densities of the unperturbed system. A direct perturbation method, along the lines of Kodama and Ablowitz, is developed for the envelope soliton solution of the nonlinear Schrodinger equation and the explicit perturbed solution obtained. This solution is found to be valid in a finite domain of the propagation space. To cover the entire region, a uniform solution is constructed using the matched asymptotic expansion technique. Finally, the spin vectors are constructed using the known procedures in differential geometry and the consequences of damping analysed briefly. (34 refs.)

Dipolar interactions in the critical dynamics of Heisenberg ferromagnets ....See Entry 108722

75.10L Band and itinerant models

108632 Theory of two-band ferromagnetism. I.T.Akhiezer (Sci. Res. Inst. of Radiophys. & Electronics, Acad. of Sci., Kharkov, Ukranian SSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.9-13 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Ferromagnetic metals are considered in a two-band model with a self-consistent field on the assumption that the conduction band is broad and the band of the inner d- or f-electrons is inifinitesimally narrow. A study is made of a nonexcited state and of the static magnetic susceptibility throughout the full range of temperatures between absolute zero and the Curie point T_c. A criterion for the appearance of ferromagnetism in this model is derived. Certain relationships are established between the observable quantities (Curie point, magnetization at $T=0$, and magnetic susceptibility). (10 refs.) *A.T.*

108633 Three body problem in transition metals—application to nickel. J.Igarashi (Dept. of Phys., Osaka Univ., Toyonaka, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2827-37 (Aug. 1983).
A many-body theory which takes account of the two-hole and one-electron multiple scattering is developed. By applying it to a simple model simulating nickel, the result of the recent angle resolved photoemission experiment is discussed. A reduction of both the exchange splitting and the d band width is obtained. The satellite position shifts toward the Fermi level from that given by the two-hole *t*-matrix theory. (19 refs.)

108634 A spin fluctuation theory of degenerate narrow bands—finite-temperature magnetism of iron. H.Hasegawa (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. F (GB), vol.13, no.9, p.1915-29 (Sept. 1983).
A previously developed theory of itinerant-electron magnetism at finite temperatures is generalised to include the effect of degenerate multi-bands with t_{2g} and e_g symmetry by adopting the static functional integral method and the coherent potential approximation (CPA). Numerical calculations of the Curie temperature, the magnetisation curve, the amplitude of local moments and the susceptibility are made for iron by using the detailed density of states generated by the recursion method for the tight-binding model. Calculated results are shown to account for finite-temperature properties of iron. In particular, the calculation explains the observed very weak temperature dependence in the spin-density asphericity, which cannot be explained by the Stoner theory. The authors' results are compared with those obtained by alternative approaches in which the five sub-bands are taken to be equivalent. (69 refs.)

108635 Magnetism of linear chains. M.Weinert, A.J.Freeman (Phys. Dept., Northwestern Univ., Evanston, IL, USA).
J. Magn. & Magn. Mater. (Netherlands), vol.38, no.1, p.23-33 (Aug. 1983).
Accurate self-consistent local spin density electronic structure calculations for linear chains of Ni and Fe atoms are presented which realistically treat their three-dimensional nature. The one-dimensional character of the bands manifests itself in high density of states arising from van Hove singularities. Both transition metals are 'strong' Stoner ferromagnets with large magnetic moments (3.3 and 1.1 μ_B for Fe and Ni, respectively) and have large s- and d-exchange splittings. From fits of results to simple tight-binding models, the authors find that the d-d effective exchange interactions is similar to that in bulk. However, the use of standard bulk tight-binding parameters is found to be inappropriate since they qualitatively change the results by, for example, misplacing the Fermi level with respect to the band edges. Moreover, in contrast to the bulk, the linear chains also show a rather large *s*-exchange interaction and hence a large and positive valence contribution to the contact hyperfine field; for Fe this results in a positive contact hyperfine field of the same magnitude as in the bulk. The unique signatures of these linear systems should make their characterization experimentally feasible. (21 refs.)

Effects of order on the electronic structure of Ni_3Fe ....See Entry 108258

Theory of excitations in the 1d singlet ground state magnet $CsFeCl_3$ ....See Entry 108708

75.20 DIAMAGNETISM AND PARAMAGNETISM

Valence fluctuations and magnetic-nonmagnetic transitions in a model for intermediate-valence systems ....See Entry 108360

Indirect exchange interaction between two doubly bridged paramagnetic atoms. A coupled-cluster model study ....See Entry 108368

75.20C Nonmetals

Diamagnetic anisotropy of liquid crystalline side chain polysiloxanes in the nematic and smectic phases ....See Entry 107531

Pentavalent iron stabilized for the first time in sixfold coordination in an oxide ....See Entry 107649

Pretransitional effects in the isotropic phase of a lyotropic nematic liquid crystal ....See Entry 107934

Photoelectronic properties of Cu_3PS_4 and Cu_3PS_3Se single crystals ....See Entry 108416

Magnetic susceptibility and the spin-glass transition of $Cd_{1-x}Mn_xS$ and $Zn_{1-x}Mn_xS$ at low temperatures ....See Entry 108656

Intrinsic paramagnetic dimers in the Magneli titanium oxides ....See Entry 108768

Quadrupolar ordering in a non-magnetic cubic doublet system: Cs_2NaHoF_6 ....See Entry 108800

75.20E Metals and alloys

108636 Effect of electron correlation on the magnetic properties of expanded liquid sodium. L.Bottyan, R.Dupree (Phys. Dept., Univ. of Warwick, Warwick, England), W.Freyland.
J. Phys. F (GB), vol.13, no.9, p.L173-8 (Sept. 1983).
The magnetic susceptibility, NMR Knight shift and spin-lattice relaxation time of sodium have been measured up to 1000°C. Strong deviations from simple interacting electron-gas behaviour are found above 400°C. The paramagnetism is still further enhanced and the NMR data show that changes in the wavevector dependence of the susceptibility consistent with fluctuations towards a spin density wave occur. Such behaviour is expected for an itinerant antiferromagnet above its ordering temperature as predicted by some recent theories of the metal-nonmetal transition in an expanded fluid metal. (16 refs.)

108637 Induced neutron magnetic form factor of $LaSn_3$. J.Zarestky, C.Stassis, B.N.Harmon, J.A.Begum (Dept. of Phys., Iowa State Univ., Ames, IA, USA), R.M.Moon, S.H.Liu, D.D.Koelling.
J. Magn. & Magn. Mater. (Netherlands), vol.38, no.1, p.61-6 (Aug. 1983).
Polarized neutron scattering techniques have been used to study the spatial distribution of the magnetization induced in a single crystal of $LaSn_3$ by a magnetic field of 42.5 kG at 100K. The authors find that the magnetic form factor decreases very rapidly with increasing scattering angle, and bears no resemblance to the spin or orbital free-atom magnetic form factor. The experimental results are in reasonable agreement with band theoretical calculations of the spin magnetic form factor of $LaSn_3$. They conclude that (a) the spin part is the dominant contribution to the bulk susceptibility of $LaSn_3$ and (b) there is a substantial amount of Sn-5p electronic character in the wavefunctions near the Fermi level. (26 refs.)

108638 A study of the paramagnetic form factor of rhodium metal by polarized neutron diffraction. P.Radhakrishna (Lab. Leon Brillouin, CENS, Gif-sur-Yvette, France), P.J.Brown.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.216-18 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The magnetic form factor of the induced moment in paramagnetic rhodium metal has been measured at 100K in an external field of 4.6 T. The data for the five innermost reflections have been corrected for the diamagnetism of the electrons and the Schwinger effect. The results are discussed in terms of recent calculations. (5 refs.)

108639 Magnetic spectral response in the intermetallic compound $CeSn_3$. A.P.Murani (Inst. Laue-Langevin, Grenoble, France).
Phys. Rev. B (USA), vol.28, no.4, p.2308-11 (15 Aug. 1983).
Neutron-inelastic-scattering measurements on $CeSn_3$ performed with high-incident-energy neutrons reveal a broad inelastic hump centered around 40 meV at low temperatures, in addition to the usual quasielastic spectrum centered on zero energy. With increasing temperature, the inelastic hump broadens and 'melts away', such that around the temperature of the maximum in the susceptibility (~130K) no observable trace of its presence remains and the full magnetic response can be described by a single quasielastic spectrum. (23 refs.)

108640 Magnetic and crystallographic characteristics of $RNiGa_4$ compounds (R-rare earth metal). V.A.Romaka, Yu.N.Grin', Ya.P.Yarmolyuk.
Ukr. Fiz. Zh. (USSR), vol.28, no.7, p.1095-7 (July 1983). In Russian.
The Faraday method in the temperature interval 78 to 300K, was used to investigate the temperature dependence of the magnetic susceptibility χ of $RNiGa_4$ compounds (R=Y,Nd,Sm,Gd,Tb,Dy,Ho,Er,Tm,Yb,Lu). The values of χ for $YNiGa_4$, $YbNiGa_4$ and $LuNiGa_4$ are quite small and do not change with temperature (Pauli paramagnetism). The $\chi(T)$ dependence for the rest of the compounds obey the Curie-Weiss law except $SmNiGa_4$. The effective magnetic moments are close to the values for R^{3+}. (9 refs.) *V.G.P.*

The crystal structure and magnetic susceptibility of $LuNi_2Sn$, $YbNi_2Sn$ and $LuNi_4Sn$ .... See Entry 107609

The de Haas-van Alphen effect and anisotropy of the magnetic susceptibility in Zn-Ag and Zn-Ga dilute alloys .... See Entry 108262

Filling of the 3d band of the manganese in $GdAl_{2-x}Mn_x$ for $x<0.2$ .... See Entry 108276

The magnetic properties of some R_5Pt_3 compounds (R=Gd, Tb, Dy, Ho) .... See Entry 108659

Soft-mode behaviour of magnetic excitations in praseodymium under uniaxial stress .... See Entry 108666

Line width of magnetic excitations in the Cubic Laves-phase compounds $PrNi_2$, $PrAl_2$ .... See Entry 108671

Magnetic short-range order and spin waves in Fe_3Si above the Curie temperature .... See Entry 108707

Magnetic cluster effects in $FeSi_{1-x}Ge_x$ .... See Entry 108725

Magnetic studies in amorphous Gd_xY_{1-x} alloys .... See Entry 108729

^{29}Si nuclear magnetic resonance and relaxation in the paramagnetic state of $CeCu_2Si_2$ .... See Entry 108825

75.20H Local moment in dilute alloys; Kondo effect

(see also 72.15Q Electronic conduction)

The appearance of the many-body resonance at the Fermi level in Kondo-lattices .... See Entry 108405

75.25 SPIN ARRANGEMENTS IN MAGNETICALLY ORDERED MATERIALS (NEUTRON STUDIES, ETC)

108641 The magnetic structure of $HoCo_2Si_2$. P.Schobinger-Papamantellos (Inst. fur Kristallographie und Petrographie, ETH Zurich, Zurich, Switzerland), C.Routsi, J.K.Yakinthos.
J. Phys. & Chem. Solids (GB), vol.44, no.9, p.875-7 (1983).
The authors have carried out neutron diffraction on a $HoCo_2Si_2$ powder sample at 4.2K. The magnetic structure of this compound is collinear antiferromagnetic with the holmium magnetic moments parallel to the *c*-axis of the crystal. The magnetic moment value of holmium is 9.85 μ_B. The magnetic space group is $I4/mm'm'$ $(Sh_{128}{}^{410})$ $k=000$. The ordering temperature is $T_N=12(1)K$. (9 refs.)

108642 Antiferromagnetic antimonides $MnSb_2O_4$ and $NiSb_2O_4$. J.R.Gavarri (Ecole Centrale des Arts et Manufactures, Univ. Paris, Villetaneuse, France), A.W.Hewat.
J. Solid State Chem. (USA), vol.49, no.1, p.14-19 (Aug. 1983). In French.
Neutron diffraction has been used to study the variation of antiferromagnetic order in the antimony isomorphous $MnSb_2O_4$ (T_N~60K) and $NiSb_2O_4$ (T_N~46K). The magnetic moments have been related to the Mn^{2+} and Ni^{2+} spins and magnetostrictive effects have been interpreted. The influence of the method of synthesis is mentioned: polycrystalline $MnSb_2O_4$ has been obtained from hydrothermal synthesis. Orthorhombic distortions are not connected with magnetic interactions but with structural defects. (12 refs.)

108643 Crystal and magnetic structure of the $CoMn_{1-x}Ti_xSi$ system. A.Szytula (Inst. of Phys., Jagiellonian Univ., Cracow, Poland), W.Bazela, S.Radenkovic.
J. Magn. & Magn. Mater. (Netherlands), vol.38, no.1, p.99-104 (Aug. 1983).
The magnetic and crystallographic nature of the compounds $CoMn_{1-x}Ti_xSi$ $(0\leq x\leq 0.5)$ is studied by X-ray, neutron diffraction and magnetometric measurements. It is shown that the solid solutions arise for $0\leq x\leq 0.05$, with the crystal structure of the NiTiSi type. All compounds are antiferromagnets. The magnetic moment localized on Mn and Co atoms forms a double spiral in both sites. The dilution of the Mn sublattice by Ti atoms change only slightly the magnetic properties—Neel temperature and parameters of magnetic structure. (12 refs.)

108644 Magnetic structures of monoclinic FeGe. D.Fruchart, B.Malaman, G.Le Caer, B.Roques (Lab. de Cristallographie, CNRS, Univ. Sci. et Medicale de Grenoble, Grenoble, France).
Phys. Status Solidi a (Germany), vol.78, no.2, p.555-69 (16 Aug. 1983). In French.
The magnetic structure of monoclinic FeGe is determined by neutron diffraction. Between $T_N=342K$ and $T_c=115K$, the magnetic structure is characterized by nearly ferromagnetic planes, antiferromagnetically coupled, while the magnetic moments of iron atoms located between these planes are not ordered. They order magnetically at T_c. For $T<T_c$, the iron moments form a coned structure with a periodicity of ≈395 Å. Mossbauer spectroscopy results are consistent with those of neutron diffraction. (22 refs.)

108645 Magnetic ordering in the layered compound $(CD_3ND_3)_2CuCl_4$. J.J.M.Steijger, E.Frikkee (Netherlands Energy Res. Found. ECN, Petten, Netherlands), L.J.de Jongh, W.J.Huiskamp.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.202-5 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The magnetic ordering in the pseudo two-dimensional ($d=2$) Heisenberg ferromagnet $(CD_3ND_3)_2CuCl_4$ is investigated by means of neutron diffraction. Long-range three-dimensional ($d=3$) order sets in at $T_c=8.84(2)K$. Comparison of the temperature dependence of the magnetization $M(T)$ with the prediction on the basis of renormalized spin-wave theory for a pseudo $d=2$ Heisenberg ferromagnet yields the interaction parameters $J/k_B=19.3(5)K$ and $J'/J\approx 10^{-3}$-10^{-5}. The critical behaviour of $M(T)$ may be described by a power law with exponent $\beta=0.242({}_{-25}{}^{+15})$. The variation of the $d=2$ ordering with temperature is deduced from scans perpendicular to the line $[00\zeta]$. Even at $T=1.68K$ only ≈5-10% of the expected magnetic scattering is actually observed in the (002) reflection, while the ridge intensity at $\zeta=3.58$ remains constant below $T\approx 7K$ at an unusually high level. The incomplete $d=3$ order for $T\ll T_c$ is ascribed to structural disorder in the positions of the Cu^{2+} ions. (17 refs.)

108646 Competing magnetic orderings in random mixtures: $Fe_xNi_{1-x}Cl_2$. A.Ito, T.Tamaki, Y.Someya, H.Ikeda (Faculty of Sci., Ochanomizu Univ., Tokyo, Japan).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.207-11 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Neutron scattering and Mossbauer absorption techniques are applied to the mixture $Fe_xNi_{1-x}Cl_2$ in which the strong Ising-type anisotropy of Fe and the weak XY-type anisotropy of Ni compete with each other. A mixed ordering phase is found to exist in a narrow range of concentration around x~0.08. It is found that if a small amount of Fe, ~2%, replaces Ni in $NiCl_2$, the directions of majority spins of Ni rise up from the *c*-plane (the spin easy axis of $NiCl_2$) as a whole. Diffuse scattering of neutrons is observed in the $S_{\parallel}$-ordered antiferromagnetic (AF) phase over a wide range of temperature for the samples with concentrations near the crossing point. It might be one of the distinctive properties of the ordered phase in the mixture with competing spin anisotropies. (5 refs.)

108647 Antiferromagnetism of YMn_2 intermetallic compound. Y.Nakamura, M.Shiga (Dept. of Metal Sci. & Technol., Kyoto Univ., Kyoto, Japan), S.Kawano.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.212-15 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The authors have made neutron diffraction measurements on powdered YMn_2 and determined its spin structure to be a collinear antiferromagnet with a Mn moment of $2.7\mu_B$. By analyzing both the intensity of magnetic peaks and the NMR spin-echo spectrum at 4.2K, the direction of the spin axis was found to be parallel to the [111] direction. The Neel temperature T_N of YMn_2 has been determined to be about 100K by means of magnetic susceptibility and thermal expansion measurements. These measurements reveal that the magnetic transition is of first order and shows a thermal hysteresis around T_N. (5 refs.)

108648 A new probe for surface magnetism: polarized neutron reflection. S.D.Bader, G.P.Felcher, K.E.Gray, R.T.Kampwirth (Argonne Nat. Lab., Argonne, IL, USA).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.219 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
A beam of polarized neutrons of wavelength λ is reflected by a magnetized surface with an intensity $R^{\pm}(\lambda)$, where R is related by optical laws to the refractive index $n^{\pm}=n_N\pm n_M$ of the material. While the nuclear refractive index n_N is constant for a homogeneous body, n_M is proportional to the magnetic induction $\mathbf{B}(z)$, where z is the distance from the surface. A perturbation of $\mathbf{B}$ close to the surface may alter the reflectivity $R^{\pm}(\lambda)$ sufficiently to allow for its detection. Numerical calculations appropriate to niobium show that neutron reflection can determine the penetration length within 10%. For elemental ferromagnets the magnetism at the surface is increasingly perturbed as the temperature approaches the Curie point; in nickel the perturbation should become detectable at 0.85 T_c. (no refs.)

108649 Magnetic structure of hcp Ho-Ce and Er-Ce alloys. S.Kawano, N.Achiwa (Res. Reactor Inst., Kyoto Univ., Osaka, Japan).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.220-3 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The authors have established the magnetic phase diagram of both hcp Ho-Ce and Er-Ce alloys by means of neutron diffraction. The alloys with 84% Ho or more exhibit a helix→cone transition, which is similar to the case of pure Ho. The 80% Ho alloy shows only a helical structure. The Er-Ce alloys with 95% and 90% Er exhibit a longitudinal sinusoidal oscillation→*c*-axis ferromagnet→cone transition and the 80% Er alloy shows only the *c*-axis ferromagnet which does not occur in pure Er. The tendency of stabilizing the ferromagnetic phase exists in hcp Ho-Ce and Er-Ce alloys. Neel temperatures and initial turn angles are lowered with the deGennes factor. The RKKY interaction in hcp Ho-Ce and Er-Ce alloys is strongly affected to have a smaller range by alloying with light rare earth Ce. (10 refs.)

108650 Magnetic properties of oxides containing six-coordinated iron (IV) or (V). J.L.Soubeyroux (Inst. Laue Langevin, Grenoble, France), B.Buffat, N.Chevreau, G.Demazeau.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.227-31 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Few oxides containing six-coordinated iron (IV) or (V) are known. Recently, the phases $Sr_{0.5}La_{1.5}Li_{0.5}Fe_{0.5}O_4$ and La_2LiFeO_6 have been prepared; X-ray and neutron diffraction studies of these oxides can be interpreted as the result of an ordering of the lithium and iron atoms. Magnetic susceptibility, Mossbauer resonance and neutron diffraction measurements have also been performed on these two phases. They lead to an antiferromagnetic ordering of the moments at 31K and 14.5K for iron (IV) and (V) respectively. For $Sr_{0.5}La_{1.5}Li_{0.5}Fe_{0.5}O_4$, magnetic lines of the neutron diffractograms at low temperature involve a helimagnetic propagation vector $Q=0.49(2\pi/a)$ $[110]\text{Å}^{-1}$. For La_2LiFeO_6 a helimagnetic structure has also been found. All these properties are compared to those of the perovskite $SrFe^{IV}O_3$. (14 refs.)

108651 Neutron scattering on solitons in quasi-one-dimensional systems. V.K.Fedyanin (Joint Inst. for Nuclear Res., Dubna, USSR).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.255 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
In the framework of the model of an ideal lattice gas of solitons, the author obtains a general formula for the dynamic neutron scattering form factor. (3 refs.)

Observation of Pendellosung effect in polarised neutron scattering from a magnetic crystal .... See Entry 107488

Neutron diffraction camera method applied in the study of phase transition .... See Entry 107490

X-ray diffraction study of the crystal structures of K_2CuF_4 and $K_2Cu_xZn_{1-x}F_4$ .... See Entry 107644

Superconductivity and magnetism in ternary rare-earth compounds .... See Entry 108595

The magnetic properties of some R_5Pt_3 compounds (R=Gd, Tb, Dy, Ho) .... See Entry 108659

Local measurement of magnetisation in a gallium-substituted YIG crystal by neutron spin echo .... See Entry 108660

Small angle elastic and inelastic neutron scattering in $Fe_{0.7}Al_{0.3}$ .... See Entry 108665

Magnetic properties of dysprosium oxisulphate ($Dy_2O_2SO_4$) .. See Entry 108686

Magnetic properties and thermal expansion of $(Zr_{1-x}Ta_x)Fe_2$ .... See Entry 108687

A study of the critical factorization of ternary dynamical spin correlations by the scattering of polarized neutrons in Fe above T_c .... See Entry 108701

Random field effects in magnets .... See Entry 108719

75.30 MAGNETICALLY ORDERED MATERIALS, OTHER INTRINSIC PROPERTIES

(for critical point effects, see 75.40)

108652 Chelate polymer showing ferro- or ferrimagnetism at room temperature. M.Kinoshita, T.Sugano.
Solid State Phys. (Japan), vol.18, no.5, p.267-70 (May 1983). In Japanese.
The iron-bonded chelate polymer of $[\{Fe(C_{13}H_{17}N_3)_2\}SO_4.6H_2O]_n$ is introduced as the first example of magnetic polymers which have a backborn frame of organic polymer and exhibit ferro- or ferrimagnetism even at room temperature. (8 refs.)

75.30C Saturation moments and magnetic susceptibility

108653 Magnetic susceptibility of dysprosium alloys with germanium over a broad temperature range. G.I.Batalin, S.I.Tyukhtenko, D.A.Stakhov, V.G.Batalin, N.V.Zhukovskaya (T.G. Shevchenko Kiev State Univ., Kiev, Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.8, p.1183-5 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1391-3 (Aug. 1982).
The magnetic susceptibility of alloys of the Dy-Ge system were studied over a broad concentration range at 300-1800K. The samples were obtained in an electric-arc furnace on a water-cooled copper Bearth in an argon medium. The temperature dependence of the specific magnetic susceptibility χ_g of the alloys was measured according to the Faraday-Sucksmith method. The maximum error in the determination of χ_g did not exceed 3%. The values of χ_g were used to determine the atomic magnetic susceptibilities χ_A. (7 refs.)

108654 Magnetic susceptibilites of the frustrated triangular lattice antiferromagnets $CsVCl_3$ and VX_2 (X=Cl, Br and I): appearance of magnetic liquid in the ordered state. K.Hirakawa (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan), H.Ikeda, H.Kadowaki, K.Ubukoshi.
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2882-7 (Aug. 1983).
Magnetic susceptibilities χ of the frustrated triangular lattice antiferromagnets $CsVCl_3$ and VX_2 (X=Cl, Br and I) have been measured by means of the conventional Faraday-type as well as the SQUID magnetometers. The χ-T curve of $CsVCL_3$ shows a typical 1D-like character in agreement with the early work by Niel et al. (1979). At $T<T_N$, χ_c increases rapidly with decreasing T, whereas χ_a stays at a constant value. The χ-T curve in VX_2 which are though to be 2D-like systems is very flat and shows an anomaly at T_N. Surprisingly, however, no anisotropy could be detected below T_N. This suggests that the transition is quite different from the conventional one for the non-frustrated antiferromagnetic systems and a magnetic liquid state is formed in the ordered state. (8 refs.)

108655 Field dependence of the d.c. magnetic susceptibility in $Fe_xMg_{1-x}Cl_2$. J.Gelard, F.Bensamka, D.Bertrand, A.R.Fert, J.P.Redoules, S.Legrand (Dept. de Phys., INSA, Toulouse, France).
J. Phys. C (GB), vol.16, no.26, p.L939-43 (20 Sept. 1983).
The authors have studied the temperature dependence of the susceptibility of insulating $Fe_xMg_{1-x}Cl_2$ in various uniform magnetic fields up to 8000 Oe. For $x=0.286$ spin glass behaviour is observed and the reversibility temperature moves down with field. For $x=0.552$ results give evidence for two transitions: paramagnetic-antiferromagnetic phase and antiferromagnetic-spin glass phases; the uniform magnetic field enlarges the domain of existence of the spin glass phase ($H<5000$ Oe), giving an experimental illustration of random field effects. (8 refs.)

108656 Magnetic susceptibility and the spin-glass transition of $Cd_{1-x}Mn_xS$ and $Zn_{1-x}Mn_xS$ at low temperatures. Y.Q.Yang, P.H.Keesom, J.K.Furdyna (Dept. of Phys., Purdue Univ., West Lafayette, IN, USA), W.Giriat.
J. Solid State Chem. (USA), vol.49, no.1, p.20-4 (Aug. 1983).
The low-field magnetic susceptibility of the diluted magnetic semiconductors $Cd_{1-x}Mn_xS$ and $Zn_{1-}s_xMn_xS$ was measured betwen 4.2 and 30K for the Mn concentration range $0.25<x<0.40$. When $x>0.25$, both of these ternary systems shows a spin-glass transition in the above temperature range, as evidenced by a somewhat rounded cusp in the susceptibility and by the presence of irreversible effects. Because these materials are insulators at low temperatures, and the interactions between the Mn ions are only antiferromagnetic, the observed spin-glass behavior if attributed to frustration inherent in the HCP lattices of these compounds. The phase diagrams for the boundary of the paramagnetic and the spin-glass phases are presented for the two alloy systems, and the difference between the two phase diagrams is discussed. (16 refs.)

108657 Preparation, structure, and magnetic properties of isostructural La_3MAlS_7 and La_3MFeS_7 (M=Mg, Mn, Fe, Co, Ni, or Zn). K.S.Nanjundaswamy, J.Gopalakrishnan (Solid State & Structural Chem. Unit, Indian Inst. of Sci., Bangalore, India).
J. Solid State Chem. (USA), vol.49, no.1, p.51-8 (Aug. 1983).
A series of quaternary metal sulfides of the general formula $La_3MM'S_7$ (M=Mn, Fe, Co; M'=Al and M=Mg, Mn, Fe, Co, Ni; M'=Fe) consisting of linear chains of face shared MS_6 octahedra and isolated $M'S_4$ tetrahedra has been prepared and studied. The aluminium compounds La_3MAlS_7 (M=Mn, Fe, Co) exhibit linear chain antiferromagnetism. The magnetic behavior of other La_3MFeS_7 sulfides has been examined in detail. The magnetic susceptibility of La_3MgFeS_7 shows that tetrahedral site Fe^{3+} undergoes a transition from $S={}^5/_2$ to $S=2$ spin state around 150K. (15 refs.)

108658 Double coordination of iron in the phase Fe_xZrSe_2 ($0<x<0.25$): magnetic properties and Mossbauer characteristics. M.-A.Buhannic, A.Ahouandjinou, M.Danot, J.Rouxel (Lab. de Chimie des Solides, Nantes, France).
J. Solid State Chem. (USA), vol.49, no.1, p.77-84 (Aug. 1983). In French.
The Fe_xZrSe_2 compounds have been studied from the structural, magnetic, and Mossbauer points of view. The structure of a $Fe_{0.18}ZrSe_2$ single crystal has been refined to a final 0.067 R factor value. Iron disorderly occupies both octahedral and tetrahedral voids of the Van der Waals gap of $ZrSe_2$. The Curie constants are consistent with the Fe (II) state. Negative θ_p show that interactions are predominantly AF. For $x<0.18$, χ^{-1} tends toward zero with temperature. For $x\geq0.18$, a susceptibility maximum occurs for $T\simeq7K$. Mossbauer spectra have been fitted considering two components: a singlet (tetrahedral Fe^{II}) and a doublet (octahedral Fe^{II}) broadened by the □-Fe disorder. The Mossbauer parameters and their thermal evolution are discussed. (11 refs.)

108659 The magnetic properties of some R_5Pt_3 compounds (R=Gd, Tb, Dy, Ho). H.Gamari-Seale, A.Yazdani (NRC Demokritos, Aghia Paraskevi Attikis, Greece).
J. Magn. & Magn. Mater. (Netherlands), vol.38, no.1, p.57-60 (Aug. 1983).
The magnetic susceptibility and magnetization of the R_5Pt_3 intermetallic compounds have been studied. Gd_5Pt_3 is ferromagnetic while Tb_5Pt_3, and Ho_5Pt_32 possess rather a nonlinear magnetic structure, with strong ferromagnetic interaction and high anisotropy effects at low temperatures. (1 ref.)

108660 Local measurement of magnetisation in a gallium-substituted YIG crystal by neutron spin echo. C.Mazure-Espejo, M.Schlenker, J.Baruchel (Lab. Louis Neel, CNRS, Grenoble, France), J.P.Guigay, F.Mezei.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.66-9 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
A non-destructive local measurement of the spontaneous magnetisation M_s along the growth direction x was performed across one growth sector of a single crystal specimen of flux-grown gallium-substituted YIG through non-conventional use of neutron spin echo. The volume probed in each measurement was 7×10^{-3} mm^3. It is found that M_s increases along the growth direction; in the present special case, two different regions, with very distinct rates of increase in M_s, are clearly evidenced. (8 refs.)

108661 The magnetism of the NiAs-type solid solution $Cr_xFe_{2-x}Te_3$. P.Terzieff (Inst. of Inorganic Chem., Univ. of Vienna, Wien, Austria).
Physica B & C (Netherlands), vol.122B+C, no.1, p.43-8 (Sept. 1983).
The magnetic properties of the NiAs-type solid solution between ferromagnetic Cr_2Te_3 and paramagnetic Fe_2Te_3 are reported. The description in terms of the molecular field theory indicates the presence of competitive ferromagnetic and antiferromagnetic interactions. Alloys with compositions near Cr_2Te_3 are ferromagnetic, while those with comparable amounts of Fe and Cr are ferrimagnetic, due to the antiferromagnetic interaction between neighbouring layers normal to the hexagonal c-axis. The discontinuity of the lattice parameters, most evident for c/a, coincides with the indicated transition from ferromagnetism to ferrimagnetism. (13 refs.)

The crystal structure and magnetic susceptibility of $LuNi_2Sn$, $YbNi_2Sn$ and $LuNi_4Sn$ .... See Entry 107609

Pentavalent iron stabilized for the first time in sixfold coordination in an oxide .... See Entry 107649

Evidence for the Ham effect in bis-tetramethylammonium hexachloroneptunate (IV) .... See Entry 108369

Charge-density-wave-like transition in V_3Te_4 .... See Entry 108399

Coexistence of antiferromagnetism and superconductivity in CrRe alloys .... See Entry 108591

Susceptibility of a quasi-one-dimensional magnet with the Ising interaction .... See Entry 108624

Theory of two-band ferromagnetism .... See Entry 108632

A spin fluctuation theory of degenerate narrow bands—finite-temperature magnetism of iron .... See Entry 108634

Magnetic and crystallographic characteristics of $RNiGa_4$ compounds (R-rare earth metal) .... See Entry 108640

The magnetic structure of $HoCo_2Si_2$ .... See Entry 108641

Antiferromagnetic antimonides $MnSb_2O_4$ and $NiSb_2O_4$ .... See Entry 108642

Crystal and magnetic structure of the $CoMn_{1-x}Ti_xSi$ system .... See Entry 108643

Antiferromagnetism of YMn_2 intermetallic compound .... See Entry 108647

Magnetic properties of oxides containing six-coordinated iron (IV) or (V) .... See Entry 108650

Spin-wave dynamics of ferromagnets with domain walls in weak magnetic fields .... See Entry 108662

Magnetic properties of dysprosium oxisulphate ($Dy_2O_2SO_4$) .. See Entry 108686

Successive phase transitions in a random system $Mn_{1-x}Zn_x(HCOO)_2.2D_2O$ .... See Entry 108688

Investigation of the magnetic and superconducting properties of $(Er_{1-x}Ho_x)Rh_4B_4$ .... See Entry 108689

Local and itinerant magnetism and superconductivity in R Rh_2Si_2 (R=rare earth) .... See Entry 108691

Critical behavior of $Fe_{15}Ni_{65}B_{18}Si_2$ ferromagnetic glass .... See Entry 108704

Magnetic cluster effects in $FeSi_{1-x}Ge_x$ .... See Entry 108725

Magnetic studies in amorphous Gd_xY_{1-x} alloys .... See Entry 108729

Variation of the magnetic properties of $SmCo_5$ powders by water milling .... See Entry 108740

Large uniaxial magnetic anisotropy in amorphous Tb-Fe evaporated thin films .... See Entry 108741

Magnetic properties of amorphous sputtered Co_xSi_{1-x} films .... See Entry 108743

Bubble film characterization by differential susceptibility measurements .... See Entry 108748

EPR and magnetic susceptibility studies of xCuO.(1-x)[$2B_2O_3$.PbO] glasses .... See Entry 108771

Magnetic studies of phase transformations in SbSI and $Sn_2P_2S_6$ crystals .... See Entry 108896

Magneto-optical properties of metallic ferromagnetic materials .... See Entry 108929

On the recovery and annealing kinetics of cold-worked Ni-4.5 at% Cu alloy .... See Entry 109327

75.30D Spin waves

(see also 76.50 Spin wave resonance)

108662 Spin-wave dynamics of ferromagnets with domain walls in weak magnetic fields. A.P.Tankeev, Yu.G.Raidugin (Inst. of Metal Phys., Ural Sci. Centre, Acad. of Sci., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.30-40 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A calculation is reported of the spectrum and amplitude of linear spin excitations of magnetically uniaxial ferromagnets with domain walls subjected to weak magnetic field. The results obtained are used to calculate the temperature dependence of the initial (reversible) magnetic susceptibility. It is shown that the main contribution to this dependence is due to states in a continuous spectrum and it is these states that determine the linear nature of the dependence. (13 refs.) *A.T.*

108663 On an anomalous behaviour of spin-wave stiffness constant in amorphous ferromagnets. T.Kaneyoshi (Dept. of Phys., Nagoya Univ., Nagoya, Japan).
Phys. Status Solidi b (Germany), vol.118, no.2, p.751-5 (1 Aug. 1983).
For the anomalous behaviour of the spin-wave stiffness constant observed in some amorphous ferromagnets, changing with the applied field, a model is suggested and discussed. (7 refs.)

108664 Magnetic excitations in Mn_3Si. S.Tomiyoshi (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan), S.Funahashi, Y.Yamaguchi.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.143-6 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Magnetic excitations in an incommensurate antiferromagnet Mn_3Si with the Neel temperature of 25.8K were measured by inelastic neutron scattering. A 10K two sharp peaks of the magnetic excitations originating from the satellite positions were observed at and energy of 1.5 meV. The width of the peaks becomes broader with increasing energy and at 2.5 MeV two peaks separated by the zone boundary combine to form a single peak with trapezoidal shape centered at the zone boundary. The width of the flat peak continues to increase with energy. Above T_N a broad peak was observed at the zone boundary at 1.5 meV. These results resemble in many respects those found in chromium, suggesting that Mn_3Si is an itinerant antiferromagnet similar to chromium. (8 refs.)

108665 Small angle elastic and inelastic neutron scattering in $Fe_{0.7}Al_{0.3}$. K.Motoya, S.M.Shapiro (Brookhaven Nat. Lab., Upton, NY, USA), Y.Muraoka.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.147-51 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Small angle elastic and high resolution inelastic neutron scattering measurements were performed on a single crystal of ordered $Fe_{0.7}Al_{0.3}$. The small angle scattering intensity drops rapidly above T_c and a peak appears at lower temperatures whose position shifts with Q. Thermal hysteresis effects observed in the small angle scattering below 300K suggests a slow relaxation motion of magnetic clusters in the ferromagnetic phase. Around 300K, well-defined spin-wave scattering is observed which follows an $E=DQ^2$ dispersion relation with $D=17$ meV Å^2. As the temperature is lowered, the spin-wave peaks fade into a quasielastic central component. An unusual property in the lower temperature region of the ferromagnetic phase was also found in the Q dependence of small angle scattering behavior. (9 refs.)

108666 Soft-mode behaviour of magnetic excitations in praseodymium under uniaxial stress. K.A.McEwen, W.G.Stirling, C.Vettier (Inst. Laue-Langevin, Grenoble, France).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.152-5 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Neutron inelastic scattering techniques have revealed a pronounced 'soft-mode' behaviour of the magnetic excitations in single-crystal praseodymium under uniaxial stress. The temperature and stress dependence of the excitations is discussed in detail. Excitations have been observed in both the paramagnetic and the sinusoidally-modulated magnetically-ordered phases. (9 refs.)

108667 Spin waves in a single-domain γ-Mn (10% Fe) alloy. K.Mikke, J.Jankowska, E.Jaworska (Inst. of Nuclear Res., Swierk, Poland).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.156-8 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Spin waves were measured over a wide energy range in single-domain γ-Mn-Fe FCT antiferromagnetic alloys. Both the energy gap in the spin wave spectrum and the magnon velocity are not much different from those in FCC γ-Mn-Fe alloys. (3 refs.)

108668 A neutron study of the magnetic excitations in CeBi. J.Rossat-Mignod (DRF/DN, CEN, Grenoble, France), D.Delacote, J.M.Effantin, C.Vettier, O.Vogt.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.163-6 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Magnetic excitations in CeBi have been measured at $T=4$K along the $[q00]$ and $[qq0]$ directions. The results reveal a very weak coupling between (001) planes and indicate that the energy is lower at the zone boundary when the excitations propagate within the (001) plane. Such a behaviour cannot be accounted for even by a bilinear anisotropic exchange Hamiltonian. (7 refs.)

108669 Magnon measurements on a γ-$Mn_{90}Cu_{10}$ single crystal. M.C.K.Wiltshire (Dept. of Solid State Phys., Res. School of Phys. Sci., Australian Nat. Univ., Canberra, Australia), M.M.Elcombe.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.167-9 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Inelastic neutron scattering measurements of magnons in antiferromagnetic γ-MnCu (90% Mn) are reported for energy transfers up to 8 THz. The data are analysed in terms of a magnon dispersion relation $\omega_q=(C^2q^2+D^2)^{1/2}$ that is heavily damped with wave vector dependent damping $\Gamma(q)=\Gamma_0+\Gamma_1 q$. The authors estimate from fits of the data that $C=39.8\pm0.7$ THz Å and $D=2.3\pm0.1$ THz, and compare these values with the results of other experiments. The linear dependence of the damping on wave vector is found to give a reasonable description of the data, in accordance with theoretical expectations. (9 refs.)

108670 Order-disorder transition and spin waves in Ni_3Mn. P.v.Blanckenhagen, C.Lin, B.Hennion, M.Hennion (Inst. fur Angewandte Kernphys., Kernforschungszentrum, Karlsruhe, Germany).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.170-2 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The spin-wave dispersion has been investigated by inelastic neutron scattering on Ni_3Mn single crystals with different degrees of atomic order. Due to the transition from the ordered to the disordered state the stiffness constant decreased by a factor of about 5. (11 refs.)

108671 Line width of magnetic excitations in the Cubic Laves-phase compounds $PrNi_2$, $PrAl_2$. V.L.Aksenov, E.A.Goremychkin (Joint Inst. for Nuclear Res., Dubna, USSR), T.Frauenheim.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.176-9 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The temperature dependence of the line width of magnetic excitons in the intermetallic rare-earth compounds $PrNi_2$ and $PrAl_2$ is studied with the help of neutron inelastic scattering. Experimental results are discussed on the basis of the s-f exchange model. (7 refs.)

108672 Magnetic excitations in the dilute one-dimensional Ising-like antiferromagnet. S.E.Nagler (AECL, Chalk River Nuclear Labs., Chalk River, Ontario, Canada), W.J.L.Buyers, R.L.Armstrong, D.J.Lockwood, R.A.Ritchie.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.183-6 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Inelastic neutron scattering experiments have been performed on the randomly dilute $S=1/2$ quasi one-dimensional Ising-like antiferromagnet $CsCo_xMg_{1-x}Cl_3$ with $x=0.83\pm0.01$. The usual spin wave response around $\omega\approx2J$ was observed with a zone boundary frequency of 3.14 ± 0.08 THz. In addition, a new band of excitations was found near $\omega\approx J$. This was observed as a broad dispersionless feature centred at a frequency of 1.64 ± 0.15 THz at 4.7K. The excitations can be associated with the spins at the ends of isolated finite chains of magnetic ions. Exact calculations of $S^{xx}(Q,\omega)$ have been made for open ended chains of up to 8 spins. These can account for the appearance of the new band observed by neutron scattering. (9 refs.)

108673 Anomalous spin correlation in a linear-chain triangular lattice antiferromagnet $CsVCl_3$. K.Hirakawa, H.Kadowaki, K.Ubokoshi (Inst. for Solid State Phys., Univ. of Tokyo, Minato-ku, Japan).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.187-9 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The authors have demonstrated that $CsVCl_3$ is a very good realization of spin 3/2, 1D Heisenberg antiferromagnetic system with $J'/J=2.7\times10^{-4}$ through the inelastic scattering of neutrons. In this substance, the antiferromagnetic coupling in the basal triangular lattice plane causes a frustration effect. They have observed certain 'mysterious' properties. For instance, the excitation spectra in the plane are difficult to explain by the simple spin wave theory. (6 refs.)

108674 Magnetic excitations in two-dimensional antiferromagnets $Rb_2Co_cNi_{1-c}F_4$. H.Ikeda, Y.Someya, Y.Endoh, Y.Noda, F.Shibata (Dept. of Phys., Ochanomizu Univ., Tokyo, Japan).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.193-6 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Results of an investigation of the magnetic excitations in randomly mixed antiferromagnets $Rb_2Co_cNi_{1-c}F_4$ by means of neutron scattering are presented. Two bands of excitations are observed over a whole Brillouin zone. In $Rb_2Co_{0.5}Ni_{0.5}F_4$, a simple Ising cluster model using pure crystal exchange and anisotropy constants is found to fail in predicting the measured zone-boundary excitations. A considerable reduction of the exchange parameters in the mixed system yields satisfactory agreement between experimental and calculated spin-wave dispersion relations. A discussion is also given on the calculation of concentration dependence of the Neel temperature. (9 refs.)

108675 Solitons in the one-dimensional easy-plane ferromagnet. H.J.Mikeska (Inst. fur Theoretische Phys., Univ. Hannover, Hannover, Germany).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.235-40 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The author presents theoretical results on nonlinear excitations in the one-dimensional easy-plane ferromagnet in a symmetry breaking external field. Soliton-like solutions to the nonlinear classical equations of motion for the real magnetic chain (as opposed to an idealized planar chain, equivalent to a sine-Gordon system) are discussed and the approach of the soliton instability in this system is described. Quantum mechanical corrections to the soliton energy in the real magnetic chain are given and shown to be substantially different from result derived in the sine-Gordon approximation. The status of quantitative predictions for the strength of contributions to the dynamic structure factor from nonlinear modes in thermal equilibrium and the investigation of these modes by neutron scattering is discussed. (14 refs.)

108676 Soliton dynamics in the one-dimensional antiferromagnet TMMC $[(CD_3)_4NMnCl_3]$. J.P.Boucher, L.P.Regnault, J.Rossat-Mignod (CENG, Grenoble, France), J.P.Renard, J.Bouillot, W.G.Stirling, F.Mezei.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.241-9 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Recently the concept of solitons has been successfully applied to magnetic chains where magnetic solitons can be viewed as travelling domain walls. The one-dimensional antiferromagnetic compound $(CD_3)_4NMnCl_3$ (TMMC) in a transverse field is shown to be a very good realisation of sine-Gordon chains, below $T\simeq5$K. A review of recent experiments, both nuclear magnetic resonance and neutron diffraction, is given for this compound. New results are presented: the fluctuations associated with the solitons themselves have been observed for the first time; the magnon width gives direct evidence of the phase coupling mechanism between solitons and magnons. It is shown also that neutron spin echo measurements offer a promising way to study such narrow central peaks. The soliton dynamics in such real sine-Gordon chains is of fundamental importance. In very pure crystals the solitons move coherently while in samples containing a small amount of magnetic impurities in the chain, the solitons behave diffusively. (15 refs.)

108677 Inelastic neutron scattering studies of nonlinear excitations in the 1D ferromagnet $CsNiF_3$ with an external field. M.Steiner, K.Kakurai (Hahn-Meitner-Inst. fur Kernforschung GmbH, Berlin, Germany), J.K.Kjems. *Physica B & C (Netherlands)*, vol.120B+C, no.1-3, p.250-4 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The authors' inelastic neutron scattering study of the planar 1D ferromagnet $CsNiF_3$ in an applied field has been extended. The presence of a central component in $S(q,\omega)$ is confirmed and quite different responses are found for the different spin components, $S^{\alpha\alpha}$, ($\alpha=x$, y, z). The relative strengths of these components have been determined through combinations of measurements with different orientations of the field and the momentum transfer relative to the crystal axes. The analyses show that both two-spin-wave and soliton-like excitations may contribute to the longitudinal central response, relative to the field, whereas the transverse response only has contributions from the solitons. (10 refs.)

108678 Reflection and transmission of magnons through an exchange-coupled biferromagnetic interface. A.Yaniv (Dept. of Phys. & Astron., Tel Aviv Univ., Ramat Aviv, Tel Aviv, Israel).
Phys. Rev. B (USA), vol.28, no.3, p.1613-17 (1 Aug. 1983).
The transmission and reflection of magnons from an exchange-coupled biferromagnetic interface is analyzed for both normal and off-normal incidence. It is shown that a measurement of the transmission coefficient determines, almost uniquely, the value of the interface exchange constant. (6 refs.)

108679 Spectrum of magnetostatic waves for two ferrite films with arbitrary magnetization. A.S.Beregov, V.G.Oblamskii (Kiev Polytech. Inst., Kiev, Ukrainian SSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.11, p.967-9 (Nov. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.11, p.1345-8 (Nov. 1982). [received: Sept. 1983]
The dispersion characteristics of surface and volume magnetostatic waves (MSW) for two ferromagnetic films with arbitrary orientation of external magnetic field are analyzed. The limiting frequencies for all types of MSW are obtained and the spectrum of volume MSW is studied. (7 refs.)

108680 Polariton solitary waves in a quasi-one-dimensional ferromagnet. R.Boudreau, A.Caille (Dept. de Phys., Univ. de Sherbrooke, Sherbrooke, Quebec, Canada).
Solid State Commun. (USA), vol.47, no.10, p.783-7 (Sept. 1983). In French.
Spin dynamics in an easy plane magnetic chain has been studied in terms of polaritons and solitons, when the coupling between magnons and their induced dipolar electromagnetic field is included. For a moderate external magnetic field in the easy plane, non-topoligical, classical ϕ^4 solitons can describe the dynamics of spins dressed with the electromagnetic field. The solitary wave thus produced propagates at phase velocities bounded by the two limiting phase velocities of the polariton dispersion relations. (15 refs.)

Magnetic ordering in the layered compound $(CD_3ND_3)_2CuCl_4$ ...... See Entry 108645

Neutron scattering on solitons in quasi-one-dimensional systems ...... See Entry 108651

Dynamics of the soliton instability in the easy-plane ferromagnetic chain ...... See Entry 108694

On stable three-dimensional low-amplitude solitons in magnetic materials ...... See Entry 108697

Magnetic short-range order and spin waves in Fe_3Si above the Curie temperature ...... See Entry 108707

Mechanisms of magnetic losses in small-grain Ni-Zn ferrites ...... See Entry 108730

Influence of spin-spin interactions on the nuclear spin-lattice relaxation in magnetically ordered substances ...... See Entry 108813

Proton spin-lattice relaxation in the three metamagnetic states of $CoCl_2.2H_2O$ ...... See Entry 108814

One-magnon Raman scattering in $RFeO_3$—magnetic anisotropy and magnon softening ...... See Entry 108933

75.30E Exchange and superexchange interactions
(see also 71.70 Level splitting and interactions)

Valence fluctuations and magnetic-nonmagnetic transitions in a model for intermediate-valence systems ...... See Entry 108360

Magnetism of linear chains ...... See Entry 108635

Magnetic structure of hcp Ho-Ce and Er-Ce alloys ...... See Entry 108649

Reflection and transmission of magnons through an exchange-coupled biferromagnetic interface ...... See Entry 108678

Low-temperature magnetization of amorphous and microcrystalline Co-P alloys ...... See Entry 108726

Micromagnetism of two-phase quasi-single-domain particles . See Entry 108736

EPR study of the randomly diluted two-dimensional Heisenberg ferromagnet $K_2Cu_xZn_{1-x}F_4$ ...... See Entry 108769

ESR fields as a function of temperature in the quasi one-dimensional Heisenberg $S={}^1/_2$ ferromagnets $[C_6H_{11}NH_3]CuCl_3$ and $[C_6H_{11}NH_3]CuBr_3$ ...... See Entry 108770

EPR and magnetic susceptibility studies of xCuO.(1-x)[$2B_2O_3$.PbO] glasses ...... See Entry 108771

Magnetic couplings in Cs_2IrCl_6 and other iridium hexachlorides from NMR studies ...... See Entry 108809

One-magnon Raman scattering in $RFeO_3$—magnetic anisotropy and magnon softening ...... See Entry 108933

Temperature dependence of the exchange splitting in Ni studied by spin-polarized photoemission ...... See Entry 109103

75.30G Anisotropy

108681 Determination of the magnetic anisotropy of ferrofluids from torque magnetometry data. R.W.Chantrell (Dept. of Phys. & Astron., Preston Polytech., Preston, England), B.K.Tanner, S.R.Hoon.
J. Magn. & Magn. Mater. (Netherlands), vol.38, no.1, p.83-92 (Aug. 1983).
A theoretical analysis is presented which enables the uniaxial magnetic anisotropy constant K_1 of particles in ferrofluids, frozen in an external field, to be obtained from torque magnetometry measurements. The two-fold symmetry of the torque curve, found experimentally, is correctly predicted. An asymptotic solution is found which enables K_1 to be determined without recourse to iterative numerical methods. In this limit, the torque amplitude varies linearly with the inverse of the freezing field for large freezing fields. For all cases, exraction of K_1 requires an accurate knowledge of the particle size distribution parameters. (9 refs.)

108682 The role of two-level systems in amorphous metallic alloys. I. Induced anisotropy in amorphous ferromagnets. H.Kronmuller (Max-Planck-Inst. fur Metallforschung, Inst. fur Phys., Stuttgart, Germany).
Phys. Status Solidi b (Germany), vol.118, no.2, p.661-73 (1 Aug. 1983).
The induced anisotropy in amorphous ferromagnets is attributed to the directional ordering of atom pair axes. The thermodynamics and micromagnetic background of this process is treated on the basis of two-level systems which are identified with mobile atom pairs in the neighbourhood of free volumes. The role of 'reversible' and of 'irreversible' relaxation processes is discussed in detail. (26 refs.)

Magnetic excitations in two-dimensional antiferromagnets $Rb_2Co_cNi_{1-c}F_4$ ...... See Entry 108674

Investigation of directional short-range ordering in iron alloys by the NGR method ...... See Entry 108695

Mechanisms of magnetic losses in small-grain Ni-Zn ferrites ...... See Entry 108730

Changes in the magnetic properties of alloy YuNDKT (35% Co, 15% Ni, 7% Al, 4% Cu, 5% Ti, 1% Nb, rest Fe) during heating ...... See Entry 108733

Micromagnetism of two-phase quasi-single-domain particles . See Entry 108736

Large uniaxial magnetic anisotropy in amorphous Tb-Fe evaporated thin films ...... See Entry 108741

Magnetic properties of amorphous sputtered Co_xSi_{1-x} films ...... See Entry 108743

Stripe domains in polycrystalline Fe thin films obtained from thick foils ...... See Entry 108745

Influence of magnetostriction on FMR in thin garnet (111) films ...... See Entry 108792

One-magnon Raman scattering in $RFeO_3$—magnetic anisotropy and magnon softening ...... See Entry 108933

75.30K Magnetic phase boundaries
(inc. magnetic transitions, metamagnetism, etc)

108683 Curie temperature in homologous series of Heusler alloys. L.S.Palatnik, I.I.Fal'ko.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.8, p.51-3 (1983). In Ukrainian.
The δ-Mn BCC lattice constant and the critical Curie temperature of transition from ferro-to paramagnetic state are estimated by a crystallochemical analysis of the Heusler alloy structure for predicted but not yet studied 'homologous' series of alloys: Co_2MnC, Co_2MnPb; Ni_2MnB, Ni_2MnAl, Ni_2MnTl, Cu_2MnB, Cu_2MnGa, Cu_2MnTl. (12 refs.)

108684 The anomalous orientation transition in disordered weak ferromagnets. E.V.Sinitsyn, I.G.Bostrem.
Fiz. Nizk. Temp. (USSR), vol.9, no.8, p.873-6 (Aug. 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The possibility is shown for the orientation transition induced by the external field applied along the weak magnetic moment to occur in noncollinear antiferromagnets with fluctuations of Dzyaloshinsky's interaction. The magnetization curve for the systems undergoing the transition is similar to that for the two-sublattice ferrimagnet. (6 refs.)

108685 Thermodynamics and the spin-glass transition. C.N.Guy, J.G.Park (Blackett Lab., Imperial Coll., London, England).
J. Phys. F (GB), vol.13, no.9, p.1955-64 (Sept. 1983).
New measurements of the magnetisation of a CuMn spin glass (0.25 at.%) are presented in order to test the hypothesis that the field-cooled magnetisation $M(H,T)$ of a spin glass can be treated by the relationships of equilibrium thermodynamics. Comparisons are made between direct measurements of $(\partial M/\partial T)_H$ and $(\partial^2 M/\partial T^2)_H$ and those deduced from recent heat capacity and magnetocaloric experiments performed on similar specimens. The results show that above 0.05 T all three experiments agree closely. At low fields, however, there are small but significant differences that most probably arise from the use of different specimens for the three experiments but might have different causes. It is concluded that the equilibrium hypothesis is consistent with the experimental data at present available but that further experiments at low fields are required to test it thoroughly. The hypothesis has the remarkable implication that just below the glass temperature the entropy of a field-cooled spin glass increases with field in low fields and goes through a maximum as the field is increased (at 0.05 T for our specimen). An analogy is drawn between this behaviour and that of an ordered antiferromagnet for which the entropy is also an increasing function of field. (12 refs.)

108686 Magnetic properties of dysprosium oxisulphate ($Dy_2O_2SO_4$). H.Hulsing, A.Kasten (Phys. Inst., Univ. Karlsruhe, Karlsruhe, Germany).
Phys. Status Solidi b (Germany), vol.118, no.2, p.725-41 (1 Aug. 1983).
Below $T_N=(8.05\pm0.10)$K $Dy_2O_2SO_4$ is a nearly two-dimensional co-linear Ising antiferromagnet. At low temperatures ($T\leq2.4$K) and in external magnetic fields between 1.7 and 2.2 T along the ordering direction there is an intermediate ferrimagnetic phase with a $T=0$ magnetization of 1/3 of the saturation value. From Zeeman spectroscopy and theoretical considerations the structure of the magnetic phases are derived. The details of the phase diagram as established by magnetization measurements are not reproduced by mean field calculations. At the boundary between the antiferromagnetic and ferrimagnetic phase there is a hysteresis which is asymmetric with respect to the sweep direction of the external magnetic field. This behaviour can be explained by the occurrence of different magnetization processes. The time constants as determined experimentally are of the order of ten minutes. (19 refs.)

108687 Magnetic properties and thermal expansion of $(Zr_{1-x}Ta_x)Fe_2$. Y.Muraoka, M.Shiga, Y.Nakamura (Dept. of Metal Sci. & Technol., Kyoto Univ., Kyoto, Japan).
Phys. Status Solidi a (Germany), vol.78, no.2, p.717-22 (16 Aug. 1983).
Magnetization, Mossbauer effect, and thermal expansion are measured on the pseudobinary $(Zr_{1-x}Ta_x)Fe_2$ Laves phase intermetallic compounds. With increasing x, the crystal structure changes from C15 to C14 around $x=0.3$ to 0.4. Ferromagnetism is observed for the C15 phase and antiferromagnetism for the C14 phase, where the spin structure is considered to be the same as that of $TiFe_2$. An Invar-like large thermal expansion anomaly is observed, most prominently for $x=0.2$. A strong magnetovolume coupling is found in the antiferromagnetic C14 phase as well as in the ferromagnetic C15 phase. (22 refs.)

108688 Successive phase transitions in a random system $\mathrm{Mn_{1-x}Zn_x(HCOO)_2.2D_2O}$. M.Matsuura, K.Koyama, Y.Murakami, Y.Ajiro, N.Terata (Faculty of Engng. Sci., Osaka Univ., Toyonaka, Japan).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.206 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
$\mathrm{Mn(HCOO)_2.2D_2O}$(MnF2D) is a quasi two-dimensional(2D) Heisenberg antiferromagnet. The canting interaction in the system couples the staggered mode weakly to the uniform one. Thus, susceptibility X_0 and magnetization M are sensitive indicators of the staggered parameters X_{os} and L, respectively. A sharp peak of X_0 of MnF2D at T_{N}, which shows the divergence of X_{os}, is split into three by random mixing of ZnF2D. Correspondingly, spontaneous magnetization M_{s}, which appears by cooling the sample in a field into the ordered phase and then removing the field, decreases in three stages as the temperature increases. The first singular point is the transition temperature T_{N} from the paramagnetic into an ordered phase. The phase below the final point T_{p2} is found by NMR to be an ordered state with the same spin configuration as in the pure system below T_{N}. (no refs.)

108689 Investigation of the magnetic and superconducting properties of $\mathrm{(Er_{1-x}Ho_x)Rh_4B_4}$. J.W.Lynn (Dept. of Phys., Univ. of Maryland, College Park, MD, USA), R.N.Shelton, H.E.Horng, C.J.Glinka.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.224-6 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Neutron scattering, susceptibility and resistivity measurements have been carried out for the system $\mathrm{(Er_{1-x}Ho_x)Rh_4B_4}$ near the multicritical point where the magnetic and superconducting phase boundaries converge ($x \simeq 0.9$). On the Ho rich side ($x > x_{\mathrm{c}}$) no superconducting state is observed, whereas for $x < x_{\mathrm{c}}$ there is a temperature interval $T_{\mathrm{c2}} < T < T_{\mathrm{cl}}$ where superconductivity exists. For all concentrations studied a transition to a long-range ordered ferromagnet is observed, with the Ho moments ordering along the tetragonal axis. The behavior of the order parameter is mean-field like, indicating that the range of the magnetic interactions is large. For $x \sim x_{\mathrm{c}}$ the ferromagnetic transition appears to be continuous, and occurs within the superconducting phase, suggesting the coexistence of ferromagnetic order and superconductivity. Below T_{m}, strongly temperature dependent small angle scattering is observed, characterized by a cross section of the Porod form $S(Q)=A(T)/Q^4$. The strength of the scattering $A(T)$ increases monotonically with decreasing temperature. (8 refs.)

108690 Magnetic phase transition in $\mathrm{(Mn_{0.95}Ni_{0.05})_3B_4}$. T.Ishii, M.Shimada, M.Koizumi (Inst. of Sci. and Industrial Res., Osaka Univ., Osaka, Japan), Y.Nishihara, Y.Yamaguchi.
Solid State Commun. (USA), vol.47, no.4, p.303-5 (July 1983).
It was found that the metallic compound $\mathrm{(Mn_{0.95}Ni_{0.05})_3B_4}$ was ferromagnetic below 195K and antiferromagnetic between 195 and 354K. The transition temperature from ferromagnetic to antiferromagnetic increases with increasing external magnetic field. On the other hand, the transition temperature from antiferromagnetic to paramagnetic decreases with increasing magnetic field. It is expected that the present results might be explained by the theoretical results on the coexistence of ferro- and antiferromagnetism in the itinerant electron system reported by Moriya and Usami (1977). (6 refs.)

108691 Local and itinerant magnetism and superconductivity in R $\mathrm{Rh_2Si_2}$ (R=rare earth). I.Felner, I.Nowik (Racah Inst. of Phys., Hebrew Univ., Jerusalem, Israel).
Solid State Commun. (USA), vol.47, no.10, p.831-4 (Sept. 1983).
Magnetization and Mossbauer studies reveal that R $\mathrm{Rh_2Si_2}$ (R=rare earth) have two magnetic phase transitions, one corresponding to the ordering of the rare earth (T_{N}=27-130K) and the other to the itinerant electron ordering of the Rh sublattice (T_{M}=5-17K). $\mathrm{LaRh_2Si_2}$ has also been studied by resistivity, specific heat and a.c. susceptibility measurements. All studies indicate that $\mathrm{LaRh_2Si_2}$ orders magnetically at $T_{\mathrm{M}}\mathrm{K}=7\mathrm{K}$ and becomes superconducting, type II, at $T_{\mathrm{c}}=3.8\pm0.2\mathrm{K}$. (8 refs.)

Neutron diffraction camera method applied in the study of phase transition .... See Entry 107490

Preparation, crystallization, and magnetic properties of amorphous $\mathrm{Fe_{100-x}B_x}$ ($18 \leq x \leq 42$) .... See Entry 107555

Spinodal decomposition in Fe-Cr alloys studied by small angle neutron scattering .... See Entry 107953

Evidence for Ising and Potts transitions in the ϵ-ζ transformation of two-dimensional $\mathrm{O_2}$ .... See Entry 108175

Filling of the 3d band of the manganese in $\mathrm{GdAl_{2-x}Mn_x}$ for $x<0.2$ .... See Entry 108276

Valence fluctuations and magnetic-nonmagnetic transitions in a model for intermediate-valence systems .... See Entry 108360

On the resistive anomaly in NiCuSi and NiCuZn alloys near the Curie temperature .... See Entry 108387

Charge-density-wave-like transition in $\mathrm{V_3Te_4}$ .... See Entry 108399

Coexistence of antiferromagnetism and superconductivity in CrRe alloys .... See Entry 108591

Superconductivity and magnetism in ternary rare-earth compounds .... See Entry 108595

Theory of two-band ferromagnetism .... See Entry 108632

A spin fluctuation theory of degenerate narrow bands—finite-temperature magnetism of iron .... See Entry 108634

The magnetic structure of $\mathrm{HoCo_2Si_2}$ .... See Entry 108641

Crystal and magnetic structure of the $\mathrm{CoMn_{1-x}Ti_xSi}$ system .... See Entry 108643

Magnetic structures of monoclinic FeGe .... See Entry 108644

Antiferromagnetism of $\mathrm{YMn_2}$ intermetallic compound .... See Entry 108647

Magnetic structure of hcp Ho-Ce and Er-Ce alloys .... See Entry 108649

Magnetic susceptibilites of the frustrated triangular lattice antiferromagnets $\mathrm{CsVCl_3}$ and $\mathrm{VX_2}$ (X=Cl, Br and I): appearance of magnetic liquid in the ordered state .... See Entry 108654

Field dependence of the d.c. magnetic susceptibility in $\mathrm{Fe_xMg_{1-x}Cl_2}$ .... See Entry 108655

Magnetic susceptibility and the spin-glass transition of $\mathrm{Cd_{1-x}Mn_xS}$ and $\mathrm{Zn_{1-x}Mn_xS}$ at low temperatures .... See Entry 108656

Double coordination of iron in the phase $\mathrm{Fe_xZrSe_2}$ ($0<x<0.25$): magnetic properties and Mossbauer characteristics .... See Entry 108658

The magnetic properties of some $\mathrm{R_5Pt_3}$ compounds (R=Gd, Tb, Dy, Ho) .... See Entry 108659

The magnetism of the NiAs-type solid solution $\mathrm{Cr_xFe_{2-x}Te_3}$ .... See Entry 108661

Magnetic excitations in two-dimensional antiferromagnets $\mathrm{Rb_2Co_cNi_{1-c}F_4}$ .... See Entry 108674

Some refrigerant materials for a magnetic refrigerator near room temperature .... See Entry 108692

Fe-Zr amorphous alloys for magnetic refrigerants near room temperature .... See Entry 108693

Critical behavior of $\mathrm{Fe_{15}Ni_{65}B_{18}Si_2}$ ferromagnetic glass .... See Entry 108704

Spin glassiness and ferromagnetism in disordered Ni-Mn alloys .... See Entry 108712

Monte Carlo study of a triangular Ising lattice. II. Occurrence of the Kosterlitz-Thouless-like phase transition .... See Entry 108717

Magnetic behaviour of spin-glass alloys beyond the percolation concentration .... See Entry 108720

Low-temperature magnetization of amorphous and microcrystalline Co-P alloys .... See Entry 108726

Large uniaxial magnetic anisotropy in amorphous Tb-Fe evaporated thin films .... See Entry 108741

Influence of plastic deformation on magnetic interaction in $\mathrm{FePt_3}$ alloy .... See Entry 108754

Magnetic couplings in $\mathrm{Cs_2IrCl_6}$ and other iridium hexachlorides from NMR studies .... See Entry 108809

Proton spin-lattice relaxation in the three metamagnetic states of $\mathrm{CoCl_2.2H_2O}$ .... See Entry 108814

NMR study of $\mathrm{GdRh_4B_4}$ and $\mathrm{SmRh_4B_4}$ .... See Entry 108815

75.30S Magnetocaloric effect

108692 Some refrigerant materials for a magnetic refrigerator near room temperature. H.Maeda, M.Sato, M.Uehara (Tsukuba Labs., Nat. Res. Inst. for Metals, Ibaraki, Japan).
J. Jpn. Inst. Met. (Japan), vol.47, no.8, p.683-7 (Aug. 1983). In Japanese.
For $\mathrm{Ni_2(Mn_{1-x}M_x)Sn}$ with M=V and Nb (x=0.1, 0.2, 0.3 and 0.4), and $\mathrm{Mn_{3-y-z}Cr_yAlC_{1+z}}$ (y=0 and z=−0.16, −0.8 and 0, and z=0.1 and y=0, 0.06, 0.15 and 0.26) the Curie temperature T_{c}, the saturation magnetization M_{s}, and the magnetic entropy ΔS_{M} near T_{c} have been studied. The values of ΔS_{M} are determined from the measured magnetization-temperature curves. As x or $(y+z)$ increases, the values of T_{c} linearly decrease from room temperature to about 200K, and M_{s} also linearly decreases. The largest values of the maximum magnetic entropy $(\Delta S_{\mathrm{M}})_{\mathrm{Max}}$ obtained at x=0.1 to 0.2 in the former system and at y=0 and z=0.1 in the latter one reach about half of that of Gd, and $(\Delta S_{\mathrm{M}})_{\mathrm{Max}}$ gradually decreases with increasing x or y. Furthermore, the values of ΔS_{M} are calculated using a molecular field approximation. The calculated values are in agreement with the experimental ones for the materials with low x or y, but the difference between both values becomes large with increasing x or y, and particularly in the former system with M=Nb and in the latter one with $z \leq 0$. (10 refs.)

108693 Fe-Zr amorphous alloys for magnetic refrigerants near room temperature. H.Maeda, M.Sato, M.Uehara (Tsukuba Labs., Nat. Res. Inst. for Metals, Ibaraki, Japan).
J. Jpn. Inst. Met. (Japan), vol.47, no.8, p.688-91 (Aug. 1983). In Japanese.
$\mathrm{(Fe_{1-x}Ni_x)_{90}Zr_{10}}$ (x=0, 0.1, 0.02 and 0.03) and $\mathrm{(Fe_{0.95}M_{0.05})_{90}Zr_{10}}$ (M=Al, Si, Ga, Ge, and Sn) amorphous alloys with thickness of about 20 μm were prepared by a single roll-quenching technique and a piston anvil-quenching one. The Curie temperature T_{c}, the saturation magnetization M_{s} and the magnetic entropy ΔS_{M} of the alloys have been investigated. The values of T_{c} increase from 240K to near room temperature with increasing x up to 0.05, tending to increase with increasing atomic number of the elements M. The values of ΔS_{M} as well as M_{s} increase with increasing x, and ΔS_{M} increases in proportion to the magnetic field H. The maximum magnetic entropy $(\Delta S_{\mathrm{M}})_{\mathrm{Max}}$ of 13 $\mathrm{kJ.m^{-3}.K^{-1}}$ near T_{c} at H up to 1.12 $\mathrm{MA.m^{-1}}$ is about 50% smaller than that of Gd. However, the change in ΔS_{M} with temperature T is much smaller than those of Gd and other crystallines. The curves of ΔS_{M}-T cannot be approximated by a molecular field theory. (6 refs.)

Quadrupolar ordering in a non-magnetic cubic doublet system: $\mathrm{Cs_2NaHoF_6}$ .... See Entry 108800

75.40 CRITICAL-POINT EFFECTS, SPECIFIC HEATS, SHORT-RANGE ORDER

(inc. spin glasses)

108694 Dynamics of the soliton instability in the easy-plane ferromagnetic chain. H.J.Mikeska, K.Osano (Inst. fur Theoretische Phys., Univ. Hannover, Hannover, Germany).
Z. Phys. B (Germany), vol.52, no.2, p.111-16 (1983).
The authors present results on the nonlinear dynamics of a realistic classical easy-plane ferromagnetic chain in an external magnetic field, concerning in particular the dependence of soliton solutions on the strength of the single-ion anisotropy. After giving two exact static solutions, slowly moving permanent profile solutions are investigated. The velocity dependent contribution tothe energy as well as the amplitude of the out-of-plane distortion of these solutions is shown to diverge when the Magyari-Thomas-Kumar instability of the static Sine-Gordon soliton is approached. The dynamic origin of this instability is shown to be an unstable behaviour of the soliton towards spontaneous motion instead of a soft mode. (11 refs.)

108695 Investigation of directional short-range ordering in iron alloys by the NGR method. G.A.Dorofeyev, V.S.Litvinov (Ural Polytechnical Inst., Sverdlovsk, USSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.470-82 (1982). [received: Aug. 1983]
Discusses new possibilities of applying the nuclear gamma resonance (NGR) method to investigate directional ordering of BCC and FCC ferromagnetic alloys. Directional ordering in the arrangement of the Fe and Si atoms was found in iron silicide (5.7 at.% Si) slowly cooled from 950°C. It is shown that Mossbauer spectra of iron silicide can best be described by assuming the disperse directional short-range ordering of atomic structure of the $\mathrm{Fe_{15}Si}$ type. In the first coordination sphere this structure is characterized by short-range order, and in the second by preferred orientation of the Fe-Fe atomic pairs along the direction of spontaneous magnetization. (18 refs.)

108696 Coexistence of the long-range magnetic order and spin-glass state in ordering alloy $FePd_2Au$ with the FCC lattice. M.A.Borozdina, Yu.A.Vereshchagin, F.A.Sidorenko, A.A.Kuranov, P.V.Gel'd, Yu.G.Karpov (S.M. Kirov Ural Polytech. Inst., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.80-4 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Magnetic properties of the alloy $FePd_2Au$ formed as a result of atomic ordering were determined. It was found that the competition between interactions with different signs in $FePd_2Au$ resulted in a transition from ferromagnetism in the atomically disordered state to antiferromagnetism in the ordered state, and the process involved the appearance and coexistence of ferromagnetic, antiferromagnetic, and spin-glass states. (12 refs.) *A.T.*

108697 On stable three-dimensional low-amplitude solitons in magnetic materials. B.A.Ivanov, A.M.Kosevich.
Fiz. Nizk. Temp. (USSR), vol.9, no.8, p.845-50 (Aug. 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The authors are considering three-dimensional centrally symmetric solitons of an equation similar to the Schrodinger nonlinear equation, but unlike the standard situation containing fourth (not second) derivatives with respect to coordinates. It describes macroscopically quasi-particles whose effective mass goes to infinity. It is shown that in contrast to the standard situation, in such systems there may be three-dimensional low-amplitude solitons representing bound states of a large number of quasi-particles. The energy per quasi-particle in the bound state is smaller than that of a continuous spectrum which suggests stability of the soliton. (8 refs.)

108698 Critical measurements in the spin glass CuMn. R.Omari, J.J.Prejean, J.Souletie (Centre de Recherches sur les Tres Basses Temperatures, CNRS, Grenoble, France).
J. Phys. (France), vol.44, no.9, p.1069-83 (Sept. 1983).
The authors present experimental data on the magnetization $M(H)$ of a CuMn 1 at.% in the range $T_c \leq T \leq 4\ T_c$, $0<H<7$ teslas. They took special precautions in order to eliminate systematic errors and improve the reliability of the data. It was then possible to study the temperature dependence of the first coefficients A_1, A_3, A_5 in the expansion of the low field magnetization data in terms of odd powers of H/T ($M=\Sigma A_{2n+1}(^H/_T)^{2n+1}$), in the range $1.1\ T_c \leq T \leq 4\ T_c$. From the divergence of A_3 and A_5 (which vary over 3 and 6 orders of magnitude respectively in this range), they derive two exponents ($\gamma=3.25$, $\beta=0.75\pm0.25$) which allow the rescaling of all the data points onto a universal function. The success of the scaling argument is strong evidence in favour of the existence of a phase transition in three dimensions for RKKY spin glasses. (29 refs.)

108699 Order parameters in spin glasses. K.H.Fischer (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany), J.A.Hertz.
J. Phys. C (GB), vol.16, no.25, p.5017-22 (10 Sept. 1983).
Various proposed characterisations of the freezing in spin glasses are examined in the light of the fluctuation-dissipation theorem. The authors find a variety of possible choices for the order parameter, all conseistent with linear respons theory, differing from each other according to the set of states accessible in the different situations. (35 refs.)

108700 On the internal fields in vector spin glasses with random uniaxial local anisotropy. O.Hudak (Inst. of Experimental Phys., Slovak Acad. of Sci., Kosice, Czechoslovakia).
J. Phys. C (GB), vol.16, no.26, p.5203-9 (20 Sept. 1983).
Local internal fields h_i^0 in vector spin glasses with random uniaxial local anisotropy are shown to be positive on all non-isolated spins whenever the spin state corresponds to any minimum of configurational energy within the classical theory. Moreover it is shown that there exists a lower positive bound on the values of the local internal fields. This bound depends on the exchange interaction constants and on the strength of the local anisotropy. (9 refs.)

108701 A study of the critical factorization of ternary dynamical spin correlations by the scattering of polarized neutrons in Fe above T_c. A.I.Okorokov, A.G.Gukasov, V.N.Slyusar, B.P.Toperverg, O.Scharpf, F.Fujara (B.P. Konstantinov Leningrad Inst. of Nuclear Phys., Acad. of Sci., Gatchina, USSR).
JETP Lett. (USA), vol.37, no.6, p.319-22 (20 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.6, p.269-72 (20 March 1983). [received: Sept. 1983]
It is shown experimentally that in the critical region $qR_c>1$ the temperature dependence of the ternary dynamical spin correlator agrees with the predictions of the Polyakov-Kadanoff operator algebra generalized to dynamical correlations. (7 refs.)

108702 A static interpretation of the order-parameters in spin-glasses. H.Orland (Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA).
J. Phys. Lett. (France), vol.44, no.16, p.L673-7 (15 Aug. 1983).
The spin-glass phase is described as a statistical mixture of an infinite number of phases. The order-parameters $q(x)$ and $\Delta(x)$, with $x \in [0,1]$ measure the correlation between the phases, and the linear response anomaly respectively. Sompolinsky's solution (1981) is recovered and reinterpreted. (14 refs.)

108703 Spin glass with short-range interaction induced by an electromagnetic field in semiconductors. II. High temperatures domain. M.Crisan, Zs.Gulacsi, M.Gulacsi (Dept. of Phys., Cluj Univ., Cluj, Rumania).
J. Magn. & Magn. Mater. (Netherlands), vol.38, no.1, p.67-77 (Aug. 1983).
For pt.I see ibid., vol.36, p.47 (1983). The spin-glass state which occurs in semiconductors due to the spin-spin interaction induced by an electromagnetic field is analysed in the high-temperature domain. The Abrikosov-Moukin model (1980) has been considered for this analysis, and the specific heat and magnetic susceptibility as function of temperature have been obtained. (4 refs.)

108704 Critical behavior of $Fe_{15}Ni_{65}B_{18}Si_2$ ferromagnetic glass. Z.Marohnic, D.Drobac, E.Babic, K.Zadro (Inst. of Phys., Univ. of Zagreb, Zagreb, Yugoslavia).
J. Magn. & Magn. Mater. (Netherlands), vol.38, no.1, p.93-8 (Aug. 1983).
AC susceptibility, magnetization and electrical resistivity around the Curie temperature (T_c) were measured for $Fe_{15}Ni_{65}B_{18}Si_2$ glass. The results yield $T_c=(307.6\pm0.1)$K and the following critical exponents $\gamma=1.50\pm0.03$, $\beta=0.375\pm0.01$, $\delta=5.1\pm0.1$ and $\alpha=-0.29\pm0.05$. These values were obtained in the reduced temperature interval $1\times10^{-3} \leq |T-T_c|/T_c \leq 5\times10^{-2}$. In spite of the fact that these values for the critical exponents were obtained from different measurements they obey the equality relations $\gamma=\beta(\delta-1)$ and $\gamma+2\beta+\alpha=2$. Reduced magnetisation and field follow a magnetic equation of state derived for a second-order phase transition over a wide temperature range. This set of critical exponents is compared with those derived from the Heisenberg model as well as with the usual ones for a pure crystalline ferromagnets. The comparison shows that the values of $|\alpha|$ and γ, for the present alloy, are considerably larger than those from the model and the usual crystalline ones. A similar difference is also observed in some other amorphous and dilute crystalline ferromagnets and is probably due to magnetic inhomogeneities. (30 refs.)

108705 Dynamics of the relaxation-time spectrum in a CuMn spin-glass. L.Lundgren, P.Svedlindh, P.Nordblad, O.Beckman (Dept. of Solid State Phys., Inst. of Technol., Univ. of Uppsala, Uppsala, Sweden).
Phys. Rev. Lett. (USA), vol.51, no.10, p.911-14 (5 Sept. 1983).
SQUID magnetometry measurements on a *Cu*Mn spin-glass reveal that the zero-field-cooled magnetization strongly depends on the time the sample is kept at constant temperature prior to the field application. This result is evidently at variance with the common belief that an equilibrium spin-glass state is quickly obtained after cooling in zero field. The nonequilibrium behavior, as reflected in the complex time dependence of $\partial m/\partial \ln t$, is interpreted to arise from slow dynamics of the relaxation-time spectrum. (8 refs.)

108706 Evidence for power-law spin-correlation decay from muon spin relaxation in *Ag*Mn spin-glass. D.E.MacLaughlin, L.C.Gupta (Univ. of California, Riverside, CA, USA), D.W.Cooke, R.H.Heffner, M.Leon, M.E.Schillaci.
Phys. Rev. Lett. (USA), vol.51, no.10, p.927-30 (5 Sept. 1983).
Muon spin relaxation measurements have been carried out below the 'glass' temperature T_g in *Ag*Mn spin-glasses. The muon spin-lattice relaxation rate varies with field H as $H^{-0.46\pm0.05}$ for $0.30 \leq T/T_g \leq 0.66$. This suggests that impurity-spin correlations decay with time as $t^{-\nu}$, $\nu \simeq 0.54\pm0.05$, in contrast to the more usual exponential decay. The present data therefore agree quantitatively with the prediction $\nu \simeq {}^1/_2$ of mean-field dynamic theories. (18 refs.)

108707 Magnetic short-range order and spin waves in Fe_3Si above the Curie temperature. P.V.Blanckenhagen, C.Lin (Inst. fur Angewandte Kernphys., Kernforschungszentrum Karlsruhe, Karlsruhe, Germany).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.173-5 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
In neutron scattering experiments on Fe_3Si the existence of magnetic short-range order and of spin-waves was detected at temperatures up to 250K above the Curie temperatures. (11 refs.)

108708 Theory of excitations in the 1d singlet ground state magnet $CsFeCl_3$. P.-A.Lindgard (Riso Nat. Lab., Roskilde, Denmark).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.190-2 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
$CsFeCl_3$ is a quasi one-dimensional planar magnet. Compared with the similar $CsNiF_3$ there is, however, a significant coupling between the chains which leads to an interesting soft mode behaviour. Using the correlation theory the temperature dependence and damping of the excitons are calculated and it is predicted that a central peak should appear at the soft mode wave vector. This mode absorbs all the spectral weight at the transition to long range order, whereas the soft mode tends to a finite frequency with decreasing weight. (6 refs.)

108709 Scaling of T_1^{-1} with T/T_{sf} in nearly magnetic systems. M.T.Beal-Monod (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France).
Phys. Rev. B (USA), vol.28, no.3, p.1630-2 (1 Aug. 1983).
The author points out that the calculation of the longitudinal spin-relaxation rate $T_1{-}^1$ in a strongly interacting, nearly magnetic Fermi system is a function of only the reduced temperature T/T_{sf} (where T_{sf} is the spin-fluctuation temperature, i.e. the Fermi temperature renormalized by the interactions), in the whole degenerate regime, $T<T_F$ (T_F, the degeneracy Fermi temperature), below, as well as above, T_{sf}. (10 refs.)

108710 Soliton confinement in polyacetylene due to interchain coupling. D.Baeriswyl, K.Maki (Dept. of Phys., Univ. of Southern California, Los Angeles, CA, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2068-73 (15 Aug. 1983).
The energy involved in the relative ordering of the dimerization patterns of neighboring $(CH)_x$ chains is evaluated with a model where the coupling is due to the interchain hopping of the π electrons. It is shown that this mechanism favors antiferromagnetic order between neighboring chains. Furthermore, it leads to soliton confinement. The energy associated with a pair of solitons on the same chain separated by l/a (CH) units is given by $E_c \simeq Wl/a$, where $W=4t_\perp{}^2/\pi t_0$. Substituting accepted values for the interchain and intrachain hopping energies, $t_\perp$ and t_0, the authors find $W \sim 10-3$K. (22 refs.)

108711 A new mean field theory on critical scaling in spin-glasses. K.Honda (Dept. of Appl. Phys., Nagoya Univ., Nagoya, Japan).
Solid State Commun. (USA), vol.47, no.10, p.815-18 (Sept. 1983).
The critical exponent γ, δ in the non-linear susceptibility are given by making use of the free energy simply consisting of order parameter, magnetization and what was previously named an internal field parameter. The crossover exponent ϕ also is obtained. It is found that they satisfy the scaling relations proposed independently by Suzuki et al. (1977). (21 refs.)

108712 Spin glassiness and ferromagnetism in disordered Ni-Mn alloys. J.S.Kouvel (Dept. of Phys., Univ. of Illinois, Chicago, IL, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.353-9
From magnetic measurements, the alloy $Ni_{78}Mn_{22}$ is found to undergo a field-induced transition from spin glassiness to ferromagnetism at a critical field that decreases from ~140 Oe to zero as the temperature is raised from 4.2K to40K, the ferromagnetic Curie point being ~270K. The alloy $Ni_{74}Mn_{26}$ is found to transform at 80K from a spin glass to a state of infinite initial susceptibility but no spontaneous magnetization and to remain so up to 155K, where it becomes paramagnetic. The spin-glass properties of $Ni_{78}Mn_{22}$ below 40K and of $Ni_{74}Mn_{26}$ below 80K include displayed hysteresis loops produced by cooling in a field. The changes in the hysteresis loops upon subsequent warming correspond to a gradual conversion of a unidirectional anisotropy to a uniaxial anisotropy. (16 refs.)

Broken ergodicity .... See Entry 105220

Holstein-Primakoff theory for many-body systems .... See Entry 105233

Determination of the spin-Peierls distortion in N-methyl-N-ethyl-morpholinium ditetracyanoquinodimethanide [MEM(TCNQ)$_2$]: neutron diffraction study at 6K .... See Entry 107663

Evidence for Ising and Potts transitions in the ϵ-ζ transformation of two-dimensional O_2 .... See Entry 108175

Valence fluctuations and magnetic-nonmagnetic transitions in a model for intermediate-valence systems .... See Entry 108360

Theory of two-band ferromagnetism .... See Entry 108632

A spin fluctuation theory of degenerate narrow bands—finite-temperature magnetism of iron .... See Entry 108634

Magnetic spectral response in the intermetallic compound $CeSn_3$ .... See Entry 108639

Competing magnetic orderings in random mixtures: $Fe_xNi_{1-x}Cl_2$ .... See Entry 108646

Antiferromagnetism of YMn_2 intermetallic compound .... See Entry 108647

Field dependence of the d.c. magnetic susceptibility in $Fe_xMg_{1-x}Cl_2$ .... See Entry 108655

Magnetic susceptibility and the spin-glass transition of $Cd_{1-x}Mn_xS$ and $Zn_{1-x}Mn_xS$ at low temperatures .... See Entry 108656

Solitons in the one-dimensional easy-plane ferromagnet .... See Entry 108675

Soliton dynamics in the one-dimensional antiferromagnet TMMC $[(CD_3)_4NMnCl_3]$ .... See Entry 108676

Inelastic neutron scattering studies of nonlinear excitations in the 1D ferromagnet $CsNiF_3$ with an external field .... See Entry 108677

Thermodynamics and the spin-glass transition .... See Entry 108685

Magnetic properties and thermal expansion of $(Zr_{1-x}Ta_x)Fe_2$ .... See Entry 108687

Investigation of the magnetic and superconducting properties of $(Er_{1-x}Ho_x)Rh_4B_4$ .... See Entry 108689

Fe-Zr amorphous alloys for magnetic refrigerants near room temperature .... See Entry 108693

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Effect of thermodynamic fluctuations of magnetization on the bound magnetic polaron in dilute magnetic semiconductors .... See Entry 108732

Critical indirect nuclear coupling in Rb_2IrCl_6 .... See Entry 108824

Mossbauer and magnetisation studies of the alloy $Fe_{0.69}Pd_{0.31}$ .... See Entry 108843

75.40D Ising and other classical spin models

108713 Phase diagrams for the spin-1 model with two- and three-spin interactions in the mean field approximation. M.Napiorkowski (Inst. of Theoretical Phys., Warsaw Univ., Warsaw, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.2, p.185-95 (Aug. 1983).
The spin-1 triangular model with two- and three-spin interactions in the presence of magnetic field is analyzed using the mean field approximation. The phase diagrams for different values of two- and three-spin couplings are presented. A comparison with analogous Ising-spin system is given. (10 refs.)

108714 A real-space renormalization group method for continuous-variable Ising model. II. W.Jezewski (Inst. of Molecular Phys., Polish Acad. of Sci., Poznan, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.2, p.215-23 (Aug. 1983).
For pt. I see ibid., vol.A53, p.163 (1980). A real-space renormalization group method is used to analyze the critical behaviour of the square Ising model described by an effective continuous-variable Hamiltonian on a lattice. The method is based on the renormalization transformation which consists of the decimation transformation in the integral form and the rescaling of variables. The thermal and magnetic critical exponents, ν and η, as well as the inverse critical temperature $\mathcal{K}_c$ are calculated using the cumulant expansion to second order. The values of ν and $\mathcal{K}_c$ are found to be in good agreement with the exact Onsager's results. (19 refs.)

108715 A continued fraction expansion of thermodynamic quantities using high-temperature expansions. B.Michalik (Inst. of Phys., Czechosl. Acad. Sci., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.8, p.941-50 (1983).
An algorithm for expanding a function into a continued fraction is given and applied to the dimensionless free energy and susceptibility of the Ising model of ferromagnetism. In terms of this expansion, approximate positions of critical points could be calculated. The author did it for the following lattices: p.t., s.q., s.c., f.c.c., b.c.c. and d. An inverse problem is solved, namely, the construction of the high-temperature expansion from a known development into the continued fraction. The author has found that some coefficients of the high-temperature expansion of the susceptibility are interrelated. Examples of these relations and a list of all mutually dependent coefficients are given for the above-mentioned lattices. (7 refs.)

108716 The order parameter in a spin glass. A.C.D.Van Enter, R.B.Griffiths (IHES, Bures-sur-Yvette, France).
Commun. Math. Phys. (Germany), vol.90, no.3, p.319-27 (1983).
Various possible precise definitions of an Edwards-Anderson type of order parameter for an Ising model spin glass are considered, using boundary conditions for a finite system, states of an infinite system and a duplicate-system approach. Several of these definitions are shown to yield identical results. (20 refs.)

108717 Monte Carlo study of a triangular Ising lattice. II. Occurrence of the Kosterlitz-Thouless-like phase transition. H.Takayama, K.Matsumoto, H.Kawahara (Dept. of Phys., Hokkaido Univ., Sapporo, Japan), K.Wada.
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2888-97 (Aug. 1983).
For pt.I see ibid., vol.52, p.1774 (1983). A two-dimensional triangular Ising lattice with the nearest-neighbor antiferromagnetic interaction J_1 and the next-nearest-neighbor ferromagnetic interaction $-J_2$ is studied by the Monte Carlo simulation. It is shown that the system with a finite J_2 undergoes the successive phase transitions, paramagnetic$\rightarrow$Kosterlitz-Thouless (KT)-like$\rightarrow$ferrimagnetic phases, as temperature decreases. The sublattice switching phenomenon observed in previous work is shown to be an intrinsic property inherent to the present system which has an XY character. The marginal exponent of the order-parameter correlation function at the KT-like transition point is seen to increase from 1/4 as the ratio J_2/J_1 decreases, namely, it reveals a deviation from the universal behavior of a genuine XY model. (27 refs.)

108718 An approximate method for the free energy. J.R.Faleiro Ferreira, N.P.Silva (Dept. de Fisica, Univ. Federal de Minas Gerais, Belo Horizonte, Brazil).
Phys. Status Solidi b (Germany), vol.118, no.2, p.829-33 (1 Aug. 1983).
A variational approximate free energy expression is derived and used to calculate the critical temperature of the anisotropic Ising model. The results are better consistent than others variationally obtained. (7 refs.)

108719 Random field effects in magnets. R.J.Birgeneau (MIT, Cambridge, MA, USA).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.180-2 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Summary form only given. In order to explore the consequences of random field effects the author has carried out a series of neutron scattering experiments on the diluted Ising magnets: $Rb_2Co_{0.7}Mg_{0.3}F_4$, a two-dimensional Ising antiferromagnet; $Co_{1-x}Zn_xF_2$, a three-dimensional Ising antiferromagnet; and $Fe_{1-x}Zn_xF_2$. (12 refs.)

Modulated structure of an Ising spin system on a triangular lattice. II. Complete devil's staircase .... See Entry 105255

Site-bond disorder in the Ising model .... See Entry 105268

The diluted spin 1/2 Ising model in the honeycomb lattice .... See Entry 108628

Spin-Peierls state vs. Neel state. I. Small Ising anisotropy .... See Entry 108629

75.40F Heisenberg and other quantized spin models

108720 Magnetic behaviour of spin-glass alloys beyond the percolation concentration. A.Mookerjee, S.B.Roy (Dept. of Phys., Indian Inst. of Technol., Kanpur, India).
J. Phys. F (GB), vol.13, no.9, p.1945-54 (Sept. 1983).
Using a mean-field effective medium approach, the authors study the phase diagram of a random Heisenberg model. In particular they study the phases and magnetisation beyond the percolation limit, and compare these with the experimental observations in AuFe alloys with high concentrations of Fe. (20 refs.)

108721 Stability of the Parisi solution for Heisenberg spin glasses. A.V.Goltsev (A.F. Ioffe Phys. Tech. Inst., Acad. of Sci., Leningrad, USSR).
J. Phys. Lett. (France), vol.44, no.16, p.L697-700 (15 Aug. 1983).
For the Heisenberg spin glasses (the Sherrington-Kirkpatrick model) the Parisi solution which preserves a rotative symmetry is considered for the case $H=0$. Existence of massless modes is proved. (11 refs.)

108722 Dipolar interactions in the critical dynamics of Heisenberg ferromagnets. J.Kotzler (Inst. fur Angewandte Phys., Univ. Hamburg, Hamburg, Germany).
Phys. Rev. Lett. (USA), vol.51, no.9, p.833-5 (29 Aug. 1983).
It is shown that in contrast to previous assumptions the real magnetic dipole interaction has to be considered as a possible source of deviations of the dynamical exponent z from $^5/_2$ as observed recently on Fe and Ni. While the dipolar crossover temperatures agree with experiment, at T_c the dynamic crossover around the dipolar wave vector q_d as predicted by current theories is absent. It is argued that this effect is related to a hitherto overlooked dynamical decoupling between transverse and noncritical longitudinal fluctuations if q exceeds the inverse correlation range κ. (24 refs.)

108723 Spin dynamics of two three-dimensional Heisenberg ferromagnets near T_c. W.L.C.Rutten, J.C.Verstelle, N.J.Poulis (Kamerlingh Onnes Lab., Rijksuniv. Leiden, Leiden, Netherlands).
Physica B & C (Netherlands), vol.121B+C, no.3, p.351-69 (Aug. 1983).
An experimental determination and quantitative theoretical analysis will be presented of the macroscopic dynamic susceptibility of $Rb_2CuBr_4.2H_2O$ and $(NH_4)_2CuBr_4.2H_2O$ (two representatives of $S={}^1/_2$, Heisenberg ferromagnetic systems) in the temperature regime of magnetic ordering above T_c. Dynamics will be analysed in terms of the relaxation rate ρ^{-1}. In the theoretical expressions for ρ^{-1}, the macroscopic critical static susceptibility χ_0 plays an important role. Therefore, also χ_0 has been measured as accurately as possible, as well as T_c. Also, attention has been focused on the effect of exchange anisotropy and of dipolar interactions on the wave vector q-dependent relaxation rate $\Gamma(q, T)$. Moreover, the effect of antisymmetric exchange on the critical dynamics has been investigated, as well as the sample shape dependence (demagnetizing effects). Spin dynamics and static susceptibility results outside the critical regime above T_c are not analysed, although briefly presented.

Spin-Peierls state vs. Neel state. I. Small Ising anisotropy .... See Entry 108629

Competing interactions in Heisenberg quantum spin systems: ground-state calculations for finite clusters .... See Entry 108630

75.50 STUDIES OF SPECIFIC MAGNETIC MATERIALS

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75.50B Ferromagnetism of Fe and its alloys

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Small angle elastic and inelastic neutron scattering in $Fe_{0.7}Al_{0.3}$ .... See Entry 108665

Magnetic properties and thermal expansion of $(Zr_{1-x}Ta_x)Fe_2$ .... See Entry 108687

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75.50C Ferromagnetism of other metals

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Magnetic phase transition in $(Mn_{0.95}Ni_{0.05})_3B_4$ .... See Entry 108690
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75.50D Ferromagnetism of nonmetals

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75.50E Antiferromagnetics

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Preparation of Mn-Zn ferrites having a low temperature coefficient of permeability .... See Entry 109203

75.50K Amorphous magnetic materials

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Large uniaxial magnetic anisotropy in amorphous Tb-Fe evaporated thin films ....See Entry 108741

Magnetic properties of amorphous sputtered Co_xSi_{1-x} films ....See Entry 108743

75.50M Magnetic liquids

108724 Determination of ferrofluid structure by neutron polarization analysis. R.Pynn, J.B.Hayter (Inst. Max von Laue-Paul Langevin, Grenoble, France), S.W.Charles.
Phys. Rev. Lett. (USA), vol.51, no.8, p.710-13 (22 Aug. 1983).
Neutron polarization analysis is combined with small-angle scattering for the study of a concentrated cobalt ferrofluid. The geometry of the cobalt particle core and surrounding surfactant layer has been determined and an anomalous magnetic layer found at the cobalt surface. The interparticle structure factor, measured for the first time in a magnetically aligned ferrofluid, agrees well with a recent theory. Magnetic fluctuations, measured as a function of applied field, are found to be predominantly paramagnetic. (13 refs.)

Determination of the magnetic anisotropy of ferrofluids from torque magnetometry data ....See Entry 108681

Influence of a magnetic suspension on the domain structure of ferromagnetic films of various thicknesses ....See Entry 108746

75.60 DOMAIN EFFECTS, MAGNETIZATION CURVES, AND HYSTERESIS

108725 Magnetic cluster effects in $FeSi_{1-x}Ge_x$. P.Nordblad, L.Lundgren, O.Beckman (Dept. of Solid State Phys., Inst. of Technol., Uppsala Univ., Uppsala, Sweden).
Phys. Scr. (Sweden), vol.28, no.2, p.246-8 (Aug. 1983).
Magnetization measurements on the solid solution $FeSi_{1-x}Ge_x$ ($x \leq 0.5$) have been performed between 2 and 900K. For low germanium content ($x \leq 0.4$) the susceptibility shows a temperature dependence similar to that of pure FeSi. The susceptibility behaviour of FeSi has previously been interpreted in a localized spin model where a nonmagnetic ground state is separated from a magnetic excited state by a small energy gap. Our experimental results on $FeSi_{1-x}Ge_x$ indicate that the same model is applicable and that the energy gap decreases with an increase of germanium content and becomes zero at $x \simeq 0.6$. Magnetization measurements at low temperatures imply the presence of ferromagnetic clusters. The ordering temperature of the magnetic moments within these clusters is around 60K for $x=0.5$ and about 8K for $x=0.4$. For the germanium richest solid solution ($x=0.5$) we estimate the average cluster size to be 30 μ_B at 4.2K and assuming $S=1$ about 20% of the iron atoms are located within these clusters. (4 refs.)

Preparation, crystallization, and magnetic properties of amorphous $Fe_{100-x}B_x$ ($18 \leq x \leq 42$) ....See Entry 107555

75.60C Domain walls and domain structure

(for magnetic bubbles, see 75.70K)

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The influence of stress relaxation on charged walls in a (100)-oriented garnet film ....See Entry 108747

Observation of magnetic bubbles by Lorentz electron microscopy ....See Entry 108749

75.60E Magnetization curves, hysteresis, Barkhausen and related effects

108726 Low-temperature magnetization of amorphous and microcrystalline Co-P alloys. R.S.Iskhakov, G.V.Popov, M.M.Karpenko (L.V. Kirenski Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.85-93 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A vibrational magnetometer was used to determine the low-temperature magnetization and thus find the exchange interaction parameter α and the saturation magnetization M_O of microcrystalline and amorphous Co-P alloys. The phase diagram of these alloys was determined in terms of the exchange interaction and concentration of P. The region of the composition-dependent transition from a crystalline solid solution to an amorphous alloy was identified. Metastable states were observed in the course of crystallization of amorphous Co-P samples. The composition and topological disorder contributions were found and these were responsible for the changes in the exchange interaction in amorphous Co-P alloys compared with pure Co. It was found that the RMS deviation of fluctuations of the volume could be deduced from the temperature dependence of the macroscopic saturation magnetization. (23 refs.) *A.T.*

108727 Hysteresis and after-effects in massive substances. From spin-glasses to the sand hill. J.Souletie (Centre de Recherches sur les Tres Basses Temperatures, Grenoble, France).
J. Phys. (France), vol.44, no.9, p.1095-116 (Sept. 1983).
Discusses the problem of magnetic hysteresis in the framework of a model of a distribution of thermally activated double well potentials. Having shown the equivalence, at $T=0$, of this description with the classical picture of Preisach (1935) and Neel (1950, 1953), the author considers specifically the effects associated with the fact that the width of the distribution of the barrier-heights is necessarily finite. It is shown how this limit can be introduced in the classical Preisach construction and how it opens the door to the description of aftereffects (in terms of time and of temperature) as well as to the description of the effect of the field beyond the Rayleigh domain. The evolution of the different hysteresis loops of the remanences and susceptibilities are described in terms of field, time and temperature. A particular reference is made to the spin-glass case. The magnetization relaxations at different temperatures ($S(T)$ curves) and the Fulcher law are discussed. Finally, a justification of the Preisach construction is attempted within a language more adapted to the great generality of this construction which successfully applies to magnetic as well as to mechanical hysteresis or to the weight of a sand hill! !... This could be viewed as a first-order approach of nonergodic problems. (42 refs.)

108728 Determination of magnetisation distributions in ferromagnetic terbium and dysprosium. J.Grimm, J.Boysen, W.D.Brewer, G.V.H.Wilson (Fachbereich Phys., Freie Univ. Berlin, Berlin, Germany).
J. Phys. F (GB), vol.13, no.9, p.1931-44 (Sept. 1983).
A theoretical study of the distribution of directions of magnetisation in ferromagnets with sixfold hexagonal anisotropy is presented. The use of various approximate treatments for ferromagnets with a large axial anisotropy, such as terbium and dysprosium, is discussed; the calculated results are compared with magnetisation and nuclear orientation experiments on polycrystalline and single-crystal samples. (16 refs.)

108729 Magnetic studies in amorphous Gd_xY_{1-x} alloys. R.Krishnan, M.Dancygier, M.Laridjani (Lab. de Magnetisme, CNRS, Meudon, France).
J. Magn. & Magn. Mater. (Netherlands), vol.38, no.1, p.78-82 (Aug. 1983).
The authors reports a magnetic study on amorphous Gd_xY_{1-x} alloys with $x=0.17$ and 0.70 and 0.70. The alloy with $x=0.17$ is paramagnetic down to 4.2K. For $x=0.70$, magnetization shows a peak in low magnetic fields ($H<0.3$ T). Magnetic saturation is difficult to obtain even for fields up to 15 T. An extrapolated value gives a moment of 6.2 μ_B/Gd at. T_c is about 70K. This led to the conclusion that ferromagnetic and antiferromagnetic clusters are present in this alloy. The results are discussed by comparing them with crystalline Gd-Y alloys and amorphous Gd-Al, Gd-Au, etc. The effect of Y seems to be specific. (14 refs.)

108730 Mechanisms of magnetic losses in small-grain Ni-Zn ferrites. V.G.Efremov, E.V.Lebedeva, M.A.Kharinskaya (Dept. of Microwave Radiophys., Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.65-70 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.57-62 (1982).
Polycrystalline samples of nickel-zinc ferrites were used to study the dependence of the excitation threshold of spin waves on the grain size. The measurements were carried out on two series of samples. In the first, the zinc concentration was varied to change the anisotropy field, and in the second, the level of internal losses was varied by the introduction of small addition of cobalt ions. It is shown that, as the anisotropy field decreases (the coupling between grains increases) the increase of the threshold field with decreasing grain size becomes weaker. When cobalt ions are introduced, the dependence of the threshold field on the grain size disappears in the region of large grains. (9 refs.)

108731 Temperature dependence and frequency dispersion mechanisms of the magnetic permeability of monocrystalline Mn-Zn ferrite. V.P.Miroshkin, Ya.I.Panova (V.I. Ulyanov (Lenin), Leningrad.Electrical Engng. Inst.,USSR).
Phys. Status Solidi a (Germany), vol.78, no.2, p.K179-82 (16 Aug. 1983).
The magnetic permeability of monocrystalline ferrite with the composition $Mn_{0.7}Zn_{0.25}Fe_{2.05}O_4$ (according to the data of X-ray microanalysis) was investigated. Monocrystalline ferrite was grown by the Verneil technique. For the permeability measurements toroidally shaped specimens, were cut with the axis along the [110] direction. The magnetic permeability measurements were carried out by impedance bridges in the frequency range 1 kHz to 30 MHz and in the temperature interval from −80 to 140°C. (8 refs.)

108732 Effect of thermodynamic fluctuations of magnetization on the bound magnetic polaron in dilute magnetic semiconductors. T.Dietl (Inst. of Phys., Polish Acad. of Sci., Warszawa, Poland), J.Spalek.
Phys. Rev. B (USA), vol.28, no.3, p.1548-63 (1 Aug. 1983).
The authors consider the magnetic field and temperature dependences of the spin splitting for an electron localized on a shallow donor, taking into account the *s-d* coupling with the surrounding magnetic ions. They calculate the probability distribution of the spin splitting Δ with the thermodynamic fluctuations of magnetization included. These are responsible for persistence of the spin splitting at ambient temperature in the absence of the field. The probability distribution of the spin splitting is the main factor determining the energy and the shape of the optical transition line between the spin-split states. These compare their results with recent experimental results on spin-flip Raman scattering in $Cd_{1-x}Mn_xSe$. Their theory provides a satisfactory quantitative description of the donor electron accompanied by a nonuniform cloud of magnetization in that material. (24 refs.)

108733 Changes in the magnetic properties of alloy YuNDKT (35% Co, 15% Ni, 7% Al, 4% Cu, 5% Ti, 1% Nb, rest Fe) during heating. V.I.Sumin, T.P.Alentova.
Russ. Metall. (GB), no.1, p.137-40 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.161-3 (1982).
At elevated temperatures (up to 840°C), alloy YuNDK35T5BA has a high H_c value, above 800 Oe. For alloys YuNDK35T5BA, YuNDK25BA and Fe-Co-Cr, there is either a peak of a plateau on the $H_c(T)$ function in the range of isothermal thermomagnetic treatment. The H_c values calculated on the basis of the Stoner-Wolfarth theory show that the maximum on the $H_c(T)$ function can be explained by the dynamics of the change in I_s, $I_{s\beta}$, p_B and ΔN and the value of the t_c of the β_o phase. The dependence $H_c(I_s)$ can be used in analysing the structure changes in alloys for permanent magnets with shape anisotropy. (7 refs.)

108734 Magnetic properties of calcium-silicates (diopside and gehlenite) doped with iron (III). R.Noller, H.Knoll (Arbeitsgruppe Archaometrie, Inst. fur Anorganische und Analytische Chemie, Freien Univ. Berlin, Berlin, Germany).
Solid State Commun. (USA), vol.47, no.4, p.237-9 (July 1983).
The incorporation of Fe^{3+} cations into some Ca-silicates (diopside, gehlenite), substituting for alkali earths of different valencies and in differently coordinated lattice positions, will give rise to considerable lattice disorder. It is shown that this will result in special magnetization properties of these silicates. (6 refs.)

Ferromagnetism and superconductivity down to 0K in b.c.t. $ErRh_4B_4$ ....See Entry 108593

Theory of two-band ferromagnetism ....See Entry 108632

A spin fluctuation theory of degenerate narrow bands—finite-temperature magnetism of iron ....See Entry 108634

Magnetic ordering in the layered compound $(CD_3ND_3)_2CuCl_4$ ....See Entry 108645

Chelate polymer showing ferro- or ferrimagnetism at room temperature ....See Entry 108652

The magnetic properties of some R_5Pt_3 compounds (R=Gd, Tb, Dy, Ho) ....See Entry 108659

The magnetism of the NiAs-type solid solution $Cr_xFe_{2-x}Te_3$ ....See Entry 108661

Thermodynamics and the spin-glass transition ....See Entry 108685

Magnetic properties of dysprosium oxisulphate ($Dy_2O_2SO_4$) .. See Entry 108686

Magnetic properties and thermal expansion of $(Zr_{1-x}Ta_x)Fe_2$ .... See Entry 108687

Some refrigerant materials for a magnetic refrigerator near room temperature .... See Entry 108692

Fe-Zr amorphous alloys for magnetic refrigerants near room temperature .... See Entry 108693

Critical measurements in the spin glass CuMn .... See Entry 108698

Critical behavior of $Fe_{15}Ni_{65}B_{18}Si_2$ ferromagnetic glass .... See Entry 108704

Spin glassiness and ferromagnetism in disordered Ni-Mn alloys .... See Entry 108712

Magnetic behaviour of spin-glass alloys beyond the percolation concentration .. .. See Entry 108720

Process of magnetization of fine magnetically uniaxial ferromagnetic particles .... See Entry 108737

Variation of the magnetic properties of $SmCo_5$ powders by water milling .... See Entry 108740

Magnetic properties and structure of cobalt-platinum thin films .... See Entry 108742

Magnetic properties of amorphous sputtered Co_xSi_{1-x} films .... See Entry 108743

Magnetic and magnetoelastic properties of compounds $Tb(Fe_{1-x}Pt_x)_2$ .... See Entry 108750

Effects of compressive stress perpendicular to the surface of four percent silicon-iron single crystals .... See Entry 108752

Quadrupolar ordering in a non-magnetic cubic doublet system: Cs_2NaHoF_6 .... See Entry 108800

Mossbauer and magnetisation studies of the alloy $Fe_{0.69}Pd_{0.31}$ .... See Entry 108843

Magneto-optical properties of metallic ferromagnetic materials .... See Entry 108929

Examination of the structure, magnetic and elastic properties of single crystals of alloy Fe-25% Co-30% Cr-3.4% Mo .... See Entry 109380

Magnetic properties of alloy 40KhNYu-VI .... See Entry 109535

Interference resistance of tests on ferromagnetic products by Barkhausen-noise parameters .... See Entry 109676

75.60G High coercivity materials

108735 On the high energy product of Fe-Pt permanent magnet alloys. K.Watanabe, H.Masumoto (Res. Inst. of Electric & Magnetic Alloys, Sendai, Japan).
J. Jpn. Inst. Met. (Japan), vol.47, no.8, p.699-703 (Aug. 1983). In Japanese.
The relations betwen permanent magnetic properties and microstructures of Fe-34-67.5 at.%Pt binary alloys were investigated using a recording fluxmeter, X-ray diffraction and electron microscopy. The excellent permanent magnetic properties have been obtained by water-quenching from a temperature in the γ phase range and subsequent reheating at a lower temperature in the γ_1 phase range. A typical Fe-38.5 at.% Pt alloy exhibits the highest value of maximum energy product of 159 $kJ.m^{-3}$ (20 MG.Oe), with a coercive force of 340 $kA.m^{-1}$ (4.3 kOe) and a residual flux density of 1.08 T (10.8 kG). It is presumed that the excellent permanent magnetic properties are related to the band microstructure of the γ_1 order phase with the $L1_0$-type structure and a high crystal magnetic anisotropy. (15 refs.)

Variation of the magnetic properties of $SmCo_5$ powders by water milling .... See Entry 108740

75.60J Fine-particle systems

108736 Micromagnetism of two-phase quasi-single-domain particles. I.I.Kryokov, N.A.Manakov (Pedagogical Inst., Irkutsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.5-8 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The methods of the theory of micromagnetism are used to study the stability of a homogeneously magnetized state of a two-phase quasi-single-domain particle with a uniaxial magnetic anisotropy. A spherical particle is considered and it is assumed that its surface layer differs from the bulk of the particle in respect of the magnetic anisotropy and exchange interaction constants, and also in respect of the saturation magnetization. An analytic expression is obtained for the critical field needed for the formation of a canted magnetic structure when the surface layer is sufficiently thin. (6 refs.) *A.T.*

108737 Process of magnetization of fine magnetically uniaxial ferromagnetic particles. M.M.Solov'ev (Inst. of Metal Phys., Ural Sci. Center, Acad. of Sci., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.25-9 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The magnetization curves are calculated for particles which are in the form of a rectangular parallelepiped and consist of two or three domains which repeat the geometric shape of the sample. The effects of the size and shape of the particles are considered. The characteristics of the magnetic behaviour of the particles with this type of domain structure are studied and the stability is considered. (10 refs.) *A.T.*

108738 Theory of agglomeration of ferromagnetic particles in magnetic fluids. K.Sano, M.Doi (Dept. of Phys., Tokyo Metropolitan Univ., Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2810-15 (Aug. 1983).
For some magnetic fluids, large agglomerates of magnetic particles are formed when a weak magnetic field is applied. The authors regard this phenomenon as a kind of gas-liquid phase transition induced by the magnetic field, and study the condition for the formation of the agglomerates by a simple mean field theory. It is found that if the particle is small enough, no phase separation occurs even if the magnetic field is infinitely large, while if the particle is large, the liquid phase appears at certain magnetic field. The van der Waals attraction between the particles enhances the agglomeration. (15 refs.)

108739 Magnetic components and particle size distribution of coal flyash. G.Chaddha, Mohindar S. Seehra (Dept. of Phys., West Virginia Univ., Morgantown, WV, USA).
J. Phys. D (GB), vol.16, no.9, p.1767-76 (14 Sept. 1983).
The results of a detailed study into the nature and concentration of magnetic components as a function of particle size in five flyash samples of bituminous coals are reported. Samples were size-fractioned into ten fractions each using sieves and temperature-dependent magnetisation studies were used to determine the magnetic components. Observation of the Verwey transition near 120K and an anomaly near 250K in the magnetisation indicate the presence of Fe_3O_4 and α-Fe_2O_3 respectively. Confirmatory evidence for the presence of these minerals was obtained from X-ray diffraction studies of the samples. Magnetic components and mass distribution were determined as a function of particle size and it is found that about half the mass and magnetic components are contained in the fraction with the smallest particles (diameter ≤ 38 μm). Based on the variation of the saturation magnetisation M_s with particle size, the five samples can be classified into two groups: group I of three samples for which M_s falls off with increasing particle size and group II of two samples for which M_s is nearly constant with particle size. Other similarities within each group are: (i) nearly equal levels of Fe_3O_4 and α-Fe_2O_3 in group I whereas in group II, α-Fe_2O_3 has nearly four times the concentration of Fe_3O_4 and (ii) group II has a much higher level of unburnt carbon than group I. Correlations between these observations and combustion conditions of flyash are discussed and their possible applications are outlined. (15 refs.)

108740 Variation of the magnetic properties of $SmCo_5$ powders by water milling. E.Konig (Wissenschaftsbereich Phys., Hochschule fur Verkehrswesen 'Friedrich List', Dresden, Germany).
Phys. Status Solidi a (Germany), vol.78, no.2, p.K159-60 (16 Aug. 1983).
The process of grinding of $SmCo_5$ pieces takes place under a protective liquid. The protective liquid in the vibration mill has been varied: the milling medium benzene was compared with water. Initial material was a $SmCo_{4.7}$ powder with particle diameters of ≤ 0.25 mm. After grinding, powder samples were prepared in air. Employing the medium benzene the intrinsic coercitivity ${}_iH_c$ rises after a milling time of 5.5 h from 13×10^4 Am^{-1} to 131×10^4 Am^{-1}, while the specific saturation magnetization σ decreases from 10.94×10^{-5} $Vsmkg^{-1}$ to 10.57×10^{-5} $Vsmkg^{-1}$. The oxygen content amounts to 1.2 wt.%. In the case of water the oxygen of the powder specimens now reaches after the same time 6.5 wt.%. These samples show a lower specific saturation magnetization $\sigma=9.22\times10^{-5}$ $Vsmkg^{-1}$, but surprisingly a higher coercitivity ${}_iH_c=154\times10^4$ Am^{-1}. (5 refs.)

Determination of the magnetic anisotropy of ferrofluids from torque magnetometry data .... See Entry 108681

Magnetic resonance in very fine ferrimagnetic powder .... See Entry 108791

Mossbauer investigations on magnetically ordered precipitates in Cu-Ni-Fe .... See Entry 109536

Method for determining the effectiveness of dispersants for magnetic oxide .... See Entry 109810

75.60L Magnetic aftereffects

Hysteresis and after-effects in massive substances. From spin-glasses to the sand hill .... See Entry 108727

75.60N Magnetic annealing and temperature-hysteresis effects

Hysteresis and after-effects in massive substances. From spin-glasses to the sand hill .... See Entry 108727

75.70 MAGNETIC FILMS AND PLATES

108741 Large uniaxial magnetic anisotropy in amorphous Tb-Fe evaporated thin films. H.Kobayashi, T.Ono, A.Tsushima (Dept. of Appl. Phys., Waseda Univ., Tokyo, Japan), T.Suzuki.
Appl. Phys. Lett. (USA), vol.43, no.4, p.389-90 (15 Aug. 1983).
Magnetic properties of amorphous Tb-Fe alloy films have been investigated for magneto-optic memory media applications. The perpendicular magnetic anisotropy, saturation magnetization, and Curie temperature were investigated in the samples deposited by vacuum evaporation at different substrate temperatures *Ts*. A very large value (2×10^7 erg/cc) of the uniaxial anisotropy constant *Ku* was found in the samples deposited at a high substrate temperature (400°C), and it was found also that the saturation magnetization and Curie temperature exhibit a strong dependence on substrate temperature during the evaporation process. (3 refs.)

108742 Magnetic properties and structure of cobalt-platinum thin films. J.A.Aboaf, S.R.Herd, E.Klokholm (Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
IEEE Trans. Magn. (USA), vol.MAG-19, no.4, p.1514-19 (July 1983).
The magnetic properties of RF sputtered Co-Pt alloy thin films were studied as a function of Pt content from 0 to 80 at%. At room temperature, ferromagnetic films were obtained in the range 0-32 and 40-80 at% Pt. For Pt contents between 32 and 40 at%, discontinuities in the magnetization, magnetostriction, and coercivity versus Pt content were observed; however no discontinuity was observed in the resistivity. The structure of films containing about 25 at% Pt is a mixture of hexagonal and face-centered cubic (FCC) phases. At this composition the magnetostriction is small, but coercivities are large—700 to 2000 Oe—and dependent upon film thickness. The coercivities of these films do not change with heat treatment up to temperatures of 600°C but decrease markedly at 700°C. The properties of equiatomic Co-Pt films are similar to those of bulk alloys. In particular the large coercivity observed in films after heat treatment at 500° to 700°C is due to the formation of an ordered tetragonal phase within the face-centered cubic matrix. The structure of films of about 75 at% Pt is initially a disordered face-centered cubic phase and with heat treatment beginning at 500°C an ordered face-centered cubic phase forms. The coercivity of these films (~200 Oe) does not change with annealing at 500°C. It decreases slightly upon further annealing at 600° to 700°C. Electron microscope observations were used to correlate the magnetic properties with film structure. (7 refs.)

108743 Magnetic properties of amorphous sputtered Co_xSi_{1-x} films. J.M.Alameda, J.M.Gonzalez, F.Lopez, J.L.Vicent (Lab. de Magnetismo, Univ. Complutense, Madrid, Spain).
J. Magn. & Magn. Mater. (Netherlands), vol.38, no.1, p.105-8 (Aug. 1983).
Magnetic properties have been measured by transverse magneto-optic Kerr effect (MOKE) in amorphous sputtered Co_xSi_{1-x} films which are ferromagnetic and amorphous at room temperature with $0.55<x<0.80$. These as-sputtered films show an in-plane easy axis with the ratio of coercive force in the hard axis H_c (HA) to easy axis H_c (EA) and the value of the blocking field H_B almost constant with $0.60<x<0.80$. Transverse magnetic susceptibilities with bias magnetic field parallel (χ_{t0}) and perpendicular ($\chi_{t\pi/2}$) to the easy axis has been measured. These measurements show a deviation of Hoffmann's (1969) micromagnetic law for the susceptibilities. (12 refs.)

Spectrum of magnetostatic waves for two ferrite films with arbitrary magnetization ....See Entry 108679

Influence of magnetostriction on FMR in thin garnet (111) films ....See Entry 108792

Frequency dispersion and angular dependence of an equatorial change in the intensity of light transmitted by iron and cobalt films ....See Entry 108928

75.70K Domain structure (magnetic bubbles)

108744 Propagation of magnetic bubbles on ion implanted patterns in a (100) Bi-yttrium iron garnet film. R.Wolfe, L.C.Luther, R.C.LeCraw, R.A.Lieberman (Bell Labs., Murray Hill, NJ, USA).
Appl. Phys. Lett. (USA), vol.43, no.3, p.322-4 (1 Aug. 1983).
Magnetic bubbles have been propagated on ion implanted patterns in a (100) garnet film for the first time. Charged walls form in the implanted layer at the edges of unimplanted features due to stress relief at the pattern edges. In response to a rotating in-plane field, they circulate completely around unimplanted circles and 8-μm contiguous disk patterns, carrying underlying bubbles along. This is because in the Bi-yttrium iron garnet composition used, the magnetostriction coefficients λ_{100} and λ_{111} are both negative. (10 refs.)

108745 Stripe domains in polycrystalline Fe thin films obtained from thick foils. V.Rivera, R.Valenzuela (Inst. de Investigaciones en Materiales, Univ. Nacionale Autonoma de Mexico, Mexico City, Mexico).
KINAM Rev. Fis. (Mexico), vol.5, no.2, p.185-7 (1983).
The stripe domain structure has been explained by Saito et al. (1964) on the basis of an induced uniaxial anisotropy which is not contained within the plane of the film, although the mechanisms for the existence of the anisotropy in the evaporated film are not fully understood. As a result, the magnetization experiences wavelike deviations from the plane of the film. The authors report some stripe domains observed on (111) planes in polycrystalline Fe thin films obtained from thick foils by electropolishing, by means of Lorentz electron microscopy. (7 refs.)

108746 Influence of a magnetic suspension on the domain structure of ferromagnetic films of various thicknesses. B.A.Avramenko, L.I.Lukashenko, L.S.Palatnik, A.G.Shishkov (V.I. Lenin Polytech. Inst., Kharkov, Ukrainian SSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.66-71 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of the influence of a magnetic suspension on the dependence of the number n of transverse links in a domain wall on the thickness t of ferromagnetic permalloy films. It was found that a magnetic suspension shifted the dependence n(t) towards higher value of t, increasing thus the stability of Neel walls. An analysis is made of the processes of formation of helical domain structures and of wall doubling. A scheme explaining the appearance of such structures in the presence of a magnetic suspension is put forward. (13 refs.) *A.T.*

108747 The influence of stress relaxation on charged walls in a (100)-oriented garnet film. D.A.Saunders, M.H.Kryder (Electrical Engng. Dept., Carnegie-Mellon Univ., Pittsburgh, PA, USA).
IEEE Trans. Magn. (USA), vol.MAG-19, no.4, p.1505-8 (July 1983).
Planar domain configurations in a (100) garnet film indicate the presence of inverse magnetostrictive anisotropies along boundaries between implanted and unimplanted regions of the film. Stress relief at such boundaries has been cited as an important factor in the formation of charged walls in (111) films. The domains seen in this (100) film illustrate dramatically the effect of this stress relief. The stress is modeled as a uniaxial stress which gives rise to uniaxial anisotropies along the boundary. Because $\lambda_{100}$and λ_{111} are of different signs, the easy axis of magnetization is found to alternate perpendicular to and parallel to the boundary around an implanted disk. It is conjectured that (100) films with λ_{100} and λ_{111} of the same sign may successfully support charged walls suitable for bubble propagation. (8 refs.)

108748 Bubble film characterization by differential susceptibility measurements. P.Novotny (Inst. of Phys., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Phys. Status Solidi a (Germany), vol.78, no.2, p.K101-4 (16 Aug. 1983).
Describes a simple equipment proposed and built up for collapse field measurements of magnetic bubble materials. The differential susceptibility is measured by an induction method and the stripe collapse field H_{sc} is determined. It is shown that static parameters derived from the results agree with those obtained independently by optical measurements. (8 refs.)

108749 Observation of magnetic bubbles by Lorentz electron microscopy. D.Watanabe, T.Sekiguchi.
Solid State Phys. (Japan), vol.18, no.5, p.255-64 (May 1983). In Japanese.
Recent studies of magnetic bubbles in HCP cobalt, hexaferrite crystals and magnetic thin films with perpendicular anisotropy observed by means of Lorentz electron microscopy are reviewed. (24 refs.)

75.80 MAGNETOMECHANICAL AND MAGNETOELECTRIC EFFECTS, MAGNETOSTRICTION

108750 Magnetic and magnetoelastic properties of compounds $Tb(Fe_{1-x}Pt_x)_2$. V.F.Novikov, L.V.Apsitis, R.S.Gamidov (Lenin Komsomol Industrial Inst., Tyumen, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.77-9 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Magnetic and magnetoelastic properties of alloys of the quasibinary system $Tb(Fe_{1-x}Pt_x)_2$ were investigated. The laws governing the dependences of the magnetostriction, magnetization, and coercive force on the platinum content were determined at room temperature. (13 refs.) *A.T.*

108751 Laws of approach to magnetic saturation for interacting and isolated spherical and cylindrical defects in isotropic magnetostrictive media. A.P.Malozemoff (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
IEEE Trans. Magn. (USA), vol.MAG-19, no.4, p.1520-3 (July 1983).
Laws of approach to magnetic saturation are derived for interacting spherical and cylindrical defects in isotropic magnetostrictive media like amorphous materials. The normalized longitudinal magnetic deviation $\Delta M/M$ goes as $1/H^2$ for both cases, provided all defects have the same sign. For randomly signed defects, $1/H^{5/4}$ and $1/H^{3/2}$ laws are derived for spheres and cylinders, respectively. Isolated cylindrical defects obey a $1/H$ or $1/H^2$ law depending on whether the defect is small or large compared to an exchange length. (11 refs.)

108752 Effects of compressive stress perpendicular to the surface of four percent silicon-iron single crystals. T.Hiramatsu (Faculty of Engng., Oita Tech. Coll., Oita, Japan), K.Narita.
IEEE Trans. Magn. (USA), vol.MAG-19, no.4, p.1562-4 (July 1983).
Effects of compressive stress perpendicular to the surface of 4 percent silicon-iron single crystals on their magnetic properties were investigated. Picture frame single crystal specimens which were used had [100] and [111] orientation, respectively. The hysteresis loops at low field ($0<H<450$ A/m) were measured under the applied stress. For the 4 percent Si-Fe [100] specimen, a large decrease of induction under stress occurs at lower fields, and for the 4 percent Si-Fe [111] specimen, the induction increases with increasing applied stress at lower fields but decreases at higher fields and coincides with the same value of the zero stress case when H is greater than about 400 A/m. The stress versus B_r/B_m curves of the 4 percent Si-Fe [100] and [111] specimens were plotted to show the change of the induction under applied stress. (4 refs.)

108753 Stress induced magnetization changes of steel pipes—laboratory tests. D.L.Atherton, L.W.Coathup, D.C.Jiles, L.Longo, C.Welbourn (Dept. of Phys., Queen's Univ., Kingston, Ontario, Canada), A.Teitsma.
IEEE Trans. Magn. (USA), vol.MAG-19, no.4, p.1564-8 (July 1983).
Magnetometer surveys above gas pipelines show stress induced magnetic anomalies at pipe bends. This suggests a potential technique for the noninvasive monitoring of stress in buried pipelines, etc. Laboratory measurements of the magnetic field changes due to the elastic bending of 110 mm diameter pipe are presented. The effects of oreientation with respect to the earths field and of internal pressure are reported. Hysteretic effects are found to be important. (5 refs.)

108754 Influence of plastic deformation on magnetic interaction in $FePt_3$ alloy. S.Takahashi (Faculty of Engng., Iwate Univ., Morioka, Japan), K.Ikeda.
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2772-6 (Aug. 1983).
It was found that in the long range ordered $FePt_3$ alloy, which showed no ferromagnetism before plastic deformation, the application of cold work caused it to become quite strongly ferromagnetic. The mechanism of transition from antiferromagnetic to ferromagnetic coupling by plastic deformation has been elucidated in terms of dislocation theory with consideration of ferromagnetic and antiferromagnetic Fe-Fe interactions. It has been proposed that the Fe atoms at the Pt-sites, being ferromagnetically coupled, is proportional to the dislocation density at the early stage of plastic deformation and its square root at the advanced stage.

108755 Magnetostriction of dilute rate-earth bismuthides: the effect of non-S-state ions versus 'S-state' ions. H.U.Hafner, D.Davidov (II Phys. Inst., Univ. zu Koln, Koln, Germany), G.J.Nieuwenhuys.
J. Magn. & Magn. Mater. (Netherlands), vol.38, no.1, p.45-50 (Aug. 1983).
Shape magnetostriction measurements along the [001] direction were carried out for dilute rare-earth bismuthides; LaBi:R (R=Ce, Sm, Gd, Tb, Er) and the antimonide LaSb:Gd. The magnetostriction of LaBi:Ce and LaBi:Sm reveal the 'reverse magnetostriction' phenomenon, enabling the authors to extract an overall crystalline field splitting of 12K for the former compound. The magnetostriction of LaBi:Gd and LaSb:Gd which are significantly larger than that of the 'pure' hosts, can be explained by a modified version of a model previously suggested by them. The fitting procedure yields magnetoelastic coupling constants for LaSb:Gd and LaGi:Gd which have the correct sign and magnitude according to existing theories. (14 refs.)

Singular stresses in a soft ferromagnetic elastic solid with a flat annular crack ....See Entry 107047

Elastic deformation of nematic liquid-crystal media ....See Entry 107799

Antiferromagnetic antimonides $MnSb_2O_4$ and $NiSb_2O_4$ ....See Entry 108642

Soft-mode behaviour of magnetic excitations in praseodymium under uniaxial stress ....See Entry 108666

Magnetic properties and thermal expansion of $(Zr_{1-x}Ta_x)Fe_2$ ....See Entry 108687

Magnetic properties and structure of cobalt-platinum thin films ....See Entry 108742

The influence of stress relaxation on charged walls in a (100)-oriented garnet film ....See Entry 108747

Influence of magnetostriction on FMR in thin garnet (111) films ....See Entry 108792

76.00 MAGNETIC RESONANCES AND RELAXATION IN CONDENSED MATTER; MÖSSBAUER EFFECT

(for measurement techniques, see 07.58)

76.20 GENERAL THEORY OF RESONANCES AND RELAXATION

108756 Two-dimensional reorientation and magnetic resonance line shapes in semiordered solids. R.G.Kooser (Dept. of Chem., Knox Coll., Galensburg, IL, USA), H.A.Resing.
J. Phys. Chem. (USA), vol.87, no.14, p.2564-74 (7 July 1983).
For systems expected to exhibit a 2-DPAP (two-dimensional powder anisotropy pattern) modulated by fixed-angle reorientation, explicit model-dependent features are present in the near-rigid limit in the form of subsidiary peaks. The location of these peaks can be used to specify the microscopic reorientation model except in the pairs 2-4- and 3-6-site jumping. The advantage of the two-dimensional powder patterns over the previously published three-dimensional powder spectra is that the symmetry can be read directly from the location of the subsidiary peaks and spectral simulation may not be needed. This suggests that, where possible, systems be examined in the 2-DPAP mode. In the narrowed region, as is well-known from exchange theory, the line widths are determined by a correlation time. The authors have shown how to relate this correlation time to the jump probability from a given state, thus again extracting the details of the microscopic model from magnetic resonance techniques. (33 refs.)

76.30 ELECTRON PARAMAGNETIC RESONANCE AND RELAXATION

108757 Single-crystal EPR of the ^{17}O-enriched dioxygen adduct of vitamin B_{12r}: reversible oxygen bonding, electronic and geometric structure, and molecular dynamics. E.Jorin, A.Schweiger, H.H.Gunthard (Lab. for Phys. Chem., Swiss Federal Inst. of Technol., Zurich, Switzerland).
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4277-86 (29 June 1983).
Single-crystal EPR studies on the oxygen adduct of vitamin B_{12r} and on the thermodynamics of the oxygenation process of B_{12r} were carried out on vitamin B_{12b} crystals doped with B_{12r} and $B_{12r}O_2$. For the determination of the spin density on the dioxygen, some of the crystals were enriched to about 25% in ^{17}O. EPR spectra of $B_{12r}O_2$ between -160 and 40°C were recorded in three perpendicular planes defined by the crystallographic coordinate system a,b,c of the B_{12b} host crystal (space group $P2_12_12_1$). At -160°C, the **g** tensor and the two oxygen hyperfine tensors of $B_{12r}O_2$ are coaxial with the largest g principal axis along the O_α-O_β bond, whereas one of the principal axes of the cobalt hyperfine tensor is oriented approximately along the corrin normal. In this low-temperature modification the dioxygen molecule was locked in a single minimum potential. The Co-O_α-O_β moiety was bent with a bond angle of 111°. The projection of the O_α-O_β direction on the corrin ring lies between rings B and C and approximately bisects the angle N22-Co-N23. The magnetic parameters of the low-temperature modification were discussed in detail within the spin-pairing and the superoxide formulation models. A total spin density on the dioxygen of $\rho(O_2)=0.7\pm0.1$ has been calculated. Drastic temperature-dependent changes in the **g** and $\mathbf{A}^{Co}$ tensors of $B_{12r}O_2$ with respect to axes directions and principal values were observed. (59 refs.)

108758 Experimental methods to determine the microwave field strength in electron spin resonance. A.I.Vistnes (Inst. of Phys., Univ. of Oslo, Oslo, Norway), L.R.Dalton.
J. Magn. Resonance (USA), vol.54, no.1, p.78-88 (Aug. 1983).
Two simple methods for determining the microwave magnetic field at the sample position in ESR spectroscopy are presented. The first method is based on the magnetization hysteresis spectrum obtained from a combination of the in-phase and out-of-phase spectra. The other method is based on the power dependent linewidth. In both cases a tiny crystal of NMP-TCNQ is used that can easily be placed inside a flat cell or a capillary. The methods based on NMP-TCNQ can be used in a wider temperature range compared to methods based on an aqueous solution of PADS. Thus, temperatures below 0°C are attainable which in turn can be useful, e.g. in saturation transfer ESR experiments on model systems. (19 refs.)

108759 Electron paramagnetic resonance of the eclipsed layered compounds $NH_3(CH_2)_nNH_3CuBr_4$ with $n=2, 3, 4$. T.M.Kite, J.E.Drumheller (Dept. of Phys., Montana State Univ., Bozeman, MT, USA).
J. Magn. Resonance (USA), vol.54, no.2, p.253-6 (Sept. 1983).
The EPR of the eclipsed layered compounds alkane diammoniumtetrabromocuprate, $NH_3(CH_2)_nNH_3CuBr_4$, with $n=2$, 3, and 4 has been studied in the temperature range 113 to 296K. The angular dependence of the linewidths is explained by the use of the static spin correlations with emphasis on the extraction of the anisotropies and to confirm the expected departure from two-dimensional magnetism. A discussion of the static spin correlation effects including a possible explanation of the usual linear temperature dependence is included. Comparisons are made to the structurally isomorphic chloride salts. (11 refs.)

Two-dimensional reorientation and magnetic resonance line shapes in semiordered solids .... See Entry 108756

76.30D Ions and impurities: general

108760 The angular dependence of EPR spectra for ions with $S=3/2$ in a crystal field of rhombic symmetry in the case of large zero-field splittings. A.K.Petrosyan.
Izv. Akad. Nauk Arm. SSR Fiz. (USSR), vol.17, no.1, p.15-21 (1982). In Russian.
In the case of large zero-field splittings analytic expressions for the angular dependence of energy levels for ions with $S=3/2$ in crystal fields of rhombic symmetry have been obtained to an accuracy of the second order of perturbation theory. Taking account of the Zeeman interaction the correct wave functions of spin levels were calculated and simple formulas for the $\lambda=E/D$ parameter were obtained. These formulas allowed the author to determine the D and E parameters of fine structure when the value of zero-field splitting was known. (9 refs.)

108761 Evaluation of spin Hamiltonian parameters of electron-nuclear spin-coupled systems from EPR data by the method of least-squares fitting. S.K.Misra (Phys. Dept., Concordia Univ., Montreal, Canada).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.193-201 (1983).
Details of a rigorous least-squares fitting procedure for the evaluation of spin-Hamiltonian parameters from EPR data for electron-nuclear spin-coupled systems are given. In this method, all EPR line positions corresponding to several orientations of the external magnetic field are simultaneously fitted. Feynman's theorem is used in order to employ numerical techniques on a digital computer for the required calculations. Details are provided of the steps taken to minimize the computer time, as well as to achieve the convergence of the iterative procedure. The procedure is illustrated by application on the X-band room temperature EPR data obtained for the electron-nuclear spin-coupled system of Mn^{2+} doping single crystal of $ZnSiF_6.6H_2O$. (17 refs.)

76.30F Iron group (3d) ions and impurities (Ti-Cu)

108762 EPR investigation of $(NH_4)_3H(SO_4)_2$ crystals doped with VO^{2+} ion. J.Minge, S.Waplak, L.Szczepanska (Inst. of Molecular Phys., Polish Acad. of Sci., Poznan, Poland).
Acta Phys. Pol. A (Poland), vol.A64, no.2, p.151-60 (Aug. 1983).
EPR is used for determining coordination and spin-Hamiltonian parameters of VO^{2+} in $(NH_4)_3H(SO_4)_2$ for both single-domain and multi-domain specimens and to determine the number of magnetically and physically equivalent complexes of VO^{2+}. It is shown that the impurity ion VO^{2+} takes interstitial position surrounded by 4 oxygen atoms, originating from 4 sulphur and two NH_4^+(II) ions. The polar VO^{2+} z-axis is parallel to the axis connecting two nearest NH_4^+(II) vacancies. As a result the +2 excess charge of VO^{2+} ion is compensated. In the single domain sample there are two physically nonequivalent VO^{2+} complexes. (21 refs.)

108763 Electronic paramagnetic resonance of the mineral metatorbenite. J.M.Diaz (Dept. de Fisica, Univ. Nacional de Colombia, Bogota, Colombia).
Rev. Colomb. Fis. (Colombia), vol.15, no.1, p.107-13 (1981). In Spanish. [received: Aug. 1983]
This mineral contains uranium, copper and phosphorus; the paramagnetic properties of copper enable this electronic resonance method to be used; the width of the resonance lines varies between 20 and 34 gauss, in contrast with the calculated value of 96 gauss. The discrepancy is explained on the hypothesis that the copper atoms are positioned in planes with a relatively large separation thus forming a two-dimensional magnetic system. (9 refs.)
N.C.

108764 Paramagnetic centres created by a thermal treatment in potassium dichromate crystals. A.A.Alybakov, V.A.Gubanova, K.Kudabaev, N.Tojchiev (Inst. of Phys. & Math., Acad. of Sci., Frunze, Kirghiz SSR).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.K68-70 (1983).
As grown $K_2Cr_2O_7$ crystals show no EPR absorption since chromium is in nonparamagnetic sixvalent state. Thermal treatment of these crystals results in the creation of paramagnetic centres. For an arbitrary crystal orientation EPR spectrum shows two groups of lines, each group consisting of two lines with the same intensity disposed close to each other. The obtained correlation between the principal g-values ($g_z<g_x$, g_y) indicates that Cr^{5+} ions in centres, responsible for the observed EPR spectra, are in heavily distorted tetrahedral surroundings. (7 refs.)

108765 Spin quenching and EPR of Mn^{2+} in $K_2Ni(SeO_4)_2.6H_2O$ single crystals. R.K.Malhotra, V.P.Seth, V.K.Jain (Dept. of Phys., Maharshi Dayanand Univ., Rohtak, India).
Can. J. Phys. (Canada), vol.61, no.9, p.1359-61 (Sept. 1983).
Anelectron paramagnetic resonance study of Mn^{2+} in $K_2Ni(SeO_4)_2.6H_2O$ single crystals has been made at 294K and 9.45 GHz. The Mn^{2+} substitutes at Ni^{2+} sites in the lattice. The spin-Hamiltonian parameters are evaluated. The observations regarding the anisotropic and field dependent line widths of Mn^{2+} in the lattice are discussed using the spin-quenching concept. (6 refs.)

108766 Low-spin ferric porphyrin complexes: analysis of the electronic structure based on single-crystal electron spin resonance measurements. M.P.Byrn, B.A.Katz, N.L.Keder, K.R.Levan, C.J.Magurany, K.M.Miller, J.W.Pritt, C.E.Strouse (Dept. of Chem. & Biochem., Univ. of California, Los Angeles, CA, USA).
J. Am. Chem. Soc. (USA), vol.105, no.15, p.4916-22 (27 July 1983).
Single-crystal electron spin resonance **g** tensor determination for a low-spin ferric porphyrin complex can provide both an accurate description of spin distribution and a quantitative characterization of the axial ligand binding. Experimental **g** tensor determinations for a series of six low-spin (tetraphenylporphinato)iron(III) thiolate complexes illustrate the simple, but not intuitive, relationship between the orientation of the principal axes of the **g** tensor and the spin distribution. The axial thiolate ligands in this series of complexes cover a relatively wide range of σ-donor strength. Analysis of the crystal field parameters obtained from the principal g values reveals an excellent correlation between the tetragonality (Δ) and the pK_a of the corresponding thiol. On the other hand, the rhombicity (V/Δ) for this series of complexes is virtually independent of σ-donor strength of the axial ligand. (39 refs.)

108767 Magnetic anisotropy of copper(II) complexes from ESR studies in solution. Use of mixed ligand complexes. R.Das, B.S.Prabhananda (Chemical Phys. Group, Tata Inst. of Fundamental Res., Bombay, India).
J. Magn. Resonance (USA), vol.54, no.1, p.89-98 (Aug. 1983).
ESR linewidths of the complex $Cu(Q)_2$ and that of the mixed ligand complex Cu(P)(Q) in liquid solution, where P and Q are two different ligand groups, can be used to determine or confirm the anisotropy of $Cu(Q)_2$, when the anisotropy parameters associated with $Cu(P)_2$ are known. This method makes use of (i) the equations derived by Kivelson and coworkers (Wilson and Kivelson, J.Chem. Phys., vol.44, p.154, 19,66; Atkins and Kivelson, J.Chem. Phys., vol.44, p.169 1966); (ii) equations which find justification in the model proposed by Kuska and coworkers (Kuska, Rogers, and Drullinger, J.Phys. Chem., vol.71, p.109, 1967; Kuska, J.Am. Chem. Soc., vol.97, p.2289, 1975) to explain the variation of metal hyperfine constant. The procedure is shown to be promising by taking the example of Cu $\{(i\text{-}C_3H_7O)_2PSe_2\}_2$. This method could be useful when it is difficult to obtain good frozen solutions/single crystal ESR spectra. (17 refs.)

108768 Intrinsic paramagnetic dimers in the Magneli titanium oxides. S.A.Fairhurst, A.D.Inglis, Y.Le Page, J.R.Morton, K.F.Preston (Div. of Chem., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
J. Magn. Resonance (USA), vol.54, no.2, p.300-4 (Sept. 1983).
An intense EPR spectrum observed between 90 and 150K in single crystals of Ti_5O_9, Ti_6O_{11}, Ti_7O_{13}, and Ti_8O_{15} attributed to Ti_2^{7+} oxygen-bridged dimers present as intrinsic components of the crystal structures. Very much weaker EPR signals detected in Ti_4O_7 and Ti_9O_{17} are attributed to defect species. (9 refs.)

108769 EPR study of the randomly diluted two-dimensional Heisenberg ferromagnet $K_2Cu_xZn_{1-x}F_4$. I.Yamada, S.Shimoda, S.Nagano (Dept. of Phys., Faculty of Sci., Chiba Univ., Chiba, Japan).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.127-33 (1983).
The authors report a room temperature EPR study of $K_2Cu_xZn_{1-x}F_4$, a randomly site-diluted system of the two-dimensional Heisenberg ferromagnet K_2CuF_4. Since the ferromagnetism of K_2CuF_4 comes from the orbital ordering of $d(z^2-x^2)$ and $d(z^2-y^2)$ due to the cooperative Jahn-Teller distortion of F^--octahedra, particular attention has been paid to the x-dependences of g-values in order to see how the orbital ordering is disturbed by Zn^{2+} ions which have no Jahn-Teller effect. From the almost unchanged g-values obtained for $x\geq0.4$, they infer that the orbital ordering remains for $x\gtrsim0.4$, which assures the in-plane exchange interactions to be ferromagnetic over this range of x. Both the linewidth of the main-line and the intensity of the satellite ($2\omega_0$)-line show different aspects above and below $x\simeq0.4$. This value of x coincides with the percolation limit 0.41 for the next-nearest-neighbor interactions on a square lattice. Taking account of the appearance of T_c for $x<0.59$, the percolation limit for the nearest-neighbor interactions, observed in the susceptibility-measurement by Okuda et al. (1980), they conclude that $x\simeq0.4$ should be the critical concentration and thus the next-nearest-neighbor exchange plays an important role in the present diluted system. (15 refs.)

108770 ESR fields as a function of temperature in the quasi one-dimensional Heisenberg $S={}^1/_2$ ferromagnets $[C_6H_{11}NH_3]CuCl_3$ and $[C_6H_{11}NH_3]CuBr_3$. R.Hoogerbeets, A.J.Van Duyneveldt (Kamerlingh Onnes Lab., Rijksuniv. Leiden, Leiden, Netherlands).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.233-6 (1983).
The 18.3 GHz ESR fields of $[C_6H_{11}NH_3]CuCl_3$ and $[C_6H_{11}NH_3]CuBr_3$ as a function of temperature (4.2-40K) are reported. Large shifts of these fields were found. It is shown that the anisotropy in the intrachain exchange interaction determines these field shifts. (7 refs.)

108771 EPR and magnetic susceptibility studies of xCuO.(1-x)[2B_2O_3.PbO] glasses. I.Ardelean, O.Cozar, G.Ilonca (Faculty of Phys., Univ., of Cluj-Napoca, Cluj-Napoca, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.5, p.451-7 (1983).
X-ray analysis, EPR and magnetic susceptibility measurements have been performed on xCuO.(1-x)[2B_2O_3.PbO] glasses with $0 \leq x \leq 55$ mol.%. The modification of the EPR spectra with the increase of CuO content are explained supposing that they are the results of the superposition of two EPR signals, one showing the hyperfine structure typical of isolated copper ions and other consisting from a broad line centred at $g \simeq 2$, typical of clustered ions. Beside the dipole-dipole coupling between copper ions, the magnetic measurements suggest that for $x>5$ mol.% CuO the superexchange interactions appear to. From the Curie constant values the authors have established that in these glasses both Cu^{2+} and Cu^{+} ions are present. (24 refs.)

108772 Electron paramagnetic resonance of VO^{2+} in $Cs_2C_2O_4.H_2O$ single crystals. R.K.Malhotra, V.P.Seth, V.K.Jain (Dept. of Phys., MD Univ., Haryana, India).
Solid State Commun. (USA), vol.47, no.9, p.721-2 (Sept. 1983).
The electron paramagnetic resonance of VO^{2+} in cesium oxalate monohydrate has been studied in X-band and at 290K. The VO^{2+} occupies two magnetically inequivalent sites in the lattice and exhibits rhombic symmetry. The values of dipolar coupling constant and Fermi contact coupling parameters are evaluated. (14 refs.)

108773 Structure of active centers in manganese-doped single crystals of yttrium titanate $Y_2Ti_2O_7$. K.A.Kuvshinova, M.L.Meil'man, A.G.Smagin, R.Yu.Abdulsaribov, V.A.Antonov, P.A.Arsen'ev, L.B.Pasternak (All-Union Correspondence Engng.-Construction Inst., USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.198-202 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.339-45 (March-April 1983). [received: Sept. 1983]
Crystals of $Y_2Ti_2O_7$(Mn), grown by zone melting in an optical beam in air, are investigated by means of optical and ESR spectroscopy. The ESR spectrum observed at 300K is attributed to transitions between sublevels of the ground state $^4A_2$ of quadrivalent manganese ions which isomorphically replace Ti^{4+} ions in positions of type c ($G_c=3m$); the spectrum is described by a spin-Hamiltonian of axial symmetry. $\hat{H}=\beta HgS+1/3DO_2{}^0+SAJ$, with parameters $g_{\parallel}=1.9895(5)$, $g_{\perp}=1.9987(7)$, $|D|=0.967(6)$, $|A_{\parallel}|=68.0(5)\times10^{-4}$, $|A_{\perp}|=105.0(5)\times10^{-4}$ cm^{-1}. The band of red photoluminescence at 655-695 nm (77K) is attributed to the spin-forbidden transitions $^2E \rightarrow {}^4A_2$ of Mn^{4+} ions, which are responsible for the ESR spectrum. An intense, broad absorption band at 505 nm is attributed to the $^5E_g \rightarrow {}^5T_{2g}$ transitions of trivalent manganese ions, which isomorphically replace Y^{3+} ions in positions of type d (G_d=3m). It is shown that the interpretation of the data obtained previously from spectroscopic investigations of manganese-activated oxide crystals of corundum Al_2O_3, strontium titanate $SrTiO_3$, and garnet $Y_3Al_5O_{12}$ is ambiguous, and evidently requires revision. (43 refs.)

Pentavalent iron stabilized for the first time in sixfold coordination in an oxide ....See Entry 107649

Structure transformation in mixed polycrystalline $Zn_{1-x}Cd_xS$ doped with Mn and Cu ....See Entry 107903

Determination of stresses in Si-SiO_2 and mechanically affected Si by EPR ....See Entry 108244

Filling of the 3d band of the manganese in $GdAl_{2-x}Mn_x$ for $x<0.2$ ....See Entry 108276

Energy levels of interstitial manganese in silicon ....See Entry 108343

Evaluation of spin Hamiltonian parameters of electron-nuclear spin-coupled systems from EPR data by the method of least-squares fitting ....See Entry 108761

Oxygen vacancies in lithium niobate ....See Entry 108981

Nickel centers in strontium tartrate tetrahydrate single crystals ....See Entry 108984

76.30H Platinum and palladium group (4d and 5d) ions and impurities (Zr-Ag and Hf-Au)

108774 ESR studies of electron irradiated $K_3Ir(CN)_6$ in KCl single crystals. Mono and di-chlorinated species. N.V.Vugman, N.M.Pinhal (Inst. de Fisica, Univ. Federal do Rio de Janeiro, Rio de Janeiro, Brazil).
Mol. Phys. (GB), vol.49, no.6, p.1315-19 (20 Aug. 1983).
ESR studies of KCl single crystals doped with small amounts of $K_3Ir(CN)_6$ and submitted to a prolonged 2 MeV electron irradiation at room temperature reveal the presence of the species $[Ir(CN)_5Cl]^{4-}$ and $[Ir(CN)_4Cl_2]^{4-}$. Ligand spin densities and ligand field parameters are calculated from the experimental hyperfine and superhyperfine interactions and compared with previous data on the species $[Ir(CN)_5]^{4-}$. (11 refs.)

76.30K Rare-earth ions and impurities

108775 Diffusion of free radicals as studied by tomography. E.V.Galtseva, O.Y.Yakimchenko, Ya.S.Lebedev (Inst. of Chem. Phys., Moscow, USSR).
Chem. Phys. Lett. (Netherlands), vol.99, no.4, p.301-4 (12 Aug. 1983).
A linear magnetic field gradient superimposed on the main static field was used to study one-dimensional diffusion of perchlorotriphenylmethyl radicals in decalin and of oxygen molecules in polytetrafluoroethylene. A simple method is developed for deducing diffusion coefficents from both time-dependent and single-scan experiments provided that the natural linewidth is small relative to the field change over the diffusion distance. (13 refs.)

108776 High pressure anomaly of the spin lattice relaxation of the cerium ion in europium ethylsulphate. G.N.Neilo, A.D.Prokhorov.
Fiz. Nizk. Temp. (USSR), vol.9, no.8, p.877-9 (Aug. 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
Temperature dependences have been measured of the spin lattice relaxation rate for Ce^{3+} ion in europium ethylsulphate under high pressure. It has been found that with pressure increase an anomalous decrease of the relaxation rate takes place which proceeds as a jump with the temperature span 0.2K. (6 refs.)

108777 Temperature dependence of the spin Hamiltonian parameters in KCl:Eu^{2+} crystals. C.Pina, E.Munoz, J.L.Boldu (Inst. di Fisica, Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
J. Chem. Phys. (USA), vol.79, no.5, p.2172-6 (1 Sept. 1983).
The temperature dependence of the spin Hamiltonian parameters of Eu^{2+} in othorhombic sites of KCl crystals has been measured in the range 87-573K using EPR techniques. In this work, the authors fit an analytical expression for the predominant parameter $b_2{}^0$ as a function of temperature, $b_2{}^0=a_0+a_1T+a_2 \coth \Theta 2/T$. With eight experimental points the equation for $b_2{}^0$ was fitted and the following values were obtained $a_0=364.54\times10^{-4}$ cm^{-1}, $a_1=-0.03\times10^{-4}$ cm^{-1} K^{-1}, and $a_2=-5.72\times10^4$ cm^{-1}. The root of the mean squared deviation between calculated and reported values $\sigma=2.03\times10^{-4}$ cm^{-1}. (33 refs.)

108778 Dilemma of $EuMo_6X_8$ (X=S,Se) and possible solution of resistance anomaly [ESR study]. S.N.Ekbote, S.K.Gupta, A.v.Narlikar (Nat. Phys. Lab., New Delhi, India).
J. Phys. C (GB), vol.16, no.25, p.L919-23 (10 Sept. 1983).
Resistance behaviours of $Eu_{1.2}Mo_6X_8$ (X=S and Se) are analysed in terms of their ESR studies. The results show that while the interaction between condulation electrons and Eu^{2+} ions is negative in $Eu_{1.2}Mo_6S_8$, it is positive in $Eu_{1.2}Mo_6Se_8$. A comparative study of the spectra is obtained for Eu-doped $PbMo_6S_8$ samples, which again show that even for lower concentrations of Eu the interaction between conduction electrons and Eu^{2+} ions is negative. The data provide a plausible explanation to the resistance anomaly of $Eu_{1.2}Mo_6S_8$. (14 refs.)

108779 Effect of γ -irradiation on EPR spectra of Eu^{2+} doped KCl and NaCl crystals. H.Opyrchal, K.D.Nierzewski, H.Drulis (Inst. for Low Temperature & Structure Res., Polish Acad. of Sci., Wroclaw, Poland).
Phys. Status Solidi b (Germany), vol.118, no.2, p.K125-7 (1 Aug. 1983).
Ionising radiation affects the aggregation of Eu^{2+}-cation vacancy (I-V) dipoles in KCl and NaCl crystals to form some precipitates. Experiments were performed by measuring EPR spectra of KCl:Eu^{2+} and NaCl:Eu^{2+} crystals subjected, after previous annealing at 500°C during ≈ 1 h and quenching to room temperature, to γ-radiation at the dose rate $\approx 10^6$ R/h. The EPR spectra were compared with those obtained for crystals stored after the growth at RT for about five years. The measurements were performed in a conventional X-band reflection spectrometer. (7 refs.)

Filling of the 3d band of the manganese in $GdAl_{2-x}Mn_x$ for $x<0.2$ ....See Entry 108276

Evidence for the Ham effect in bis-tetramethylammonium hexachloroneptunate (IV) ....See Entry 108369

76.30L Other ions and impurities

(for colour centres, see 76.30M)

108780 EPR study of the Tl^{2+} center in the paraelectric and antiferroelectric phases of $NH_4H_2PO_4$. D.N.Domingues, A.S.Chaves, G.M.Ribeiro, R.Gazzinelli (Dept. of Phys., Univ. Federal de Minas Gerais, Belo Horizonte, Brazil).
Solid State Commun. (USA), vol.47, no.9, p.665-8 (Sept. 1983).
The EPR Tl^{2+} center in $NH_4H_2PO_4$ was studied in the range of temperature 85K-175K which includes the antiferroelectric transition. The center has the symmetry of $NH_4{}^+$ site, where it goes substitutionally, in both the paraelectric and antiferroelectric phases. In the antiferroelectric phase there is a charge compensation mechanism involving the repulsion of one of the neighbour protons in the hydrogen bond. A measurement of the splitting of the resonance lines for the field along the crystallographic direction a is presented as a function of temperature. This splitting is proportional to the order parameter. (9 refs.)

Disorder phenomena in β-alumina ....See Entry 108034

Investigation of formation conditions of thermal donors-I and -II in oxygen-containing n-type silicon within the temperature range 400 to 800°C ....See Entry 108458

76.30M Colour centres and other defects

108781 Paramagnetic centres in X-irradiated $LiNaSO_4$ single crystal: A comment. G.Lehmann (Inst. fur Phys. Chem., Univ. of Munster, Munster, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.K75-6 (1983).
For original paper see ibid., vol.16, p.611 (1981). The publication of Alybakov et al. contains several obvious errors in the presentation, evaluation and interpretation of their experimental results which the author comments on. He concludes that the proposed structures of these radiation defects in $LiNaSO_4$ appear to be correct despite the indicated errors. (4 refs.)

108782 Reply to comments on 'Paramagnetic centres in X-irradiated $LiNaSO_4$ single crystals'. A.A.Alybakov, V.M.Bujko, K.Sharsheev (Inst. of Phys. & Math., Acad. of Sci., Frunze, Kirghiz SSR).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.K77-8 (1983).
For original paper see ibid., vol.16, p.611 (1981). For comment see ibid., vol.18, p.K75 (1983). The authors reply to the comments of Lehmann on the paramagnetic centres in X-ray irradiated $LiNaSO_4$. They present additional experimental data which show that there is no error in the presentation of their experimental results. (7 refs.)

108783 Electron-spin-resonance studies of pyrrole polymers: Evidence for bipolarons. J.C.Scott, P.Pfluger, M.T.Krounbi, G.B.Street (IBM Res. Lab., San Jose, CA, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2140-5 (15 Aug. 1983).
ESR measurements have been performed on samples of neutral polypyrrole, polypyrrole-perchlorate, oxygen-doped polypyrrole, and poly(β,β'-dimethylpyrrole perchlorate). A narrow Lorentzian line is observed in oxidized, highly conducting films, but no correlation between conductivity and either linewidth or intensity is found. Electrochemically cycled films, which remain highly conducting, show little or no detectable ESR absorption. It is deduced that the ESR signal seen in the as-prepared material does not arise from the current-carrying species, but rather from accidental neutral π-radical defects. The absence of paramagnetism in the metallic state is discussed within the framework of bipolaron formation. (13 refs.)

108784 Some features of surface formation during brittle failure of covalent crystals with diamond-type lattice according to EPR data. M.V.Vlasova, N.G.Kakazei (Inst. of Materials Sci., Acad. of Sci., Kiev, Ukrainian SSR).
Solid State Commun. (USA), vol.47, no.4, p.255-7 (July 1983).
The dependence was found of the intensity of 'mechanical paramagnetic centres' EPR signals on the temperature of grinding of diamond, silicon carbide, silicon and germanium crystals. Signals intensity increase with grinding temperature lowering (up to 77K) is related with formation of the materials' amorphous phase during their brittle failure as well as with specific features of the microcracks structure development. (20 refs.)

108785 A trapped-hole center causing rose coloration of natural quartz. D.Maschmeyer, G.Lehmann (Inst. fur Phys. Chemie, Westfalische Wilhelms-Univ., Munster, Germany).
Z. Kristallogr. (Germany), vol.163, no.3-4, p.181-96 (1983).
In rose-colored natural quartz crystals two new hole centers were detected and analyzed by electron paramagnetic resonance (EPR). A hole center with characteristic doublet and sextet hyperfine structures was identified as an O^- ion bridging between a substitutional aluminum and phosphorus atom each. This center slowly bleaches in UV light and can be enhanced by X-ray irradiation. It is most likely responsible for the rose coloration and also explains the repeatedly reported bleaching of 'rose' quartz in daylight. Light-induced transfer of the hole in the PO_4, not the AlO_4 unit is assumed to cause this strong visible absorption. All the phosphorus present is obviously associated with aluminum, in agreement with estimates of the equilibrium distribution based on a purely Coulomb attraction between Al^{3+} and P^{5+} on sites of Si^{4+}. The isotropic ^{27}Al superhyperfine structure is four times smaller than in the unperturbed smoky quartz center, evidently as a result of the strong electron attraction by the pentavalent phosphorus opposite to Al which also gives rise to a large and practically isotropic ^{31}P doublet superhyperfine splitting. (38 refs.)

Raman studies on local structural disorder in silicon-based amorphous semiconductor films .... See Entry 108958

Oxygen vacancies in lithium niobate .... See Entry 108981

Influence of elementary structure defects on the optical properties of glasses .... See Entry 108986

Temperature-independent photoluminescence in amorphous $Si_{1-x}C_x$:(F,H) films with low defect density .... See Entry 108993

76.30R Free radicals

108786 Hydroxyl radicals in aqueous glasses: characterization and reactivity studied by ESR spectroscopy. H.Riederer, J.Huttermann (Inst. fur Biophys. und Phys. Biochem., Univ. Regensburg, Regensburg, Germany), P.Boon, M.C.R.Symons.
J. Magn. Resonance (USA), vol.54, no.1, p.54-66 (Aug. 1983).
The parallel g value (g_z) for hydroxyl radicals trapped in solids is goverened by the interaction with matrix molecules. In ice or salt hydrates this is primarily hydrogen bonding, which lifts the degeneracy of the $2p\pi$ orbitals in a precise manner yielding well defined g_z features in the electron spin resonance spectra. In contrast, when OH· radicals are formed in amorphous electrolyte glasses the g_z feature is extremely broad and detectable only as an ascending baseline. In the presence of small concentrations of organic substrate in the glasses, well defined products are formed from hydroxyl attack which occurs when they become mobile at elevated temperatures. This is in contrast with phase-separated aqueous systems and the results establish glasses like 7-9 *M* BeF_2/H_2O as suitable media for studying the reactions of hydroxyl radicals. (29 refs.)

108787 ESR studies of radicals derived from tetrahydrofuran derivatives. Share-Wing Ko, A.C.Ling (Dept. of Chem., San Jose State Univ., San Jose, CA, USA), R.J.Waltman, J.Bargon.
J. Magn. Resonance (USA), vol.54, no.1, p.67-77 (Aug. 1983).
Free radicals derived from tetrahydrofuran, 2,3- or 2,5-dihydrofuran as well as from some methoxy or mono- and di-methyl derivatives thereof have been generated via hydrogen abstraction via photolytically generated *t*-butoxy radicals. The g values of these radicals have been determined by ESR spectrometry and the hyperfine splitting constants have been assigned using deuterium labeling. Saturated systems give rise to cyclic alkyl radicals via hydrogen abstraction from the carbon in the α-position to oxygen; unsaturated systems yield cyclic allyl-type radicals. (25 refs.)

108788 Vanadyls from oil shale. Rotational motion studied by electron spin resonance spectroscopy. B.B.Garrett (Florida State Univ., Tallahassee, FL, USA), W.M.Gulick,Jr..
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.8, p.1733-40 (Aug. 1983).
Electron spin resonance studies of several vanadyl complexes from the Antrim oil-shale formation of the lower Michigan peninsula reveal a wide range of rotational correlation times. The hyperfine splittings and g factors are all consistent with porphyrin structures, but three vanadyls have very different rotational correlation times. At ambient temperature, one gives a motionally averaged spectrum, one gives a slow-tumbling spectrum and one has its spectrum broadened into unobservability. A temperature-dependence study was carried out for the species which is in the slow tumbling region at ambient temperature. A rotational correlation time of 4.0×10^{-8} s rad^{-1} is estimated for this species at 303K and an activation energy of 6.9 kcal mol.$^{-1}$ is estimated for the rotation. (13 refs.)

ESR of the cation radicals from γ-irradiated ketenes in haloalkane and SF_6 matrices .... See Entry 106469

Radical cations of halogenobenzenes. An electron spin resonance study .... See Entry 109771

76.40 DIAMAGNETIC AND CYCLOTRON RESONANCES

108789 Cyclotron resonance in the conduction band of GaP in very high magnetic fields. N.Miura, G.Kido, M.Suekane, S.Chikazumi (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2838-48 (Aug. 1983).
Cyclotron resonance in *n*-type GaP was observed in pulsed high magnetic fields up to 140 T using far-infrared lasers as radiation sources at 119 μm and 337 μm wavelengths. When the magnetic field was applied along the ⟨100⟩ axis, the second resonant peak was observed at 100 T in addition to the first peak at 23 T for a wavelength of 119 μm, the apparent anisotropy factor K^* of the effective mass on the assumption of an ellipsoidal band model being estimated to be 19 ± 2. For a wavelength of 337 μm, the second peak in the absorption was observed as a broad shoulder centered at 42 T, giving a different value of K^*. These observations were interpreted in terms of the camel's back structure model of the conduction band, and the band parameters were determined by a comparison of the data with calculation of the Landau levels.

108790 Theory of cyclotron resonance halfwidth for electrons scattered by impurities and phonons. T.K.Srinivas, S.Chaudhury, S.Fujita (Dept. of Phys. & Astron., State Univ. of New York, Amherst, NY, USA).
J. Phys. & Chem. Solids (GB), vol.44, no.9, p.931-7 (1983).
A general theory of the cyclotron resonance halfwidth for electrons scattered by impurities and phonons is developed on the basis of the proper connected diagram expansion of the current-correlation-function formula for the dynamic conductivity. The theory is applied to the cases of Ge samples at extremely high magnetic fields and different temperatures. The usual form of Matthiessen's rule $\Gamma=\Gamma_1+\Gamma_2+...$, where Γ and Γ_j are the total and component energy-dependent resonance widths, is valid only if the component widths Γ_j computed separately for each cause of scattering depend linearly on the densities of scatterers. The resonance width Γ_1 due to the charged impurities at very low electron densities ($\sim10^{12}$ cm^{-3}) and at very low temperatures is known to vary in proportion to the square-root of the impurity density. Large deviations from the Matthiessen's rule occur in such a case. The theory is in good quantitative agreement with currently available experimental data. In order to test the generalized form of Matthiessen's rule, however, the high-field resonance experiments around 15K is desirable where both phonon and impurity scatterings contribute in a comparable manner. (10 refs.)

Far-infrared magneto-plasma wave transmission and the dielectric constant in bismuth under high magnetic fields .... See Entry 108463

76.50 FERROMAGNETIC, ANTIFERROMAGNETIC, AND FERRIMAGNETIC RESONANCES; SPIN WAVE RESONANCE

(see also 75.30D Spin waves)

108791 Magnetic resonance in very fine ferrimagnetic powder. J.Kolacek (Inst. of Phys., Czechoslovak Acad. of Sci., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.9, p.1024-34 (1983).
A simple model of a two-sublattice ferrimagnetic powder is described and numerically solved. In the framework of this model the ground state deviation from the exactly antiparallel spin order is estimated for very small particles and, by extrapolation, for the bulk material, too. This departure proved to be rather small. Besides usual ferrimagnetic resonance it is possible—according to the model—to expect three magnetic absorption lines—the exchange resonance and the two surface modes which are localized in the surface layer of the depth of about three lattice constants. The influence of the surface of the frequency and the intensity of the exchange resonance is also considered. (5 refs.)

108792 Influence of magnetostriction on FMR in thin garnet (111) films. L.Pust (Inst. of Phys., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Phys. Status Solidi a (Germany), vol.78, no.2, p.741-9 (16 Aug. 1983).
Parallel and perpendicular resonance conditions are derived for films under stress σ applied either uniaxially along [110] or [112] directions, or isotropically in the film plane. The shift of the resonance field is expressed in a dimensionless form up to the fourth power of the magnetostriction constants λ_{100} and λ_{111} multiplied by σ, the influence of the cubic magnetocrystalline anisotropy is included. Only on the perpendicular configuration with isotropic σ the shift is a linear function of σ. A method for measuring λ_{100} on (111)-thin films is proposed. (5 refs.)

Mechanisms of magnetic losses in small-grain Ni-Zn ferrites .... See Entry 108730

76.60 NUCLEAR MAGNETIC RESONANCE AND RELAXATION

108793 High-resolution proton magnetic resonance and catalytic studies concerning Bronsted centers of amorphous Al_2O_3-SiO_2 solids. M.Hunger, D.Freude, H.Pfeifer (Sektion Phys., Karl-Marx-Univ. Leipzig, Leipzig, Germany), H.Bremer, M.Jank, K.-P.Wendlandt.
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.29-33 (26 Aug. 1983).
By application of the magic angle spinning (MAS) technique it was possible to observe highly resolved proton NMR spectra of the OH groups of amorphous silica-alumina. The spectra exhibit two lines at 2 and 7 ppm. The former line must be ascribed to non-acidic OH groups since it also occurs for silica and alumina. The latter line shows a maximum of intensity in the range of 20-30 wt.% Al_2O_3. It must be due to acidic hydroxyl groups since the catalytic activity of the silica-aluminas measured by the cracking rate of cumene shows quantitatively the same behaviour with respect to the number of OH groups at 7 ppm. (15 refs.)

108794 Cadmium-113 shielding tensors of cadmium-oxo compounds. I. Single-crystal studies on $Cd(NO_3)_2.4H_2O$ and $3CdSO_4.8H_2O$. R.S.Honkonen, F.D.Doty, P.D.Ellis (Dept. of Chem., Univ. of South Carolina, Columbia, SC, USA).
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4163-8 (29 June 1983).
Diffraction-quality single crystals of $Cd(NO_3)_2.4H_2O$ and $3CdSO_4.8H_2O$ have been investigated by ^{113}Cd Fourier transform NMR methods in a home-built single-crystal probe. As expected from point group symmetry arguments, the shielding tensors do not exhibit axial symmetry. The ^{113}Cd NMR of $Cd(NO_3)_2.4H_2O$ gave rise to two cadmium resonances for the magnetically nonequivalent (but crystallographically equivalent) positions in the unit cell. The principal elements of the symmetry related tensors for $Cd(NO_3)_2.4H_2O$ are -174.4, -154.3, and 22.2 ppm for σ_{11}, σ_{22}, and σ_{33}, respectively (the chemical shifts are reported with respect to solid $Cd(ClO_4)_2$). The ^{113}Cd NMR of $3CdSO_4.8H_2O$ afforded three resonances as expected from the crystal symmetry. Two of the resonances are assigned to general positions within the lattice. These positions gave rise to symmetry-related tensors, which have principal elements -93.1, -76.7, and 25.5 ppm. The remaining resonance is assigned to cadmium in special position; the corresponding shielding tensor has principal elements -95.6, -85.3, and -3.4 ppm. These data are discussed in terms of the structure of the cadmium salts. (24 refs.)

108795 Fourth moment of the magnetic resonance line of a dipolar coupled rigid lattice for powders with two different species of magnetic nuclei. B.Nowak, J.Kowalewski, O.J.Zogal (Inst. for Low Temperature & Structure Res., Polish Acad. of Sci., Wroclaw, Poland).
J. Magn. Resonance (USA), vol.54, no.1, p.9-18 (Aug. 1983).
A general analytical expression for calculating the polycrystalline fourth moment of a nuclear magnetic resonance line is given for powders with two different species of magnetic nuclei. Only Cartesian coordinates of the magnetic nuclei are necessary as input data in numerical calculation of M_4 for cubic, tetragonal and orthorhombic crystals. Numerical values of appropriate lattice sums are given for powders of crystals having CaF_2 and NaCl structures. (9 refs.)

108796 Carbon-13 chemical shielding tensors in L-threonine. N.Janes, S.Ganapathy, E.Oldfield (School of Chem. Sci., Univ. of Illinois, Urbana, IL, USA).
J. Magn. Resonance (USA), vol.54, no.1, p.111-21 (Aug. 1983).
The carbon-13 chemical shielding tensors of the amino acid L-threonine have been determined by solid state proton-enhanced NMR of a single crystal at 3.52 T. For the first time a carbinol shielding tensor is determined quantitatively and unambiguously; the most shielded axis lies 4° from the C-O bond.

A coordinate system which approximates the alpha carbon tensor orientation is proposed, and it is suggested that this 'local symmetry' may be general to many amino acid alpha carbons. The carboxyl and methyl tensor orientations closely approximate previously established 'local symmetry', although the methyl (C^{γ}) C_{3v} symmetry is slightly disrupted, apparently by the neighboring (O^{γ}) oxygen. The influence of the carbon-nitrogen dipolar interaction on the observed spectra is discussed, and used to make unique assignments for the carboxyl, alpha, and beta carbon tensors. (36 refs.)

108797 Multipulse 'spin-locking' effect on a dipolar ordered state. L.Quiroga, J.Virlet (Dept. de Phys.-Chimie, CENS, Gif-sur-Yvette, France), M.Goldman.
J. Magn. Resonance (USA), vol.54, no.1, p.161-4 (Aug. 1983).
Recently it was shown how the heat capacity of the dipolar energy reservoir could be varied adiabatically by the slow switching on of some line-narrowing multipulse sequences of the WHH-4 type. Adiabaticity and reversibility of such a process breaks down, however, when the value of the pulse angle θ approaches 90° because the dipolar interaction strength is then so low that spin diffusion takes a prohibitively long time. For the same reason, a spin temperature cannot be established in the toggling frame when such a multipulse sequence is turned on suddenly at $\theta \approx 90°$. The authors present a particular situation where these difficulties are absent, i.e. a pulse sequence for which the magnitude of the effective dipolar interaction is modified, but not its form. If the system is initially at equilibrium with respect to these interactions its state will be unaffected by the switching on or off of this pulse sequence, whose only effect is a sudden but isentropic scaling of the dipolar reservoir heat capacity (and spin temperature). The authors have performed an experiment on a polycrystalline sample of adamantane. (6 refs.)

108798 Deuterium NMR of molecules adsorbed on active alumina. H.E.Gottlieb, Z.Luz (Weizmann Inst. of Sci., Rehovot, Israel).
J. Magn. Resonance (USA), vol.54, no.2, p.257-71 (Sept. 1983).
Deuterium NMR spectra were recorded of a number of perdeuterated compounds adsorbed on active alumina. The compounds include benzene, *p*-xylene, pyridine, acetone, acetonitrile, cyclohexane, methanol, and water and were studied in the range probe/alumina=0.02 to 0.30 (w/w). In most cases the spectra were typical of powder samples exhibiting a finite quadrupole interaction tensor. The quadrupole parameters depend on the probe/alumina ratio and on the temperature. The results are interpreted in terms of a model in which each crystallite surface supports an ordered layer of molecules which are in fast dynamic equilibrium with disordered 'bulk' molecules associated with the same surface. In the case of benzene the average quadrupole tensor was biaxial and in the case of acetone the spectrum appears to be a superposition of spectra from two distinct sites. The results demonstrate that deuterium NMR may provide a useful tool for the study of molecular ordering and molecular motion of adsorbed probes and may become an important complementary technique for the study of interface systems in general. (11 refs.)

108799 Methyl rotation in 1,2,4,5-tetramethylbenzene and tetramethylpyrazine in the solid state. Tunneling spectra by proton NMR. S.Takeda, H.Chihara (Dept. of Chem., Osaka Univ., Osaka, Japan).
J. Magn. Resonance (USA), vol.54, no.2, p.285-99 (Sept. 1983).
The temperature dependence of proton spin-lattice relaxation behaviour in 1,2,4,5-tetramethylbenzene (durene) and tetramethylpyrazine (TMP) was measured with particular attention to the dependence of magnetization recovery on the kind of pulse sequences. The tunneling spectra of the methyl groups of durene and TMP, which correspond to the tunneling-assisted maxima of the spin-lattice relaxation rate, were obtained by the NMR field-cycling method. The three tunneling splittings were observed for both materials in the low temperature limit: 29.3±0.7 MHz, 25.3±0.6 MHz, and 17.8±0.5 MHz for durene and 26.8±0.8 MHz, 20.2±0.8 MHz, and 14.3±0.6 MHz (or 6.4±0.7 MHz) for TMP. Those tunneling spectra indicate collective rotational tunneling of the two neighboring methyl groups in the molecules. There is an indication that the apparent tunneling frequencies decrease as the temperature increases. The effects of correlated reorientation of two methyl groups on the spin-lattice relaxation rate are discussed. (45 refs.)

108800 Quadrupolar ordering in a non-magnetic cubic doublet system: Cs_2NaHoF_6. E.J.Veenendaal, H.B.Brom, W.J.Huiskamp (Kamerlingh Onnes Lab., Rijksuniv. Leiden, Leiden, Netherlands).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.1-29 (1983).
The cubic elpasolite Cs_2NaHoF_6 is a van Vleck-paramagnet with a non-magnetic Γ_3-doublet ground state and an enhanced nuclear magnetic moment. The degeneracy of the ground state is lifted at a phase-transition temperature $T_c = 393 \pm 5$ mK, as determined from specific heat measurements. Calculations indicate, that the quadrupolar interactions, which drive the phase transition, mainly arise from the electron-lattice interaction. The transition may thus be regarded as a cooperative Jahn-Teller effect. The enhanced nuclear magnetic resonance spectrum of ^{165}Ho ($I=7/2$) has been measured at lattice temperatures from 4.2K down to 20 mK. The enhanced nuclear gyromagnetic ratio along a [001]-axis rises from 1.16 GHz/T at 4.2K to 2.33 GHz/T at 20 mK. The last value corresponds to an enhancement factor $K=258$. The NMR-spectra indicate that the low-temperature phase is ferro-quadrupolar in a magnetic field of 0.1 T. In nuclear demagnetization experiments a nuclear spin temperature of 1.8 mK has been obtained. The NMR-spectra do not indicate nuclear magnetic order. (44 refs.)

108801 Nuclear acoustic resonance in single-crystal gold metal. R.K.Sundfors (Dept. of Phys., Washington Univ., St. Louis, MO, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2284-6 (15 Aug. 1983).
Nuclear acoustic resonance is reported for the first time for ^{197}Au in single-crystal gold metal. The ratio $\omega^{(197)}/H$ was measured to be $(2\pi)(74.118 \pm 0.007)$ Hz/G and the line shape of the $\Delta m = \pm 2$ resonance was a Lorentz line shape with a half width at half amplitude of 154.8±1 G at 78K after high-temperature annealing. S tensor components which relate dynamic electric field gradients with dynamic elastic strain are determined to be of opposite sign and their magnitudes are $S_{11}\text{-}S_{12} = 13.6 \times 10^{15}$ statvolts/cm^2 and $S_{44} = 13.0 \times 10^{15}$ statvolts/cm^2. Lattice contributions to these components are computed and the conduction-electron contributions determined. (12 refs.)

Study by NMR of organic compounds containing chalcogenes. VIII. ^{13}C NMR of chromannone, chromone, coumarannone-3 and coumarine and their sulphur, selenium and tellurium analogues .... See Entry 106464

Broadband population inversion .... See Entry 106738

Nuclear magnetic resonance study of point defects in aluminium and copper .... See Entry 107679

Impurity composition and surface-layer state of diphenyl crystals .... See Entry 107735

Magnetic resonance study of diffusive phenomena in the phases of the NaF-BiF_3 system .... See Entry 108028

Disorder phenomena in β-alumina .... See Entry 108034

Fast diffusion of copper (I) ions in NaI .... See Entry 108062

Coexistence of antiferromagnetism and superconductivity in CrRe alloys .... See Entry 108591

Successive phase transitions in a random system $Mn_{1-x}Zn_x(HCOO)_2.2D_2O$ .... See Entry 108688

76.60C Chemical and Knight shifts

108802 High-field static and MAS ^{31}P NMR: chemical shift tensors of polycrystalline potassium phosphates $P_2O_5.xK_2O$ $(0 \leq x \leq 3)$. A.-R.Grimmer (Central Inst. of Inorganic Chem. Acad. of Sci., Berlin, Germany), U.Haubenreisser.
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.487-90 (19 Aug. 1983).
Static and MAS ^{31}P NMR spectra of polycrystalline h-P_4O_{10} and phosphates K_3PO_4, $K_4P_2O_7$, $K_5P_3O_{10}$, $K_3P_3O_9$ and $(KPO_3)_x$ were measured at 109.3 MHz. It is shown that the principal values of the ^{31}P shielding tensor and the isotropic ^{31}P chemical shift values reflect sensitively the constitution of both the various phosphate anions and the phosphorus oxide h-P_4O_{10}. (17 refs.)

108803 Effects of restricted molecular motion on the high-resolution solid-state ^{13}C CP MAS NMR spectrum of the nitrile group of the stearonitrile-urea inclusion complex. M.Okazaki, A.Naito, C.A.McDowell (Dept. of Chem., Univ. of British Columbia, Vancouver, British Columbia, Canada).
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.15-18 (26 Aug. 1983).
The solid-state ^{13}C CP MAS NMR spectra of stearonitrile and its urea inclusion complex were observed at room temperature. The splitting of the nitrile group in the complex was 92 Hz, and was 330 Hz for crystalline stearonitrile. This reduction can be explained by the assumption that the included molecule rotates rapidly ($\tau_R < 10^{-8}$ s) around the c axis of the complex. (12 refs.)

108804 ^{19}F NMR spectra of hexafluoride groups: UF_6. E.P.Zeer, O.C.Falaleev, V.E.Zobov (L.V. Kirensky Inst. of Phys., SB AS, Krasnoyarsk, USSR).
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.24-8 (26 Aug. 1983).
Using the example of the ^{19}F NMR spectrum of polycrystalline UF_6 in a magnetic field of 5 T, the authors propose a new interpretation of NMR spectra of hexafluoride groups in solids. A simple theoretical model explains the contradiction with the earlier interpretation and corrects the NMR conclusion on the symmetry of the UF_6 molecule. (13 refs.)

108805 Temperature dependence of Knight shift in Cd-Mg alloys. S.A.Vorontsov, G.E.Grechnev.
Fiz. Nizk. Temp. (USSR), vol.9, no.8, p.884-7 (Aug. 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The contribution to the isotropic part of the Knight shift in cadmium from the states on the narrow neck of the hole surface of the second zone (monster) is calculated. Because of E_F proximity to the point where the Fermi surface topology changes, the behavior of K_{iso} with rising temperature and magnesium impurity addition is mainly governed by the electron spectrum rearrangement due to the effects of the Debye-Waller factor, the impurity potential and the lattice parameter variations. The calculated dependences of K_{iso} on temperature and concentration in $Cd_{100-x}Mg_x$ alloys are consistent with experimental results. (10 refs.)

108806 Dispersed liquid phase referencing of NMR spectra. J.Homer (Dept. of Chem., Univ. of Aston, Birmingham, England).
J. Magn. Resonance (USA), vol.54, no.1, p.1-8 (Aug. 1983).
It is shown that suitable liquids, when dispersed through samples with which they are immiscible, can be used as otherwise uncontained references for the measurement of chemical shifts. These shifts are independent of the volume magnetic susceptibility of the components of the heterogeneous sample. The ^1H chemical shifts for various compounds in model systems have been measured using both the traditional external reference and the new dispersed methods and the differences between these are explained. (13 refs.)

108807 NMR chemical shifts of ^{51}V, ^{93}Nb, ^{181}Ta, and ^{205}Tl in ternary A_3BC_4 semiconductors. K.D.Becker, U.Berlage (Inst. fur Phys. Chem. & Elektrochem., Univ. Hannover, Hannover, Germany).
J. Magn. Resonance (USA), vol.54, no.2, p.272-84 (Sept. 1983).
Chemical shifts of the group-V transition metals, V, Nb, and Ta, and of Tl(I), were determined in 15 ternary semiconductors of the cubic A_3BC_4 sulvanite type. The transition metal ions were found to possess large shielding ranges of approximately 2000 ppm for Nb and 3000 ppm for V and Ta, while the thallium shifts span a range of 800 ppm. For a given cation, shifts increase with increasing atomic number of the chalcogen. These data were compared with predictions of a localized-bond model using Harrison's bond-orbital model (1980). Good agreement is obtained between the observed shifts and calculated values for the paramagnetic contribution to chemical shielding. (29 refs.)

108808 A linear relationship between the ^{13}C ester carbon chemical shift and the melting point or S to N transition temperature of n-alkyl esters of biphenyl-4,4′-dicarboxylic acid. J.K.Swadesh, J.C.Poirier (Dept. of Chem., Duke Univ., Durham, NC, USA).
Mol. Cryst. & Liq. Cryst. Lett. (GB), vol.92, no.4-5, p.119-26 (1983).
The authors present evidence that the relative electron densities at the ester carbon of the symmetrical n-alkyl diesters of biphenyl-4,4′dicarboxylic acid may determine the relative melting points of homologs in this series. A similar relationship may determine the relative smectic to nematic transition temperatures of the corresponding monoesters. They present a model to rationalize their observations. (12 refs.)

108809 Magnetic couplings in Cs_2IrCl_6 and other iridium hexachlorides from NMR studies. A.M.Raaen, I.Svare (Phys. Dept., Univ. of Trondheim, Trondheim, Norway), B.Pedersen.
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.88-94 (1983).
NMR line shift and relaxation of ^{133}Cs in FCC Cs_2IrCl_6 show that this salt is antiferromagnetic with $T_N < 1.6$K and $\theta = -4 \pm 2$K. The contact couplings $A\mathbf{I}_i.\mathbf{S}_j$ of ^{133}Cs to Ir^{4+} are much larger than the corresponding dipolar couplings, $A_1/h = -5.9$ MHz to nearest neighbours and $A_2/h = 0.9$ MHz to the next nearest neighbours. The corresponding couplings to ^{39}K in K_2IrCl_6 are $A_1/h = -0.3$ MHz and $A_2/h = 0.05$ MHz. The Ir^{4+}-Ir^{4+} superexchange $J_1\mathbf{S}_j.\mathbf{S}_k$ vary very rapidly with alkali ion A^+ substitution in the iridium hexachlorides. The authors suggest that this is due to an increasing ferromagnetic coupling $IrCl_6^{2-}(\uparrow)$-$A^+(\downarrow)$-$Cl_6Ir^{2-}(\uparrow)$ partly counteracting the decreasing antiferromagnetic coupling $IrCl_6^{2-}(\uparrow)$-$Cl_6Ir^{2-}(\downarrow)$ when one goes from $A^+ = K^+$, NH_4^+ and Rb^+ to $A^+ = Cs^+$. They give some very crude estimates for the strengths of the superexchanges. (27 refs.)

108810 Knight shift of H adatoms on $Cu_{1-x}Ni_x$ alloy. S.Modak, B.C.Khanra (Solid State & Molecular Phys. Div., Saha Inst. of Nuclear Phys., Calcutta, India).
Phys. Rev. B (USA), vol.28, no.4, p.2279-980 (15 Aug. 1983).
A simple model in terms of chemisorption-induced segregation has been proposed to explain the observed Ni concentration dependence of the Knight shift of a hydrogen atom chemisorbed on $Cu_{1-x}Ni_x$ alloy systems. It has been suggested that the adatom Knight-shift measurement may be a new way to probe the chemisorption-induced segregation in alloys and adatom coverages on surfaces. (15 refs.)

Effect of electron correlation on the magnetic properties of expanded liquid sodium .... See Entry 108636

Two-dimensional reorientation and magnetic resonance line shapes in semiordered solids .... See Entry 108756

Cadmium-113 shielding tensors of cadmium-oxo compounds. I. Single-crystal studies on $Cd(NO_3)_2.4H_2O$ and $3CdSO_4.8H_2O$ .... See Entry 108794

NMR study of $GdRh_4B_4$ and $SmRh_4B_4$ .... See Entry 108815

Critical indirect nuclear coupling in Rb_2IrCl_6 .... See Entry 108824

^{29}Si nuclear magnetic resonance and relaxation in the paramagnetic state of $CeCu_2Si_2$ .... See Entry 108825

Composition and temperature dependence of the density of states at the Fermi level in vanadium-based A-15 compound systems [NMR study] .... See Entry 108826

76.60E Relaxation effects

108811 Motional behavior of 2,3:5,6-di-O-isopropylidene-α-D-mannofuranose in solution. A ^{13}C spin-lattice relaxation study. P.Dais, A.S.Perlin (Dept. of Chem., McGill Univ., Montreal, Quebec, Canada).
Can. J. Chem. (Canada), vol.61, no.7, p.1542-8 (July 1983).
^{13}C nuclear magnetic resonance spin-lattice relaxation times (T_1) have been used to probe the motional behavior of 2,3:5,6-di-*O*-isopropylidene-α-D-mannofuranose in dimethyl sulfoxide solution. This system offers structural features well suited to the study of a variety of internal motions, i.e. ring oscillation, ring puckering interconversion and methyl internal rotation, all of which are superimposed on an isotropic overall reorientation. Among various models examined to evaluate internal rotations, a two-sites jump model was found satisfactory for interpreting the oscillation and puckering motions of the flexible 5,6-*O*-isopropylidene ring, whereas a diffusional model described hindered rotation of the geminal methyl groups of the rigid 2,3-*O*-isopropylidene ring from 15° to 80°C. (25 refs.)

108812 Formulae for intramolecular nuclear magnetic relaxation in an anisotropic medium. D.Canet, J.Brondeau (Lab. de Methodologie, Univ. de Nancy I, Vandoeuvre-les-Nancy, France).
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.70-5 (26 Aug. 1983).
Woessner's formulae have been adapted to the anisotropic medium case. The molecular vector involved in nuclear magnetic relaxation is assumed to rotate around an axis Δ which reorients itself within a phase possessing a preferred direction. General formulae concerning the spectral densities $J_0(\omega)$, $J_1(\omega)$ and $J_2(\omega)$ are established. The special situation for which the director is at the magic angle with the magnetic field is discussed and compared with the isotropic case. (15 refs.)

108813 Influence of spin-spin interactions on the nuclear spin-lattice relaxation in magnetically ordered substances. L.L.Buishvili, S.V.Ivanov, A.V.Kunevich, M.I.Kurkin (Inst. of Phys., Acad. of Sci., Tbilisi, Georgian SSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.94-103 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The longitudinal $1/T_1$ and transverse $1/T_2$ rates of relaxation of the ^{57}Fe nuclear spins in lithium ferrite depended similarly on the temperature of a sample and concentrations of some impurities. This similarity was explained on the assumption that the values of $1/T_1$ and $1/T_2$ were governed by the indirect (via magnons) interactions of nuclear spins with one another and with rapidly relaxing magnetic moments of the impurity atoms. A preliminary estimate was obtained of the necessary concentration of such impurities. It was found to be fairly low (less than 10^{-4} at.%), so that it would be difficult to monitor by direct methods. One of the mechanisms of the influence of the indirect interaction via magnons on $1/T_1$ corresponding to spin diffusion was investigated in detail. This mechanism failed to account for the observed correlation between the relaxation rates $1/T_1$ and $1/T_2$. (21 refs.) *A.T.*

108814 Proton spin-lattice relaxation in the three metamagnetic states of $CoCl_2.2H_2O$. T.Goto (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2514-22 (July 1983).
The field-, temperature- and angular dependences of T_1 of proton in the three metamagnetic states of Ising-like one-dimensional antiferromagnet $CoCl_2.2H_2O$ have been studied in view of two different types of relaxation mechanisms; the two-magnon process and the relaxation process due to scattering between one-magnon excitation and two-magnon bound state. The calculations for the former process based on the small-k approximation are in good agreement with the experimental results in the antiferromagnetic state with the external fields less than about 23 kOe. The experimental results in higher fields (223 kOe) over the three metamagnetic states are reasonably interpreted by the latter process, which predicts an approximate equation $T_1^{-1} \sim \exp(-2g_{||}\mu_B H_{eff}/k_B T)$ where H_{eff} is an effective field acting on effective ferromagnetic chains in each of the three states.

108815 NMR study of $GdRh_4B_4$ and $SmRh_4B_4$. Y.Kohori (Dept. of Phys., Kobe Univ., Kobe, Japan), K.Kumagai, K.Asayama.
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2910-17 (Aug. 1983).
Pulses NMR study of ^{11}B has been performed in $GdRh_4B_4$ and $SmRh_4B_4$ at frequencies of 1-10 MHz and at 50 mK-300K. From the isotropic Knight shitf, the authors obtained the conduction electron spin polarization at B site. T_1 in the paramagnetic state is explained by the dipolar and RKKY coupling between ^{11}B and the rare earth (RE) moments which are modulated by the RE-RE exchange interaction and the s-f interaction. Below the magnetic transition temperature both the line width and T_1 increase, which is associated with the magnetic ordering. In $SmRh_4B_4$ NMR measurement was made in the antiferromagnetic and superconducting states. Appreciable difference in T_1 was not observed between the normal and superconducting state. (13 refs.)

108816 ^{133}Cs spin-lattice relaxation in pseudo-one-dimensional CsH_2PO_4. R.Blinc, B.Lozar, B.Topic, S.Zumer (Dept. of Phys., E. Kardelj Univ. of Ljubljana, Ljubljana, Yugoslavia).
J. Phys. C (GB), vol.16, no.25, p.5053-62 (10 Sept. 1983).
The ^{133}Cs spin-lattice relaxation rate T_1^{-1} has been determined in the paraelectric phase of CsH_2PO_4. The anomalously short values of T_1 as well as the form of the critical temperature dependence are the result of the pseudo-one-dimensional nature of the fluctuations in this O-H$-$O bonded order-disorder system. The time between two successive passages of domain walls separating oppositely polarised one-dimensional short-range ordered clusters through a given ^{133}Cs site is short compared with 10^{-5}s in the whole paraelectric temperature range investigated. (20 refs.)

108817 A study of the low spin$\rightleftharpoons$high spin transitions in $[Fe(phen)_2(NCSe)_2]$, $[Fe(bipy)_2(NCS)_2]$, and $[Fe(isoxazole)_6](ClO_4)_2$ complexes using ^1H nuclear magnetic resonance. B.Maiti, B.R.McGarvey, P.Sambasiva Rao, L.C.Stubbs (Dept. of Chem., Univ. of Windsor, Windsor, Ontario, Canada).
J. Magn. Resonance (USA), vol.54, no.1, p.99-110 (Aug. 1983).
The spin-crossover complexes $[Fe(phen)_2(NCSe)_2]$ (phen=1,10 phenanthroline), $[Fe(bipy)_2(NCS)_2]$ (bipy=2-2′bipyridyl), and $[Fe(isoxazole)_6](ClO_4)_2$ have been studied using proton NMR. The spin-lattice relaxation times T_1 and the linewidths have been measured above and below the transition temperature. The transition from the low spin state to the high state is accompanied by a marked increase in the linewidth and a sharp decrease in the value of T_1, and vice versa. In the paramagnetic region T_1 remains constant (approximately 3 msec), whereas the linewidth varies as the inverse of the temperature T. For $[Fe(isoxazole)_6](ClO_4)_2$, a pronounced separate peak on the low frequency side of the spectrum is assigned to the hydrogen ortho to the nitrogen in the isoxazole ring. The lineshape analysis using a point-dipole model gives a value of 331 pm for the Fe-H distance. The results of the T_1 measurements support the Ising-type theory of these transitions and appropriate thermodynamic parameters for the transitions were determined by fitting the $\ln T_1$ vs. T^{-1} plot to the theory. To achieve a good fit it was found necessary to assume a temperature dependence for the correlation time below the transition temperature. (19 refs.)

108818 Frequency dependence of the effects of eccentricity on nuclear magnetic relaxation in liquids. ^{13}C relaxation of neopentane due to free radicals. P.H.Fries (Dept. de Recherche Fondamentale, CENG, Grenoble, France), J.P.Albrand, M.C.Taieb, E.Belorizky, M.Minier.
J. Magn. Resonance (USA), vol.54, no.2, p.177-89 (Sept. 1983).
Measurements of the relaxation time T_1 of the central and of the four equivalent off-center ^{13}C nuclei in neopentane, $C(CH_3)_4$, were performed in solutions containing di-tert-butyl nitroxide free radicals. In such systems, the intermolecular dipole magnetic interaction with the electronic spins of the free radicals is the only efficient relaxation mechanism for the resonating ^{13}C nuclei. The difference between the relaxation times of the central and of the off-center carbons was measured at three different resonance frequencies (15, 25, and 63 MHz) at $T=303K$. Spin exchange has a negligible effect and the results are interpreted using the spectral densities resulting from the molecular translational and rotational motions as the authors estabished previously. The effects of eccentricity cannot be explained with a uniform equilibrium distribution of the interacting molecules. It is essential to take into account pair correlation effects and the translational diffusive motion of the molecules must be described by a Smoluchowski equation. Good agreement with experiment is then obtained for the relaxation times and the effects of eccentricity. (31 refs.)

108819 Spin-lattice relaxation of ^{13}C in solid amino acids using the CP-MAS technique. A.Naito, S.Ganapathy, K.Akasaka, C.A.McDowell (Dept. of Chem., Univ. of British Columbia, Vancouver, British Columbia, Canada).
J. Magn. Resonance (USA), vol.54, no.2, p.226-35 (Sept. 1983).
It is shown by a simple application of relaxation theory that the ^{13}C magnetization decays nonexponentially, in principle, in the CP-MAS experiment because of the distribution of the spin-lattice relaxation times; however, the deviation from the exponential decay is quite small. The transient Overhauser effect also contributes appreciably to the nonexponential decay of the ^{13}C magnetization when the protons are not saturated during the ^{13}C T_1 measurements and the correlation time of the group rotational motion satisfies the condition, $\omega^2\tau_c^2 \leq 1$. It is shown by both experiment and theory that the transient Overhauser effect in the solid state is much smaller than that expected for the liquid state. The ^{13}C spin-lattice relaxation times of L-alanine, deutero-L-alanine, glycine, and L-serine were determined for the individual carbon atoms. The experimentally obtained ^{13}C T_1 values agree well with calculated ones, showing that the CH_3 group rotation provides the main source of the relaxation in alanine, while the NH_3^+ group motion plays an important role for the relaxation in glycine and serine. (21 refs.)

108820 Sulfur-33 spin-lattice relaxation time in the sulfate anion: concentration and temperature effects. J.F.Hinton, D.Shungu (Dept. of Chem., Univ. of Arkansas, Fayetteville, AR, USA).
J. Magn. Resonance (USA), vol.54, no.2, p.309-11 (Sept. 1983).
The authors report the results of an investigation of the ^{33}S spin-lattice relaxation time (T_1) of $^{33}SO_4^{2-}$ anion as a function of concentration and temperature. The T_1 value for the ^{35}Cl and ^{37}Cl in the ClO_4^- anion was also measured. A comparison is made between the T_1 for the $^{33}SO_4^{2-}$ anion and that of the $^{35}ClO_4^-$ and $^{37}ClO_4^-$ to determine the effect of quadrupole moment magnitude and anion charge on the ^{33}S relaxation. Although the relative receptivity of the ^{33}S nucleus is low, very good signal-to-noise spectra can be obtained with the $^{33}SO_4^{2-}$ anion which makes it possible to perform accurate T_1 experiments using the inversion recovery technique. For a 1 *M* $(NH_4)_2SO_4$ solution, a signal-to-noise ratio of approximately 10 to 1 was obtained from the Fourier transform of 500 accumulated free induction decays using a line-broadening factor of 0.5 Hz. A spectral width of 400 Hz stored in 2K memory was used for all spectra. For each T_1 experiment 15 to 20 tau values were used and 4000 to 6000 free-induction decays accumulated for each tau value. The average of a minimum of three measurements was used as the representative value for each concentration and temperature. (16 refs.)

108821 On nuclear magnetic relaxation due to slow molecular reorientation and fast internal rotation interference. Lian-Pin Hwang (Dept. of Chem., Nat. Taiwan Univ., Taipei, Taiwan).
Mol. Phys. (GB), vol.49, no.6, p.1341-52 (20 Aug. 1983).
Spin-lattice relaxation arising from modulation of the dipole-dipole interaction by slow molecular motion together with fast internal rotation interference is investigated. The magnetic interaction for the internal rotation is treated as a perturbation and a modified stochastic Liouville equation, which is exact in all orders of the residual perturbation for the overall reorientation of the molecule, is derived after averaging over the internal rotation modes. The resultant equation is solved by the eigenfunction expansion method to study the spin-lattice relaxation. Results show complicated damping oscillations which Donskaya's work (1975) has failed to predict. Such oscillations in the relaxation are found in the slow motion region. Effects due to jump diffusion and brownian diffusion in the internal rotation are also considered. (11 refs.)

108822 Entangled linear polymer chains in melts: n.m.r. and Rouse or reptation models; stress relaxation. J.P.Cohen-Addad (Lab de Spectrometrie Phys., Univ. Sci. et Medicale de Grenoble, Saint-Martin d'Heres, France).
Polymer (GB), vol.24, no.9, p.1128-38 (Sept. 1983).
Deals with detailed descriptions proposed to analyse slow chain diffusional process effects on n.m.r. properties of nuclei linked to long linear polymer molecules in melts or in concentrated solutions. It aims to predict relationships among macroscopic viscoelastic properties and semi-local dynamical properties observed from n.m.r. These relationships are discussed considering two main models of low-frequency chain fluctuations in melts; a multiple relaxation-mode spectrum analogous to a Rouse model or a single relaxation-mode spectrum analogous to a reptation model. The Rouse model was chosen because n.m.r. properties might be sensitive to the equilibration process of conformational fluctuations within a so-called 'tube' as well as to the reptation in a 'tube'. Local molecular properties are transferred to the unusual n.m.r. semi-local space scale (<30 Å) through the submolecule concept: every monomeric unit is supposed to have a uniform average orientational order within a given submolecule. Semi-local dynamical properties are analysed from the transition of the spin-system response from a pseudo-solid behaviour to a liquid-like one, induced by shortening polymer molecules or by slightly diluting them. This transition is currently observed from the transverse magnetic relaxation function of nuclei linked to entangled polymer chains. This spin-system response is contrasted to the longitudinal response only sensitive to local high relaxation frequency motions. Stress-relaxation processes induced on a macroscopic scale can be monitored on a semi-local space scale from n.m.r. Relaxation rates of the transverse magnetization depend strongly upon both the initial stretching ratio λ of the polymer sample and the structure of its chain relaxation spectrum. (29 refs.)

108823 On the intramolecular spin-lattice relaxation in reorienting three-spin $^1/_2$ systems. S.Emid, J.Smidt (Lab. voor Tech. Natuurkunde, Tech. Hogeschool Delft, Delft, Netherlands).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.47-52 (1983).
For three-spin $^1/_2$ systems like CF_3 groups reorienting about their C_3-axes which make an angle β with the magnetic field, theory predicts that under extreme narrowing condition the ratio of the intramolecular dipolar and Zeeman relaxation times $(T_{1D}/T_{1Z})_{\mathrm{intra}}=(2/3)(1+3\cos^2\beta)$. Experiments on a CF_3COOAg single crystal confirm this. Even with intermolecular contributions included their ratio is found to be greater than $^1/_2$, whereas for most dipolar solids it is $\leq ^1/_2$. (10 refs.)

108824 Critical indirect nuclear coupling in Rb_2IrCl_6. A.M.Raaen, I.Svare (Phys. Dept., Univ. of Trondheim, Trondheim, Norway).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.95-9 (1983).
The observed critical ^{87}Rb NMR line broadening $T_2=T_1/10\propto(T-T_N)^{0.33}$ in paramagnetic and FCC Rb_2IrCl_6 is caused by critical indirect nuclear coupling via the correlated Ir^{4+} electron spins. The theoretical critical index for T_2 is shown to be 0.33 for both static and rapidly relaxing nuclear neighbours, using scaling theory and the accepted values for the 3D Heisenberg critical exponents. The simpler mean field approximation with the known contact couplings in Rb_2IrCl_6 gives the correct order of magnitude for T_2 if it is assumed that the antiferromagnetic mode is of type 2. (15 refs.)

108825 ^{29}Si nuclear magnetic resonance and relaxation in the paramagnetic state of $CeCu_2Si_2$. J.Aarts, F.R.de Boer (Natuurkundig Lab., Univ. van Amsterdam, Amsterdam, Netherlands), D.E.MacLaughlin.
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.162-8 (1983).
^{29}Si nuclear magnetic resonance (NMR) and relaxation studies of the unstable-moment compound $CeCu_2Si_2$ have been carried out to probe the electronic state of the nearly-trivalent Ce ions. Isotropic and anisotropic NMR shifts indicate effects of both crystalline electric fields (CEF) and low-temperature moment reduction on the Ce ionic states. A relatively large anisotropic shift was observed at low temperatures, and also obtained from a CEF-state calculation in the molecular-field approximation. The hyperfine coupling also appears to be anisotropic, although this is not manifested in the temperature dependence of the shift due to changing CEF-state populations. NMR estimates of the Ce-spin fluctuation time vary with temperature in a manner similar to the neutron quasielastic scattering linewidth at high temperatures, but suggest the onset of spatially coherent fluctuations. (15 refs.)

108826 Composition and temperature dependence of the density of states at the Fermi level in vanadium-based A-15 compound systems [NMR study]. A.Gevers, T.O.Klaassen, N.J.Poulis (Kamerlingh Onnes Lab., Rijksuniv. Leiden, Leiden, Netherlands), H.R.Khan, C.J.Raub.
Physica B & C (Netherlands), vol.122B+C, no.1, p.55-66 (Sept. 1983).
The nuclear spin-lattice relaxation time T_1 of the V, Pt and Ga nuclei in the A-15 systems $V_{1-x}Pt_x$, $V_{1-x}Ga_x$ and $V_{1-x}Si_x$ has been measured as a function of the composition x and the temperature in the normal state. The V and Pt respectively Ga states are found to be strongly admixed. The experimental results indicate that the major contribution to the density of states at the Fermi energy $N(E_F)$ originates from the V 3d conduction electrons. This contribution, $N_d^V(E_F)$, exhibits a maximal value for the stoichiometric composition ($x=0.25$) in the systems investigated. Moreover, the anomalous temperature dependence of $N(E_F)$, typical for A-15 compounds, is largest for $x=0.25$. Both composition and temperature dependence of $N_d^V(E_F)$ can be explained with a simple model, using the results of recent band structure calculations on stoichiometric A-15 compounds. (14 refs.)

108827 Unusual isotope effects for diffusion in $VH_{0.50}$ and $VT_{0.50}$. R.C.Bowman,Jr., A.Attalla, B.D.Craft (Monsanto Res. Corp., Miamisburg, OH, USA).
Scr. Metall. (USA), vol.17, no.7, p.937-42 (July 1983).
NMR experiments were performed on vacuum encapsulated $VH_{0.50}$ and $VT_{0.50}$ powders. High purity vanadium metal was used to prepare both samples where stoichiometries are equal within an uncertainty of ±0.005. The nuclear relaxation times were measured by conventional pulse techniques. Proton relaxation times for $VH_{0.50}$ were measured between 100K and 520K and are presented. Triton relaxation times for $VT_{0.50}$ between 100K and 450K are summarized. (16 refs.)

108828 Critical slowing down of fluctuations in *p*-terphenyl and *p*-quaterphenyl observed by proton spin-lattice relaxation. B.Toudic, J.Gallier, P.Rivet, H.Cailleau (Univ. de Rennes I, Rennes, France).
Solid State Commun. (USA), vol.47, no.4, p.291-5 (July 1983).
The temperature evolution of the proton spin-lattice relaxation time T_1 in *p*-terphenyl and in *p*-quaterphenyl around their order-disorder phase transition has been measured. In both cases pretransitional collective fluctuations destroy the high temperature Arrhenius behaviour of the relaxation rate corresponding to a single reorientational jump motion. The spin-lattice relaxation times present then a drastic decrease until the transition temperature ($T_0=193$K in *p*-terphenyl, $T_0=238$K in *p*-quaterphenyl). This decrease is associated to the critical slowing down of fluctuations. In the low temperature phase the ordering phenomena lead to a sharp drop of the spin-lattice relaxation rate. (19 refs.)

Rotational states of NH_4^+ in dilute solution in alkali halide lattices. II. An NMR study of KBr/NH_4Br ....See Entry 107571

Diffusion behavior in titanium-chromium hydrides ....See Entry 108052

Hydrogen mobility in crystalline and amorphous Zr_2PdH_x ....See Entry 108059

Paramagnetic relaxation of protons of water adsorbed on the aerosil surface ....See Entry 108191

Hyperfine interactions measurements on ^{181}Ta probes in HfV_2H_x compounds: $(0\leq x\lesssim 4)$ ....See Entry 108366

Effect of electron correlation on the magnetic properties of expanded liquid sodium ....See Entry 108636

Methyl rotation in 1,2,4,5-tetramethylbenzene and tetramethylpyrazine in the solid state. Tunneling spectra by proton NMR ....See Entry 108799

Magnetic couplings in Cs_2IrCl_6 and other iridium hexachlorides from NMR studies ....See Entry 108809

Diffusion-induced quadrupole relaxation of ^{27}Al nuclei in dilute Al-Ti, Al-Cr, Al-Mn, and Al-Cu alloys at high temperatures ....See Entry 108829

Anomalous behavior of ^{19}F NMR signals in K_2CuF_4 at ultralow temperatures ....See Entry 108832

Study of the temperature dependence of the rate of oxygen exchange across an air-water interface ....See Entry 110488

76.60G Quadrupole resonance

108829 Diffusion-induced quadrupole relaxation of ^{27}Al nuclei in dilute Al-Ti, Al-Cr, Al-Mn, and Al-Cu alloys at high temperatures. L.Bottyan (Dept. of Materials Sci., Hungarian Aluminium Corp., Budapest, Hungary), D.L.Beke, K.Tompa.
Phys. Status Solidi b (Germany), vol.118, no.2, p.835-42 (1 Aug. 1983).
The temperature dependence of the laboratory frame spin-lattice relaxation time of ^{27}Al nuclei is measured in 5N Al and in dilute Al-Ti, Al-Cr, Al-Mn, and Al-Cu alloys at 5.7 and 9.7 MHz resonance frequencies. The relaxation in pure aluminium is found to be purely due to the conduction electrons. An excess T_1-relaxation contribution is detected in all Al-3d alloys investigated above 670K. The excess relaxation rate is proportional to the impurity content and the temperature dependence of the excess contribution is of Arrhenius-type with an activation energy of (1.3 ± 0.3) eV for all of the investigated alloys. The relaxation contribution is found to be quadrupolar in origin and is caused by the relative diffusional jumps of solute atoms and Al atoms relatively far from the impurity. (30 refs.)

108830 Study of rubidium hydroselenite by NMR of ^{87}Rb and ^2D. A.I.Roslyakov, I.S.Vinogradova (Inst. of Phys., Acad. of Sci., USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.99-100 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.175-7 (Jan.-Feb. 1983). [received: Sept. 1983]
Uses nuclear magnetic resonance (NMR) to make a systematic investigation of the hydroselenite family $MHSeO_3$. The authors discuss the determination of the nuclear quadrupole interaction constants of rubidium and deuterium and the lengths and direction cosines of the hydrogen bonds in $RbHSeO_3$, and seek the phase transitions. (7 refs.)

On the phase transition in $[(CH_3)_4N]_2ZnBr_4$ ....See Entry 107912

76.60L Spin echoes

108831 A note on the signal intensity of the second spin echo in Carr-Purcell-Meiboom-Gill sequence of turbulent flows. Y.Kawabe, K.Fukuda, A.Hirai (Dept. of Phys., Kyoto Univ, Kyoto, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2308-11 (July 1983).
In the study of turbulent flows by a pulsed NMR method, the signal intensity of the second spin echo in a Carr-Purcell-Meiboom-Gill sequence is measured as a function of the magnetic field gradient. A theoretical expression for the signal intensity has been obtained which seems to explain the experimental data, particularly the dependence of the signal intensity on the magnetic field gradient, more satisfactorily than the previous models. (6 refs.)

108832 Anomalous behavior of ^{19}F NMR signals in K_2CuF_4 at ultralow temperatures. M.Fujii, A.K.Hirai (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2898-9 (Aug. 1983).
^{19}F NMR in a two dimensional Heisenberg ferromagnet K_2CuF_4 has been studied down to 30 mK at zero or small external fields. Below 1K the NMR signals show anomalous behavior, which can be explained satisfactorily, by solving the coupled equations of motion for four ^{19}F nuclear spins and an electron spin, whose ferromagnetic resonance frequency is nearly equal to zero. Furthermore, below 90 mK, a new strong spin echo signal appeared at 54.5 MHz under a slightly different excitation condition. The origin and nature of this new signal is difficult to understand at present. (17 refs.)

108833 NMR study of the orientational ordering of monolayers of $^{15}N_2$ on graphite. N.S.Sullivan, J.M.Vaissiere (Service de Phys. du Solide et de Resonance Magnetique, CENS, Gif-sur-Yvette, France).
Phys. Rev. Lett. (USA), vol.51, no.8, p.658-61 (22 Aug. 1983).
NMR pulse techniques have been used to study the orientational ordering of $^{15}N_2$ molecules physisorbed on graphite. A small hysteresis ($\sim$2.5%) and small discontinuity in the evolution of the NMR echo amplitudes which depend directly on the local order parameters indicates that the order-disorder transition is first order. (26 refs.)

108834 Oscillations of NMR-echo signals in antiferromagnets. Ya.Ya.Asadullin.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1208-13 (Aug. 1983). In Russian.
A theory of NMR-echo in antiferromagnets is given with account of nonlinear mechanisms of three types: excitation, damping and dispersion. Oscillations of the echoes are predicted and explained. Their significance for determination of unknown parameters of the system is discussed. The displacement of the echo appearance time and 'capture' echo are also explained. It is shown that the oscillations mentioned are inherent in a class of echo phenomena in solids, gases and plasmas. (9 refs.)

Antiferromagnetism of YMn_2 intermetallic compound ....See Entry 108647

76.70 MAGNETIC DOUBLE RESONANCES AND CROSS EFFECTS

76.70D Electron-nuclear double resonance (ENDOR)

108835 Transferred hyperfine interactions between ^{25}Mg nuclei and neighbouring Cr^{3+} impurities in magnesium oxide [ENDOR study]. P.Freund (Clarendon Lab., Univ. of Oxford, Oxford, England).
J. Phys. C (GB), vol.16, no.25, p.5039-51 (10 Sept. 1983).
Using the ENDOR technique, magnetic hyperfine and quadrupole interactions of ^{25}Mg nuclei close to Cr^{3+} and Ni^{2+} substitutional impurities in MgO have been measured. The results are discussed in terms of the amount of unpaired spin in the Mg^{2+} orbitals. It is shown that the size of the isotropic part of the magnetic hyperfine interaction is explained better if the Mg^{2+} 1s orbitals are included in the calculation that if only the outer, 2s orbitals are used. The anisotropic part is described well by a combination of the effects of the magnetic dipole interaction and the overlap of Mg^{2+} 2p orbitals with O^{2+} orbitals containing unpaired spin. The quadrupole interactions can only be partly analysed because of insufficient information but it is shown that charge transfer only accounts for a small part of the observed interactions. (20 refs.)

108836 Spin density distribution in cobaltocene: a proton ENDOR study on $Co(cp)_2$ diluted in $Mn(cp)(CO)_3$ single crystals. M.Rudin, J.M.Fauth, A.Schweiger, R.R.Ernst (Lab. for Phys. Chem. ETH, Zurich, Switzerland), L.Zoller, J.H.Ammeter.
Mol. Phys. (GB), vol.49, no.6, p.1257-75 (20 Aug. 1983).
In order to obtain information on the spin density distribution in cobaltocene $(CO(cp)_2)$ at low temperature, a single crystal proton ENDOR study of $Co(cp)_2$ doped $Mn(cp)(CO)_3$ has been carried out. The hyperfine tensors of all ten ring protons have been determined. These data indicate that the molecular symmetry of $Co(cp)_2$ is almost D_{5h}, i.e. the two cp rings are eclipsed. The isotropic hyperfine couplings reflect approximate $C_{2v}(y)$ symmetry of the spin density distribution and hence support a ground state with predominant d_{xz} character. Both isotropic and dipolar proton hyperfine couplings have been used to derive the spin densities at the adjacent carbon centres. These results show that the isotropic proton coupling is mainly due to polarization of the proton 1*s* orbitals and that direct contributions from σ-spin density on the cp rings are of minor importance. The spin densities in the carbon $2p_z$ orbitals derived from proton ENDOR data are compared to those calculated from EPR (g-tensor) and HMO results. Discrepancies which have been found are, among other reasons, due to the fact that the experimental spin density distribution shows only approximately $C_{2v}(y)$ symmetry. To account for this low symmetry, orbital mixing of the d_{xz} and d_{yz} orbitals has been considered. (43 refs.)

ENDOR study of VO^{2+} adsorbed on Y zeolite .... See Entry 106473

Two types of F centres in alkaline earth fluoro-halides. I. Superhyperfine interactions and electronic structure .... See Entry 107693

76.70F Double nuclear magnetic resonance (DNMR)

108837 Double resonance saturation recovery in 2,6-lutidine. K.Mizuno, M.Ishiwata (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2918-21 (Aug. 1983).
The time variation of the longitudinal magnetization of an individual A-proton line in an AB_2-proton system in 2,6-lutidine was observed by the saturation-recovery method under continuous irradiation of a second radio-frequency field to certain particular lines of the B protons. The stirring field was so weak that the spin-tickling effect caused no detectable splitting of the observed line. The dependence of the recovery time T_{H2} on the strength H_2 of the stirring field differs according to the combination of the observed and the stirred lines; as H_2 increases, the T_{H2} for regressively connected lines increases monotonically, that for unconnected lines hardly changes, and that for progressively connected lines decreases at first and then increases. (8 refs.)

Spin-lattice relaxation of ^{13}C in solid amino acids using the CP-MAS technique .... See Entry 108819

76.70H Optical double magnetic resonance (ODMR)

108838 Optical and optically detected magnetic resonance studies of AgBr:I$^-$. A.P.Marchetti, M.S.Burberry (Res. Labs., Eastman Kodak Co., Rochester, NY, USA).
Phys. Rev. B (USA), vol.28, no.4, p.2130-5 (15 Aug. 1983).
Low-temperature emission and optically detected magnetic resonance (ODMR) spectra of AgBr containing various amounts of iodide have been obtained. The ODMR spectrum at low iodide concentrations (1-100 p.p.m.) is assigned to transitions of the iodine-bound exciton. Time and wavelength evolution of the emission from high-iodide-concentration (~3 at.%) samples provides evidence for donor-acceptor recombination. ODMR spectra of high-iodide-concentration samples suggest an iodide-related hole trap. (21 refs.)

108839 ODMR study of the nature of iron-red photoluminescence in ZnS crystals. M.Godlewski (Inst. of Phys., Polish Acad. of Sci., Warsaw, Poland).
Solid State Commun. (USA), vol.47, no.10, p.811-13 (Sept. 1983).
Based upon the ODMR (optically detected magnetic resonance) measurements on the so-called iron-red (Fe-R) luminescence in ZnS it is shown that the emission is due to the radiative capture of either free or weakly bound electron by substitutional Fe^{3+} associated with an unknown defect residing in n.n. Zn position. (12 refs.)

76.80 MÖSSBAUER EFFECT; OTHER GAMMA-RAY SPECTROSCOPY

108840 Mossbauer study of cage motion in Ag^{57}Co/^{57}Fe. I.Sakamoto, B.Furubayashi, W.Petry.
Bull. Electrotech. Lab. (Japan), vol.47, no.6, p.489-96 (1983). In Japanese.
It has been observed that ^{57}Co/^{57}Fe atoms in 3 MeV e^- irradiated Ag have moved restrictively within a cage near 60K. An application in the investigation of radiation damage by a method making use of cage motion is described. (17 refs.)

108841 Preliminary study of the recoil implanted perturbed angular distribution. H.Watanabe, H.Sekiguchi.
Bull. Electrotech. Lab. (Japan), vol.47, no.6, p.497-504 (1983). In Japanese.
The internal magnetic field of ferromagnetic materials has been measured by the integral perturbed angular correlation method following a low energy ^{53}Mn recoil implantation into the ferromagnetic materials by the resonant proton capture reaction $^{52}Cr(p,\gamma)^{53}Mn$. The experimental method and results are given. (15 refs.)

108842 Mossbauer effect of ^{57}Fe impurity atoms in TiAl. I.A.Zelenkov, S.N.Pastushenko (Inst. of Civil Aviation Engng., Kiev, Ukrainian SSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.610-14 (1982). [received: Aug. 1983]
The purpose of the present study was to examine the hyperfine structure of Mossbauer absorption spectra from ^{57}Fe impurity atoms (0.3%) and to elucidate the local neighborhood and distribution of Fe atoms in TiAl sublattices. Mossbauer spectra of powdery specimens were taken on a YaGRS-4 spectrometer with constant accelerations using a multichannel pulse analyzer. It is concluded that Fe impurity atoms in the matrix of the stoichiometric TiAl metallide tend to occupy Al sites. This results in a greater amount of Fe-Ti bonds and may indicate that there is a higher covalency in the Fe-Ti interatomic bond and a greater Fe-Ti interaction energy as compared to that of Fe-Al interaction. Near the melting point Fe atoms with equal probability replace Al and Ti sites in an ordered TiAl matrix, which is stronger than between the atoms of the matrix and impurity. (3 refs.)

108843 Mossbauer and magnetisation studies of the alloy $Fe_{0.69}Pd_{0.31}$. N.V.Nair, D.C.Khan (Dept. of Phys., Indian Inst. of Technol., Kanpur, India).
J. Phys. F (GB), vol.13, no.9, p.1965-72 (Sept. 1983).
The authors report Mossbauer and magnetisation studies of the alloy $Fe_{0.69}Pd_{0.31}$ with special emphasis on the FCC-FCT martensitic transformation. The transition temperature of 184K is determined from the $T^{3/2}$ dependence of the quadrupole splitting which undergoes a change in slope after the transformation. The hyperfine field distribution in the FCC phase at various temperatures shows a steady increase in the distribution width with temperature, which indicates a short-range order in the material. The recoilless fraction of the material is determined using the method of Trooster et al. (1978) and the value of f_a obtained at room temperature is 0.568 in this alloy. (9 refs.)

108844 ^{121}Sb Mossbauer study of some lithium thioantimonates. J.-C.Jumas, J.Olivier-Fourcade, E.Philippot, M.Maurin (Lab. de Chimie Minerale C, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
J. Solid State Chem. (USA), vol.49, no.1, p.6-13 (Aug. 1983). In French.
Antimony 121 Mossbauer spectra have been recorded at liquid-helium temperature for ternary sulfides isolated from the Li_2S-Sb_2S_3 system. The chemical isomer shifts observed (−6.22 to −3.50 mm/sec relative to InSb at 78K) are characteristic of antimony (III) compounds. The Mossbauer data are discussed in relation to their known structures with regard to the stereochemical activity of the antimony (III) lone pair of electrons. (20 refs.)

108845 A Mossbauer study of the κ phase in the Fe-W-C system. P.Jernberg, R.Wappling (Inst. of Phys., Univ. of Uppsala, Uppsala, Sweden).
J. Solid State Chem. (USA), vol.49, no.1, p.123-5 (Aug. 1983).
It is shown that, taking the absorber thickness properly into account, reliable values of the iron population of the different sites in κ-(Fe-W-C) can be obtained although the resolution in the Mossbauer spectrum is limited. The partial population of one 2*a* crystallographic position was determined to be $40\pm2\%$ in good agreement with the value $45\pm1\%$ obtained from a recent diffraction study. (5 refs.)

108846 Contribution of the direct B-B interaction to the supertransferred hyperfine field at diagmagnetic antimony in oxidic spinels determined by ^{121}Sb Mossbauer spectroscopy. G.Dehe, U.Behn (Sektion Phys., Karl-Marx-Univ. Leipzig, Leipzig, Germany).
Phys. Status Solidi a (Germany), vol.78, no.2, p.485-8 (16 Aug. 1983).
By studying the magnitude of the magnetic hyperfine splitting in the ^{121}Sb Mossbauer spectrum, the substitution of nominally diagmagnetic Sb^{5+} ions in oxidic spinels is suitable for determining the strength of the contribution of the different magnetic interactions, producing the supertransferred hyperfine field. The samples $ZnNi_{2/3}FeSb_{1/3}O_4$ and $Ni_{5/3}FeSb_{1/3}O_4$ are prepared and ^{121}Sb Mossbauer spectra at room temperature with and without a transverse external magnetic field are recorded and analyzed. In the $ZnNi_{2/3}FeSb_{1/3}O_4$ sample a contribution due to covalency mixing by a direct cation-cation orbital combination of about 10% of the contribution due to a polarizing mechanism via the intermediate ligands is proved. It can be shown that there is a certain temperature region above the Neel temperature (T_N) in which ^{121}Sb nuclei are still sensitive to the magnetic ordering in the sample, whereas ^{57}Fe nuclei are not sensitive to it. (7 refs.)

108847 Quadrupole interaction of tantalum impurities in bismuth metal. S.N.A.Jaaffrey, J.Varma (Phys. Dept., Univ. of Udaipur, Udaipur, India).
Pramana (India), vol.20, no.5, p.387-92 (May 1983).
The time differential perturbed angular correlation technique has been used in the measurement of the electric quadrupole interaction of Ta impurity in bismuth metal. The interaction frequencies at 293, 400 and 500K have been observed to be 288 ± 1.5, 266.0 ± 3 and 244.5 ± 4.3 MHz respectively. The electric field gradient at 293K is $4.75\pm0.3\times10^{17}$ V/cm^2 with the temperature coefficient $B=2.2\pm0.2\times10^{-5}(K)^{-3/2}$. (26 refs.)

108848 ^{151}Eu isomer shifts and charge transfer in Eu-base intermetallic compounds. J.W.C.de Vries, R.C.Thiel (Kamerlingh Onnes Lab., Rijksuniv. Leiden, Leiden, Netherlands), K.H.J.Buschow.
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.100-8 (1983).
The ^{151}Eu isomer shift found in various divalent Eu compounds have been analysed by means of the model proposed earlier for the ^{197}Au isomer shift in Au-base materials by Miedema and Van der Woude (1980). Relative changes of 5d and 6s electron occupation numbers due to alloying of divalent Eu with other elements were deduced from this analysis and compared with electronic properties reported for such compounds in the literature. (23 refs.)

108849 The Mossbauer effect on ^{119}Sn nuclei in vanadium, platinum and niobium. R.B.Yadav (Phys. Dept., Memorial Univ. of Newfoundland, St. John's, Newfoundland, Canada).
Solid State Commun. (USA), vol.47, no.4, p.267-8 (July 1983).
The probabilities for recoilless resonant absorption of 23.8 keV γ-rays by ^{119}Sn in matrices of vanadium, platinum and niobium have been calculated in the temperature ranges 80-400K. The calculated results show a good agreement with the experimental data. (13 refs.)

108850 Mossbauer studies of defect-impurity interaction and impurity diffusion in metals. G.Vogl, W.Petry, K.Sassa (Hahn-Meitner-Inst., Berlin, Germany), S.Mantl.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.33-40
On the basis of the earlier determination of the characteristic Mossbauer spectra of ^{57}Co/^{57}Fe impurities with tapped interstitials or vacancies in aluminium, point defects produced by plastic deformation and neutron or ion irradiation have been studied. In plastically deformed aluminium vacancy migration was found at temperatures well below stage III, whereas no freely migrating interstitials were detected. The diffusion of Fe impurity atoms in

aluminium has also been investigated. From Mossbauer studies on a single crystal specimen the elementary diffusion jump was determined. It has further been possible to detect and investigate special jump processes due to interstitial-impurity binding (impurity jumps in a cage) and vacancy-impurity binding. (31 refs.)

108851 ^{57}Fe Mossbauer study on point defects in pure iron. Y.Yoshida, S.Nasu, F.E.Fujita (Dept. of Material Phys., Osaka Univ., Osaka, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.199-202
The study of the point defects in neutron irradiated pure iron is performed by using the normal transmission and new thermal scan method in the Mossbauer source experiment. Clear annealing stages below 110K and around 200K are found in the measurements of the count-rate, total resonance area, average hyperfine field and full width at half maximum. These temperatures may correspond to the recovery of interstitials and vacancies, respectively. (8 refs.)

108852 Theory of Mossbauer line broadening due to diffusion. K.Schroeder (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany), D.Wolf, P.H.Dederichs.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.570-3
The authors have calculated the line broadening of the Mossbauer line due to diffusion of Mossbauer atoms via single vacancies. They take into account the perturbation of vacancy jumps in the neighbourhood of an impurity Mossbauer atom (e.g. Fe in Al) using the 5-frequency model. The anisotropy of the line width is given by the Fourier transform of the final distribution of a Mossbauer atom after an encounter with a vacancy. This distribution is calculated by Monte Carlo computer simulation. (17 refs.)

Measurement of subatomic displacements for Mossbauer spectroscopy .... See Entry 105434

The mechanism of implanted ion tapping in thick targets investigated by Mossbauer technique .... See Entry 106189

Electronic structure and tetragonality of martensite .... See Entry 107600

Local atomic distribution in solid solutions of iron in α and β modifications of manganese .... See Entry 107606

Three crystalline polymorphs of KFeSiO$_4$, potassium ferrisilicate .... See Entry 107638

Pentavalent iron stabilized for the first time in sixfold coordination in an oxide .... See Entry 107649

PAC study of point defects in metals .... See Entry 107678

Surface damage and crystallization in amorphous alloys by helium ion bombardment .... See Entry 107783

Systematic experimental and theoretical studies of the lattice vibrations of host atoms and substitutional Sn impurities in III-V semiconductors .... See Entry 107837

Migration of implanted He in stainless steel as observed by trapping at ^{111}In atoms .... See Entry 108065

Hyperfine interactions measurements on ^{181}Ta probes in HfV$_2$H$_x$ compounds: $(0 \leq x \leq 4)$ .... See Entry 108366

Paramagnetic hyperfine structure of iron (57) in V$_{1-x}$Fe$_x$O$_2$ .... See Entry 108370

Electrical and structural properties of iron-doped β-alumina .See Entry 108482

Magnetic structures of monoclinic FeGe .... See Entry 108644

Magnetic properties of oxides containing six-coordinated iron (IV) or (V) .... See Entry 108650

Double coordination of iron in the phase Fe$_x$ZrSe$_2$ $(0<x<0.25)$: magnetic properties and Mossbauer characteristics .... See Entry 108658

Local and itinerant magnetism and superconductivity in R Rh$_2$Si$_2$ (R=rare earth) .... See Entry 108691

Investigation of directional short-range ordering in iron alloys by the NGR method .... See Entry 108695

Mechanism and kinetics of formation of ferrite in the solid phase in the CaO-Fe$_2$O$_3$ system [Mossbauer observations] .... See Entry 109205

Cementite decomposition in steel under plastic deformation .. See Entry 109212

Interaction of additions of vanadium and copper with admixture atoms of iron in α-Zr [Mossbauer observations] .... See Entry 109224

Structural and magnetic studies of pure and substituted gamma iron oxide .... See Entry 109322

Conversion electron Mossbauer spectroscopy on the oxidation of a (110) Fe-57 single crystal 100 Å thick .... See Entry 109563

Hydrogen absorption in Mg-Ni-Fe alloys .... See Entry 109922

76.90 OTHER TOPICS IN MAGNETIC RESONANCES AND RELAXATION

(inc. muon probe studies)

Studies of point defects by positrons and positive muons .... See Entry 107676

Observation of monovacancies in iron by the μSR technique .See Entry 107677

Evidence for power-law spin-correlation decay from muon spin relaxation in *Ag*Mn spin-glass .... See Entry 108706

Selectivity of muonic radical formation in methyl-substituted buta-1,3-dienes .... See Entry 109772

77.00 DIELECTRIC PROPERTIES AND MATERIALS

(for conductivity phenomena, see 72.20 and 72.80)

77.20 PERMITTIVITY

108853 Evaluation of dielectric permittivity by DC transient current. S.Yagihara, R.Nozaki, S.Takeishi, S.Mashimo (Dept. of Phys., Tokai Univ., Kanagawa, Japan).
J. Chem. Phys. (USA), vol.79, no.5, p.2419-22 (1 Sept. 1983).
Inverse Laplace transformation of the Havriliak-Negami (HN) equation (1967) of complex dielectric permittivity has been obtained analytically both in short time and long time regions. A convenient procedure for determining the relaxation parameters in the HN equation from the DC transient current has been presented. Even if the current measurement is not carried out over the whole time range but only in a restricted time range, this procedure gives satisfactory values to the relaxation parameters. (33 refs.)

108854 Dielectric susceptibility and thermal hysteresis in K$_2$SeO$_4$ and Rb$_2$ZnCl$_4$. H.Mashiyama, H.-G.Unruh (Fachrichtung Experimentalphys., Univ. des Saarlandes, Saarbrucken, Germany).
J. Phys. C (GB), vol.16, no.25, p.5009-16 (10 Sept. 1983).
The dielectric constant of potassium selenate and rubidium tetrachlorozincate is measured in the temperature range including the incommensurate phase. The inverse susceptibility obeys the Curie-Weiss law in a certain temperature region above the lock-in temperature. The thermal hysteresis of the susceptibility is interpreted as being caused by pinning effects on the incommensurate modulation in the crystal and consequences thereof are explained by using the Landau-type free energy. (15 refs.)

108855 Some comments on the complex permittivity of ellipsoids dispersed in continuum media. C.Boned, J.Peyrelasse (Dept. de Phys., Inst. Univ. de Recherche Sci., Univ. de Pau et des Pays de l'Adour, Pau, France).
J. Phys. D (GB), vol.16, no.9, p.1777-84 (14 Sept. 1983).
Complex permittivity equations have been derived using the Bruggeman method at high volume fractions for a random distribution of ellipsoids dispersed in a continuous medium. (24 refs.)

108856 Estimation of permittivity of a compact crystal by dielectric measurements on its powder: A stochastic mixture model for the powder-dielectric. P.S.Neelakantaswamy, B.V.R.Chowdari, A.Rajaratnam (Dept. of Phys., Faculty of Sci., Nat. Univ. of Singapore, Singapore).
J. Phys. D (GB), vol.16, no.9, p.1785-99 (14 Sept. 1983).
A stochastic mixture model is proposed for the dielectric formed by the powder of an isotropic polycrystalline material included in an embedding medium of air or a non-polar substance. The relevant expression of the complex dielectric constant of the mixture is obtained in terms of the dielectric parameters of the mixture constituents and the volume fraction of the crystalline material. Hence the possibility of deducing the dynamic state dielectric characteristics of the solid (compact) crystal from the measured data on the powder is indicated. Theoretical results obtained for 1-cyanoadamantane using the present model over a wide spectral range (1 kHz to 1 GHz) are compared with corresponding experimental data available elsewhere. Results due to the present method agree more closely with the measured values for both low and high volume fractions, when compared with the results based on other existing models due to Bottcher and Looyenga. (10 refs.)

108857 Observation of dielectric collapse at excited acceptors in germanium. V.I.Bocharnikov, E.E.Godik, A.V.Petrov (Inst. of Radio Engng., & Electronics., Acad. of Sci., USSR).
JETP Lett. (USA), vol.37, no.6, p.306-8 (20 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.6, p.259-61 (20 March 1983). [received: Sept. 1983]
The dielectric constant of germanium is found to display a superlinear dependence on the concentration of photoexcited impurities. It is shown that the observed effect is due to the growth of the polarizability of the excited centers as a result of their interaction. (5 refs.)

108858 Dielectric properties of alkali halides using Mott-Littleton polarization theory. J.Shanker, R.Sundaraj (Phys. Dept., Agra Coll., Agra, India).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.175-80 (1983).
Some new relations between the electronic and static dielectric constants and the transverse optical mode frequency are obtained using the Mott-Littleton expressions (1938) for effective polarization fields. The usefulness of these relations is demonstrated, in explaining the dielectric behaviour of alkali halide crystals under the effect of pressure, by calculating the volume derivatives of dielectric constant and transverse optical mode Gruneisen parameter. (28 refs.)

Nonlinear absorption of electromagnetic waves in crystals with large dielectric constant caused by SBS .... See Entry 106824

A new type of modulated structure in a smectic A .... See Entry 107540

New compounds with the structure of tetragonal potassium-tungsten bronze .... See Entry 107631

Disorder phenomena in β-alumina .... See Entry 108034

Electronic structure of anisotropic semiconductors: optical properties and behaviour under hydrostatic pressure .... See Entry 108280

Concentration-dependent dielectric response of Ga$_{1-x}$Al$_x$As ..See Entry 108323

Far-infrared magneto-plasma wave transmission and the dielectric constant in bismuth under high magnetic fields .... See Entry 108463

Nonstoichometric germanium nitride. A new insulating material for MIS microelectronics. II. Composition, properties, and the interface with a semiconductor .... See Entry 108569

Dielectric relaxation study of the incommensurate phase of [(CH$_3$)$_4$N]$_2$CuBr$_4$ near the transition temperature .... See Entry 108871

Electrical relaxation in pure and alkali metal thiocyanate complexed poly(ethylene oxide) .... See Entry 108873

Phase transition in $\{$N(CH$_3$)$_4\}_2$MnBr$_4$ .... See Entry 108891

Anomalously narrow peak in the dielectric constant of Cd$_2$Nb$_2$O$_7$ near the diffuse phase transition .... See Entry 108892

Ammonium dihydrogen phosphate (ADP) impurity effects on phase transition and domain-wall freezing in potassium-ammonium dihydrogen phosphate [(KDP)$_{1-x}$(ADP)$_x$] crystals .... See Entry 108894

Temperature dependences of optical birefringence and dielectric constant of [N(CH$_3$)$_4$]$_2$ZnCl$_4$ crystals .... See Entry 108918

Growth and properties of large LiNbO$_3$ crystals .... See Entry 109128

Preparation and properties of single crystals of some cadmium-containing indium, thallium, and cesium halides .... See Entry 109133

Properties of plasma-deposited films using ethylene and fluoroethylenes as starting monomers .... See Entry 109168

On the theory of adiabatic electron-transfer reactions in polar solvents .... See Entry 109719

Dielectric properties of sulfopropyl Sephadex gel beads dispersed in aqueous solutions .... See Entry 109809

77.30 POLARIZATION AND DEPOLARIZATION EFFECTS

108859 Thermostimulated depolarization currents on a glass surface in ambient gases. B.Despax, C.Huraux, R.Lacoste, M.Abdullah (Lab. de Genie Electrique, Univ. Paul Sabatier, Toulouse, France).
J. Mater. Sci. (GB), vol.18, no.9, p.2544-54 (Sept. 1983).
Interdigital comb-shaped electrodes were used to observe thermostimulated depolarization currents flowing on a soda glass surface in ambient gases. The experimental set up, electrode shaping by photograving and measurement procedure are described. Surface thermostimulated depolarization current (STDC) spectra were recorded on glass specimens in carbon dioxide or helium. In both cases, after short gas residence times, depolarization currents were not different from those obtained in vacuum. Different STDC spectra were recorded as the residence time of a glass specimen in CO_2 was increased; these spectra also changed with polarization time and polarization temperature. In helium, STDC peaks were observed at −110°C and −90°C with a shoulder at −65°C. A discussion and an attempt to interpret the results in terms of charge injection in glass involving slow adsorption or absorption of the ambient gas are given. (7 refs.)

108860 Effect of iodine on depolarisation behaviour of polyvinyl fluoride (PVF) films. P.C.Mehendru, Suresh Chand (Nat. Phys. Lab., New Delhi, India).
J. Phys. D (GB), vol.16, no.9, p.L185-8 (14 Sept. 1983).
The depolarisation behaviour of PVF films doped with iodine (0-2.0% by weight) has been studied using the TSD technique. The TSD spectra of these films reveal two relaxation peaks. The peak positions, peak currents, charges and activation energies associated with the two peaks are strongly affected by the concentration of iodine and have been explained in terms of formation of charge transfer complexes and molecular aggregates. (12 refs.)

108861 Non-uniform polarization effects in DC stressed low-density polyethylene. D.K.Das-Gupta, K.Doughty, J.S.Duffy (School of Electronic Engng. Sci., Univ. Coll. of North Wales, Bangor, Wales), D.E.Cooper.
J. Electrostat. (Netherlands), vol.14, no.2, p.165-74 (Aug. 1983).
Thermal current transients have been measured in untreated and hexane-treated low-density polyethylene as a function of electrical pre-stress. The results indicate a significant non-uniform polarization which is moderated by increasing fields in a complex manner. (30 refs.)

108862 A relationship between the universal law of susceptibility response and the correlation weakening principle. R.R.Nigmatullin, R.M.Hill (Dept. of Phys., Chelsea Coll., Univ. of London, London, England).
Phys. Status Solidi b (Germany), vol.118, no.2, p.769-78 (1 Aug. 1983).
The observation of the universal response of electrical, mechanical, acoustic, and magnetic systems in which power law behaviour in the time and frequency domains is seen indicates the universal behaviour of correlation functions in these systems. It is shown that this behaviour can be obtained by making use of the correlation weakening principle which plays an essential role in quantum-statistical physics and which does not depend on the detailed structure of the many-body system involved. (23 refs.)

108863 Thermally stimulated depolarisation currents in $Ce_2(SO_4)_3.9H_2O$. A.Torres, J.Jimenez, V.Carbayo, J.A.De Saja (Lab. de Fisica del Estado Solido, Facultad de Ciencias, Valladolid, Spain).
Phys. Status Solidi a (Germany), vol.78, no.2, p.671-7 (16 Aug. 1983). In French.
The results shown in this paper for $Ce_2(SO_4)_3.9H_2O$ and $Ce_2(SO_4)_3.9D_2O$ single crystals, are a part of a general study of the physical properties of lanthanide (III) sulfate hydrates. From TSDC (thermally stimulated depolarization current) and TSPC (thermally stimulated polarization current) studies of hydrated and deuterated single crystals one can deduce that the current arises from dipole relaxation which may be related to the hydrogen or deuterium atoms (hydrogen bonds). The experimental set-up is described in detail. (20 refs.)

108864 The generalization of the Debye equation and its application to the electrets study. R.M.Neagu (Phys. Dept., Polytechnic Inst. of Jassy, Jassy, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.6, p.547-53 (1983).
In order to generalize the Debye equation the reaction field of a dipole and the internal field, deduced by Onsager, are considered. This equation describes the behaviour of a dielectric which contains polar molecules, under the influence of an electric field which varies in time. Starting from this equation the author obtains the equations which describe the charge and the discharge of a thermoelectret during the thermostimulated discharge (TSD). (7 refs.)

Chiral SmC* liquid crystals obtained by mixing of SmC and cholesteric phase .... See Entry 107522

Study of the phase transition in some cholesteryl and B-nor cholesteryl derivatives .... See Entry 107935

The effect of cure on thermally stimulated discharge measurements in epoxy resin coatings .... See Entry 108442

Thermally stimulated depolarization effect in thiourea-formaldehyde condensate .... See Entry 108448

Dielectric properties of alkali halides using Mott-Littleton polarization theory .... See Entry 108858

Low-temperature dielectric properties of ceramic potassium tantalate ($KTaO_3$) .... See Entry 108867

Ammonium dihydrogen phosphate (ADP) impurity effects on phase transition and domain-wall freezing in potassium-ammonium dihydrogen phosphate $[(KDP)_{1-x}(ADP)_x]$ crystals .... See Entry 108894

Pulsed polarization reversal in gamma-irradiated crystals of triglycine sulfate .... See Entry 108895

Ferroelectric domain structure of $PbHPO_4$ .... See Entry 108897

77.40 DIELECTRIC LOSS AND RELAXATION

108865 Secondary amines: a low-temperature dielectric relaxation study. J.Gilchrist, H.Godfrin (Centre de Recherches sur les Tres Basses Temperatures/CNRS, Grenoble, France).
Chem. Phys. (Netherlands), vol.79, no.2, p.307-20 (1 Sept. 1983).
Polyethylene matrices containing dibutylamine and dioctylamine were studied at temperatures down to 4.4 mK, and the mean inversion splitting of each amine was estimated to be 425±25 MHz. This result prompted a new study of some thiophenol derivatives from which it is concluded that internal-rotation barriers and inversion barriers both tend to be a little higher (on the order of 100 cm^{-1}) in hydrocarbon matrices than in the vapours. An unexplained non-linearity of the dielectric response at sub-Kelvin temperatures was investigated by superposing alternating voltages of different frequencies. Thirty other secondary amines and similar compounds were also examined to evaluate the effects on nitrogen inversion of bulky alkyl groups, neighbouring π-bonds and ring strain. Derivatives of allylamine, benzylamine and pyrrolidine apparently had alternative configurations distinguished by markedly different inversion rates. The proportions depended on the matrix, polyethylene or polypropylene, as well as on the derivative. (34 refs.)

108866 Temperature dependence of dielectric properties of water. II. Absorption cell method. A.M.Gazimuddin (Phys. Dept., Coll. of Sci., Univ. of Basrah, Basrah, Iraq).
Proc. Pak. Acad. Sci. (Pakistan), vol.19, no.1, p.37-55 (1982).
The time of relaxation of water molecules at microwave frequencies is directly related with the structure of liquid water according to the concept of hydrogen-bonds bending, breaking and reforming. The effects of temperature on the relaxation time are the changes in the freedom of orientation of water molecules in the changing electric field. Therefore, the relaxation phenomenon is considered as a kind of rate process. It is demonstrated experimentally that there are 'structure temperatures' or 'thermal anomalies' in the temperature variation of $\Delta I(M,N)T$, which are directly due to the structures in $\epsilon''(T)$ and $\zeta(T)$ of the liquid water. These structural anomalies suggest that the structure of liquid water may not be homogeneous at all temperatures. From the idea of microcrystalline domains, it is proposed that there are different types of not easily interconvertible domain structures existing in liquid water and each particular one favoured over a narrow range of temperature. (12 refs.)

108867 Low-temperature dielectric properties of ceramic potassium tantalate ($KTaO_3$). Z.X.Chen, X.L.Zhang, L.E.Cross (Materials Res. Lab., Pennsylvania State Univ., University Park, PA, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.7, p.511-15 (July 1983).
Dielectric properties of $KTaO_3$ ceramic fabricated by both conventional sintering and sintering followed by isostatic hot pressing (HIP) were measured at T=4.2 to 300K over a frequency range from 400 Hz to 4 MHz. The weak field response shows a faint peak near 10K which has a clear relaxation character, as in high-purity single crystals. The general response is well reproduced by the Barrett function, but additional polarizability with relaxation character is also in evidence at higher temperatures. No dielectric hysteresis was observed at high fields for cycling frequencies down to 0.04 Hz anywhere in the temperature range. (16 refs.)

108868 Low-frequency dielectric loss of triglycine sulfate. E.Courtens (IBM Zurich Res. Lab., Ruschlikon, Switzerland), R.Garcia, J.A.Gonzalo.
Phys. Rev. Lett. (USA), vol.51, no.9, p.844-5 (29 Aug. 1983).
Discusses the observation of Ising dipolar critical behaviour of TGS with dielectric loss measurements performed at 1 kHz by Garcia and Gonzalo (1983). It is shown that the procedure of equating the q-dependent static susceptibility with a phenomenological dynamic response is not physically well founded and leads to numerical inconsistencies. (12 refs.)

108869 Dielectric relaxation in the crystalline smectic-*B* phase. L.Benguigui (Solid State Inst., Technion-Israel Inst. of Technol., Haifa, Israel).
Phys. Rev. A (USA), vol.28, no.3, p.1852-4 (Sept. 1983).
The author measured the parallel dielectric relaxation in pentoxybenzlidene octylaniline (5O.8), in the nematic, smectic-*A*, and smectic-*B* phase. This last phase is characterized by a low-frequency relaxation with a small activation energy. Although the Sm-*B* has a three-dimensional positional ordering, the molecules are mobile as in the nematic and Sm-*A* phases. (11 refs.)

108870 Dielectric and electrical properties of SnO_2, Sb_2O_3, and their mixed films. J.S.Kumar, G.Narayana, M.C.Shekar, U.V.Subba Rao, V.H.Babu (Dept. of Phys., Osmania Univ., Hyderabad, India).
Phys. Status Solidi a (Germany), vol.78, no.2, p.647-553 (16 Aug. 1983).
The dielectric and electrical properties of sandwiched Al-SnO_2-Al, Al-Sb_2O_3-Al, and Al-(SnO_2+Sb_2O_3)-Al structures of different thicknesses are investigated. The AC capacitance and tan δ increase with decrease in frequency in all these films. A comparison of the capacitance values of these films shows that the values of the capacitance are larger in mixed films as compared to the values of capacitance in SnO_2 and Sb_2O_3 films. The variation of tan δ with frequency for mixed films lies between to that of SnO_2 and Sb_2O_3 films. Current-voltage characteristics of these films show that the breakdown voltage increases and the dielectric strength decreases with increase in film thickness in all the three types of films. The logarithm of breakdown field strength is plotted against the logarithm of the film thickness for the three types of films. Photomicrographs of the breakdown patterns at different stages of voltage are given and the results are explained. (15 refs.)

108871 Dielectric relaxation study of the incommensurate phase of $[(CH_3)_4N]_2CuBr_4$ near the transition temperature. R.Jakubas, L.Sobczyk (Inst. of Chem., Univ. of Wroclaw, Wroclaw, Poland).
Phys. Status Solidi a (Germany), vol.78, no.2, p.K147-50 (16 Aug. 1983).
Reports the results of $\epsilon^*(\omega)$ measurements for a crystal showing interesting incommensurate properties: $[(CH_3)_4N]_2CuBr_4$ (TMATB-Cu). The $\epsilon''(T)$ maxima at lower frequencies are shifted below T_c. This effect is reproducible and beyond the limits of experimental error. At higher frequencies, the maxima of permittivity and losses shift to higher T values reflecting a typical critical slowing down. The Cole-Cole diagram shows a considerable distribution of the relaxation time independently of the distance from the transition point. (9 refs.)

108872 Dielectric relaxation in networks of end-linked dimethylsiloxane oligomers. M.Naoki, S.Kondo (Faculty of Technol., Gunma Univ., Gunma, Japan).
Polymer (GB), vol.24, no.9, p.1139-44 (Sept. 1983).
Networks composed of very short dimethylsiloxane chains were prepared by end-linking dimethylsiloxane oligomers with a tetrafunctional crosslinking agent. Their dielectric properties were studied to elucidate the effects of crosslinks on molecular motion in highly crosslinked networks. The temperature of maximum loss for the primary relaxation process (α process) shifted greatly to high temperature with decrease in the chain length between crosslinks. The activation energy and the width of the absorption curve increased with decrease in chain length. No linear relation existed between the dielectric properties for the α relaxation and the crosslink density. On the other hand,

the temperature of maximum loss for the secondary relaxation process (β process) shifted to high temperature with decreasing chain length, but the activation energy was almost independent of the chain length. Characteristics for the α, β and hypersonic relaxations in the networks are discussed in terms of inter- and intramolecular contributions. (37 refs.)

108873 Electrical relaxation in pure and alkali metal thiocyanate complexed poly(ethylene oxide). J.J.Fontanella, M.C.Wintersgill, J.P.Calame (Phys. Dept., US Naval Acad., Annapolis, MD, USA), C.G.Andeen.
Solid State Ionics (Netherlands), vol.8, no.4, p.333-9 (July 1983).
Audio frequency complex admittance and DSC studies have been performed on pure poly(ethylene oxide) (PEO) and PEO complexed with alkali metal thiocyanates over the temperature range 5.5-380K. The dielectric constant of the complexed materials is found to be greater than for pure PEO. A discontinuity in the conductivity is found which increases in temperature as the size of the cation increases. In every case, the discontinuity is associated with a feature in the DSC results. Next, some evidence is given that water may enhance the formation of amorphous complexed PEO. In pure PEO, α_a and γ relaxations are observed in good agreement with previous work. A thermal anomaly is found corresponding to α_a. In addition, α_c is identified in pure PEO. Very little difference is found for the γ relaxation between pure PEO and PEO-LiSCN and PEO-NaSCN. For PEO-KSCN, three distinct peaks are found in the γ relaxation region. These results are consistent with a $tg^{+}t \rightleftarrows tg^{-}t$ transition interpretation for γ where the cations reside within the helical channels at low temperatures. (41 refs.)

New compounds with the structure of tetragonal potassium-tungsten bronze ....See Entry 107631

Disorder phenomena in β-alumina ....See Entry 108034

A relationship between the universal law of susceptibility response and the correlation weakening principle ....See Entry 108862

Static and dynamic dielectric properties on the pressure induced tricritical point of ferroelectric NH_4HSO_4 ....See Entry 108890

On the theory of adiabatic electron-transfer reactions in polar solvents ....See Entry 109719

Dielectric properties of sulfopropyl Sephadex gel beads dispersed in aqueous solutions ....See Entry 109809

77.50 DIELECTRIC BREAKDOWN AND SPACE-CHARGE EFFECTS

108874 Electrical breakdown studies in didymium oxide thin films. G.Narayana, J.Siva Kumar, G.A.Badri Narayana, U.V.Subba Rao, V.Hari Babu (Dept. of Phys., Osmania Univ., Hyderabad, India).
Mater. Lett. (Netherlands), vol.2, no.1, p.63-6 (July 1983).
I-V characteristics of sandwiched Al-didymium oxide-Al structures are studied for different thicknesses. The breakdown voltage increases and the dielectric strength decreases with increase of film thickness. Optical photomicrographs of the breakdown patterns during different stages of DC voltage are taken and the results discussed. (18 refs.)

108875 Conditioning effect of dielectric breakdown in liquid helium. S.Kim, M.Terauchi, K.Yoshino, Y.Inuishi (Faculty of Engng., Osaka Univ., Osaka, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.6, p.952-4 (June 1983).
In a non-uniform field with a needle-plane electrode system, the breakdown voltage V_b of a positive needle decreases as the number of breakdown events N increases, but that of a negative needle increases slightly with N. In a uniform field, the breakdown voltage decreases with increasing N. However, when the polarity of the voltage pulse is reversed after many breakdown events, V_b increases suddenly and then again decreases slightly with increasing N, tending to saturate. These conditioning effects can be explained by the increase of the electron injection from the cathode due to the formation of a rough surface by the previous breakdown events. (8 refs.)

108876 On the question of the maximum radius of destruction in the electrical breakdown of solid bodies. T.I.Alekseeva, V.I.Kurets, G.P.Filatov.
Elektron. Obrab. Mater. (USSR), no.3, p.54-7 (1983). In Russian. English translation in: *Electrochem. Ind. Process. & Biol. (GB)*
A method is proposed of evaluating the maximum radius of destruction in the electrical breakdown of dielectrics. Presented data of experimental studies on the destruction of specimens of a quartz ceramic confirm the adequacy of the proposed model. (8 refs.) *A.J.B.*

108877 Effect of heat treatment on dielectric strength of polyethylene terephthalate under compressive stress. C.H.Park, K.Okajima, M.Hara, M.Akazaki (Kyushu Univ., Kasuga, Japan).
IEEE Trans. Electr. Insul. (USA), vol.EL-18, no.4, p.380-9 (Aug. 1983).
Measurements of DC dielectric strength of polyethylene terephthalate (PET) film at room temperature are reported when it is heat set in silicone oil over a range of temperature between 60 to 200°C for durations of 1 and 60 min in order to control the degree of crystallinity of the sample. It is found that the DC dielectric strength under no mechanical stress increases with an increase in the degree of crystallinity, but the maximum dielectric strength under compressive stress at first increases with the degree of crystallinity, then reaches a maximum value, and decreases thereafter. For the samples heat treated near the glass transition temperature, which is about 70°C, the characteristics of dielectric strength under compressive stress are also varied significantly with heat treatment temperature and time although the crystallinity is constant. (39 refs.)

Dielectric and electrical properties of SnO_2, Sb_2O_3, and their mixed films ....See Entry 108870

Properties of plasma-deposited films using ethylene and fluoroethylenes as starting monomers ....See Entry 109168

77.55 DIELECTRIC THIN FILMS

Apparatus for probing electric fields in dielectric films by the albedo method .. ..See Entry 105422

Electrical breakdown studies in didymium oxide thin films ... See Entry 108874

77.60 PIEZOELECTRICITY AND ELECTROSTRICTION

(for piezo-optical effects, see 78.20H)

108878 Observation of the existence of electrically excited purely mechanical resonance in piezoelectric and ferroelectric materials. P.J.Chen (Sandia Nat. Lab., Albuquerque, NM, USA).
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.1145-55 (July-Aug. 1983).
A displacement laser interferometer system has been adapted to measure the mechanical displacements of specimens of piezo-electric and ferroelectric materials driven by cyclic electric fields. It is found that mechanical resonances of quite large amplitudes can exist independent of any noticeable electrical disturbances. They are also detected in virgin and depoled specimens of ferroelectric ceramics. Preliminary experimental evidence suggests that this phenomenon depends on the domain structure of the ferroelectric materials. (7 refs.)

108879 Generalized thermoelastic wave propagation in an infinite piezoelectric solid. S.M.Sanjukta Ray, A.K.Pal (Dept. of Maths., Jadavpur Univ., Calcutta, India).
Rev. Roum. Phys. (Rumania), vol.28, no.6, p.513-23 (1983).
In problems of thermopiezoelectric interacvtions, since the derivation of the constitutive equations by Mindlin (1961), the classical coupled thermoelasticity theory is generally applied. Recently, more advanced thermoelasticity theories have been proposed taking into account the thermal relaxation parameters. In the present paper, the authors make use of these generalized theories to study the three-dimensional bulk wave propagation in an infinite piezoelectric medium of monoclinic symmetry. (9 refs.)

108880 Registration of macroscopic quadrupole effects in crystals. V.V.Gladkii (Inst. of Crystallography, Acad. of Sci., USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.191-5 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.328-33 (March-April 1983). [received: Sept. 1983]
The author discusses various ways of registering electrical effects arising in crystals spontaneously or under external actions owing to changes in the macroscopic quadrupole moment (MQM). He describes methods of calculating all the MQM components from the results of measurements of the electric field at various points on the surface of the specimen. He lists the principal requirements imposed on the form and orientation of the specimens and on the configurations of the surface electrodes. (11 refs.)

108881 Acoustic body waves and electromechanical coupling coefficients in crystals of berlinite. B.I.Klimenko, N.V.Perelomova, V.S.Bondarenko (Inst. of Steel & Alloys, Moscow, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.231-2 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.392-3 (March-April 1983). [received: Sept. 1983]
Contains the results of computer calculations of the anisotropy of propagation and piezoelectric activity of acoustic body waves (ABW) in single crystals of berlinite $AlPO_4$. (3 refs.)

108882 A dynamic method of measuring piezoelectric constants. P.Buck, J.Reinhardt (Inst. fur Mineralogie, Univ. Marburg, Marburg, Germany).
Z. Kristallogr. (Germany), vol.163, no.3-4, p.233-41 (1983). In German.
A method for measuring piezoelectric constants by a dynamic method operating at frequencies of about 3-5 kHz is described. It is characterized by simple handling and evaluation of the piezoelectric constants d_{ijk} and their sign, high accuracy ($<1\%$) and the possibility of piezoelectric measurements of semiinsulating ($\rho \geq 10^9$ Ω cm) crystals. The method is based on the inverse piezoelectric effect. The piezoelectrically induced deformation of the test crystal is detected by a piezoelectric ceramic and compared with that of a standard crystal (α-quartz). Piezoelectric coefficients of some substances are redetermined. Values for the d_{ijk} of CdTe and $N_2H_5LiSO_4$ are given. (23 refs.)

108883 Electrostrictive and electro-optic properties of urea. L.Bohaty (Inst. fur Kristallographie, Univ. zu Koln, Koln, Germany).
Z. Kristallogr. (Germany), vol.163, no.3-4, p.307-9 (1983).
Urea, $CO(NH_2)_2$, point group $42m$, exhibits strong nonlinear optical coefficients (Kurtz and Perry, 1968; Bauerle et al., 1977; Cassidy et al., 1979; Halbout et al., 1979). Morrell et al. (1979) have determined experimentally the linear electro-optic tensor $[r_{ijk}]$ of urea. Further, they have derived theoretical values for the electro-optic coefficients. In the comparison of their experimental results based on the condition of constant mechanical stress ($r_{ijk}{}^{\sigma}$) and theoretical values, which are valid only for constant mechanical strain ($r_{ijk}{}^{\epsilon}$), the elastooptic-electrostrictive contribution ($p_{ijmn}{}^{E}d_{kmn}$) was not taken into account. Moreover, the experimental procedure employed by Morrell et al. (1979) (determination of $r_{231}{}^{\sigma}$) appears to be doubtful. The purpose of this paper is to clarify the role of the electrostrictive effect $[d_{ijk}]$ (def.: $\epsilon_{ij}=d_{kij}E_k$, $[\epsilon_{ij}]$=strain tensor, $[E_k]$=electric field) and to present correct values for electrostrictive and electro-optic effects in urea. The dynamical measurements of electrostrictive and electro-optic effects were performed with the aid of a Michelson interferometer as described recently (Bohaty, 1982). (7 refs.)

Acoustoelectric injection in piezoelectric CdS resonators ....See Entry 108479

The benitoites $KMgP_3O_9$, $KZnP_3O_9$ and $KCaP_3O_9$: crystal growth, electrooptical and electrostrictive properties ....See Entry 108927

Growth and properties of large $LiNbO_3$ crystals ....See Entry 109128

77.70 PYROELECTRIC AND ELECTROCALORIC EFFECTS

Phase transitions in Bi_2WO_6 crystals ....See Entry 107930

Electric field effects on phase transitions in mixtures of cholesteryl esters ....See Entry 107936

Investigation of the phase transition in mixed crystals $Rb_x(NH_4)_{1-x}HSeO_4$ by the pyroelectric method ....See Entry 108884

On the isotopic effect in NH_4HSeO_4 ....See Entry 108885

Static and dynamic dielectric properties on the pressure induced tricritical point of ferroelectric NH_4HSO_4 ....See Entry 108890

77.80 FERROELECTRICITY AND ANTIFERROELECTRICITY

Chiral SmC* liquid crystals obtained by mixing of SmC and cholesteric phase ....See Entry 107522

Field dependence of helicoidal pitch and its phenomenological theory ....See Entry 107524

New compounds with the structure of tetragonal potassium-tungsten bronze .... See Entry 107631

X-ray diffraction study of monoclinic RbD_2PO_4 .... See Entry 107636

Raman spectra of low-lying longitudinal model of KH_2PO_4 and KD_2PO_4 in ferroelectric phase .... See Entry 108959

The effect of MnO_2 and La_2O_3 additions on the sintering of $Pb(Zr,Ti)O_3$ solid solutions .... See Entry 109206

77.80B Transitions and Curie point

108884 **Investigation of the phase transition in mixed crystals $Rb_x(NH_4)_{1-x}HSeO_4$ by the pyroelectric method.** H.Pykacz, J.Mroz (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland), Z.Czapla.
Acta Phys. Pol. A (Poland), vol.A64, no.2, p.197-201 (Aug. 1983).
Experimental results on the pyroelectric coefficient are reported for the $Rb_x(NH_4)_{1-x}HSeO_4$ crystals along the ferroelectric *b*-axis with different molar fraction *x*. A non-monotone change of the phase transition temperature depending on the molar fraction of rubidium contents in the crystal has been stated. (11 refs.)

108885 **On the isotopic effect in NH_4HSeO_4.** Z.Czapla, O.Czupinski, L.Sobczyk (Inst. of Chem., Univ. of Wroclaw, Wroclaw, Poland), J.Mroz, H.Pykacz.
Acta Phys. Pol. A (Poland), vol.A64, no.2, p.203-5 (Aug. 1983).
This paper is a comment on the work by W. Bronowska, R. Poprawski and A. Pawlowska published in Acta Phys. Pol. A60, 823 (1981). In the discussed paper the observations of pyroelectric effect and X-ray diffraction pattern have been performed for the polycrystalline samples with 70±10% deuteration degree. There were observed the current peak at 108K, ascribed to low temperature phase transition and a number of peaks above 270K, from which the highest at 299K was ascribed to the para-ferroelectric phase transition. The peaks at higher temperatures were attached to the pyroelectric effect. (9 refs.)

108886 **On the ferroelectric phase transition in $Li_2Ge_7O_{15}$.** H.Terauchi (Dept. of Phys., Kwansei-Gakuin Univ., Hyogo, Japan), S.Iida, Y.Nishihata, M.Wada, A.Sawada, Y.Ishibashi.
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2313-14 (July 1983).
X-ray scattering experiments on $Li_2Ge_7O_{15}$ were carried out above and below the ferroelectric phase transition temperature $T_c=283.5K$. The space groups are confirmed to be $D_{2h}{}^{14}$-*Pbcn* and $C_{2v}{}^{5}$-*Pbc*2_1 above and below T_c, respectively. The coupling between the ferroelectric displacements of atoms along the *c*-direction and the displacements of atoms along the *a*-direction are important in causing the phase transition.

108887 **A theory of antiferroelectric phase transition in copper formate tetrahydrate $Cu(CHO_2)_2.4H_2O$ crystal. II.** Y.Ishibashi (Synthetic Crystal Res. Lab., Nagoya Univ., Nagoya, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2443-8 (July 1983).
For pt.I see ibid., vol.34, p.888 (1973). The theory of the antiferroelectric transition in copper formate tetrahydrate based upon a dimer model is extended to include the contribution of anharmonicity in interaction of sublattice polarization. For the case of zero applied electric field the temperature behavior of the model system is analyzed with emphases put on the tricritical point, and the peculiarity encountered around the temperature of saturation of the order parameter is pointed out. The applied field vs. temperature phase diagram is discussed.

108888 **Effect of hydrostatic pressure on the phase transitions in monoclinic and tetragonal RbD_2PO_4 crystals.** K.Gesi (JAERI, Ibaraki, Japan), K.Ozawa, T.Osaka, Y.Makita.
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2538-43 (July 1983).
The effect of hydrostatic pressure was studied for the phase transitions in the two forms of RbD_2PO_4; monoclinic (ferrielectric) and tetragonal (ferroelectric) crystals. In monoclinic crystal, the I-II and II-III transition temperatures monotonically decrease with increasing pressure, and the phase boundaries are represented by a quadratic form of $T_c=T_c{}^0+K_p+\gamma p^2$ with the parameters of $T_c{}^0$, K, and γ being 102.5°C, -50 deg GPa^{-1}, -39 deg GPa^{-2} for the I-II transition and 41.8°C, -24 deg GPa^{-1}, -15 deg GPa^{-2} for the II-III transition, respectively. A pressure-induced phase of IV was newly observed above about 0.7 GPa. The transition to phase IV shows marked first order character. In tetragonal RbD_2PO_4, the ferroelectric Curie temperature monotonically decreases with increasing pressure with the initial slope of -47 deg GPa^{-1}. The slope of the Curie temperature against pressure seems to decrease as pressure increases above about 0.3 GPa. (13 refs.)

108889 **Order-disorder type phase transition in ferroelectric CsD_2PO_4 studied by X-ray structure analysis.** K.Itoh, T.Hagiwara, E.Nakamura (Faculty of Sci., Hiroshima Univ., Hiroshima, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2626-9 (Aug. 1983).
The mechanism of the ferroelectric phase transition of CsD_2PO_4 was investigated by examining the crystal structures determined by X-ray structure analysis at seven different temperatures above and below the transition temperature T_c. The PO_4 group has two equilibrium arrangements in the paraelectric phase while only one of them remains in the ferroelectric phase. The thermal amplitude of the D atom which forms a one-dimensional chain along the ferroelectric *b*-axis reduces drastically at T_c with decreasing temperature. These results are well described on the basis of the mechanism of the order-disorder type phase transition. (12 refs.)

108890 **Static and dynamic dielectric properties on the pressure induced tricritical point of ferroelectric NH_4HSO_4.** A.Tamaki, T.Fujimura (Res. Inst. for Sci. Measurements, Tohoku Univ., Sendair, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2922-30 (Aug. 1983).
The effects of hydrostatic pressure on a ferroelectric compound of NH_4HSO_4 have been investigated with the static, dielectric and pyroelectric measurements. It has been found that the tricritical point of NH_4HSO_4 exists at the temperature of 6.5°C and the pressure of 750 bar. The dielectric critical slowing down at the tricritical point has been observed. The amplitude ratio of the relaxation time above and below the tricritical point has the value of $A/A'=4$, which conforms to the theoretical prediction.

108891 **Phase transition in $\{N(CH_3)_4\}_2MnBr_4$.** K.Gesi (JAERI, Ibaraki, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2931-5 (Aug. 1983).
Single crystals of tetramethylammonium tetrabromomanganate $\{N(CH_3)_4\}_2$-$MnBr_4$ were grown, and the phase transition was studied by dielectric measurements. The crystal shows a phase transition at 3.5°C. The transition temperature increases linearly with increasing hydrostatic pressure with a slope of 0.185 deg MPa^{-1}. Similarity of the lattice parameters, dielectric properties, and pressure coefficient of the transition temperature to those found in $\{N(CH_3)_4\}_2ZnBr_4$ and $\{N(CH_3)_4\}_2CoBr_4$ compounds suggests that there is a common mechanism of the phase transitions in these bromide compounds. (13 refs.)

108892 **Anomalously narrow peak in the dielectric constant of $Cd_2Nb_2O_7$ near the diffuse phase transition.** G.A.Smolenskii, F.M.Salaev, L.S.Kamzina, N.N.Krainik, S.N.Dorogovtsev (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
JETP Lett. (USA), vol.37, no.6, p.303-6 (20 March 1983). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.37, no.6, p.257-9 (20 March 1983). [received: Sept. 1983]
An unusually narrow peak is observed in the dielectric constant of the ferroelectric $Cd_2Nb_2O_7$ at 201K, above the broad peak of the diffuse ferroelectric phase transition. Possible causes of this anomaly, observed in this study for the first time, are discussed. (6 refs.)

108893 **Modified phase modulation-only approximation of incommensurate phases in K_2SeO_4-type crystals.** H.Mashiyama (Fachrichtung Experimentalphys., Univ. des Saarlandes, Saarbrucken, Germany).
Phys. Status Solidi b (Germany), vol.118, no.2, p.757-67 (1 Aug. 1983).
The incommensurate-commensurate transition in K_2SeO_4-type crystals is studied on the base of a Landau free energy. The phase modulation-only approximation is modified to take account of the effect of the amplitude modulation partially but in a consistent way. The soliton density decreases continuously with a logarithmic law near the lock-in temperature. It is also shown that the specific heat and the dielectric susceptibility diverge at the transition point. (16 refs.)

108894 **Ammonium dihydrogen phosphate (ADP) impurity effects on phase transition and domain-wall freezing in potassium-ammonium dihydrogen phosphate $[(KDP)_{1-x}(ADP)_x]$ crystals.** B.K.Choi, J.J.Kim (Phys. Dept., Korea Advanced Inst. of Sci. & Technol., Seoul, Korea).
Phys. Rev. B (USA), vol.28, no.3, p.1623-5 (1 Aug. 1983).
Dielectric constants and polarization reversal currents are measured in $(KDP)_{1-x}(ADP)_x$ crystals for $x \lesssim 0.015$ to study the roles of ADP impurities. In this low-concentration limit it seems that the ADP impurities form hard defects responsible for lowering both the ferroelectric transition temperature (T_c) and the domain-wall freezing temperature (T_f). Qualitative discussion is given on the experimental observation of $|dT_f(x)/dx|>|dT_c(x)/dx|$, which causes the range of the plateau anomaly between T_c and T_f to widen rather than narrow in the presence of impurities. (14 refs.)

108895 **Pulsed polarization reversal in gamma-irradiated crystals of triglycine sulfate.** R.M.Pecherskaya, H.Schlemmbach, W.Windsch (Karl Marx Univ., Liepzig, Germany).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.195-7 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.334-8 (March-April 1983). [received: Sept. 1983]
For crystals of triglycine sulfate (TGS) gamma-irradiated with 0.01, 0.05, and 0.1 MR, the authors have investigated how the switching time τ_s in pulsed fields with $E\leq 2$ kV/cm depends on the field strength at temperatures between 288 and 308K. The activation energies for these specimens are calculated. It is shown that in this temperature range the polarization reversal of irradiated TGS crystals is due to at least two different mechanisms. (13 refs.)

108896 **Magnetic studies of phase transformations in SbSI and $Sn_2P_2S_6$ crystals.** S.V.Karbovsky, Yu.V.Masyutka, G.Ya.Pikus.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1242-6 (Aug. 1983). In Russian.
A study of the phase transformation (PT) effect on magnetic susceptibility of ferroelectric semiconductors SbSI and $Sn_2P_2S_6$ made it possible to achieve some additional conclusions on PT mechanism in these compounds. A set of magnetochemical parameters of the crystal under study is established. (10 refs.)

Neutron diffraction camera method applied in the study of phase transition .... See Entry 107490

Monte Carlo investigation of the Mitsui model .... See Entry 107864

Effect of hydrostatic pressure on the phase transitions in $\{N(CH_3)_4\}_2XBr_4$ (X:Zn,Co) .... See Entry 107911

Phase transitions in deuterated compound $\{N(CD_3)_4\}_2CuBr_4$. See Entry 107914

Critical behavior in the heat capacity of ferroelectric TGS, TGSe, and TGFB .... See Entry 107972

EPR study of the Tl^{2+} center in the paraelectric and antiferroelectric phases of $NH_4H_2PO_4$ .... See Entry 108780

^{133}Cs spin-lattice relaxation in pseudo-one-dimensional CsH_2PO_4 .... See Entry 108816

Dielectric susceptibility and thermal hysteresis in K_2SeO_4 and Rb_2ZnCl_4 .... See Entry 108854

Low-frequency dielectric loss of triglycine sulfate .... See Entry 108868

Anomalous domain switching in triglycine sulfate crystals ..... See Entry 108899

Temperature dependences of optical birefringence and dielectric constant of $[N(CH_3)_4]_2ZnCl_4$ crystals .... See Entry 108918

Rayleigh and Brillouin scattering in $RbH_3(SeO_3)_2$ near the phase transition temperature .... See Entry 108963

77.80D Domain structure and effects; hysteresis

108897 **Ferroelectric domain structure of $PbHPO_4$.** N.Nakatani (Dept. of Appl. Phys., Faculty of Engng., Toyama Univ., Toyama, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.6, p.948-51 (June 1983).
Etching methods to delineate the ferroelectric domain structure of $PbHPO_4$ are presented. Geometrical configuration of antiparallel domains bounded by 180° walls were investigated by these methods. The cross sections of domains are generally lenticular or lamellar and stretched along the *a-c* plane. The direction of spontaneous polarization, which lies in the *a-c* plane, was accurately determined by the domain structure revealed by successive etching. It makes an angle of (9.9±0.8)° with the *a*-axis and is almost parallel to the *a**-axis. (21 refs.)

108898 **On the width of charged {110} ferroelectric domain walls in potassium niobate.** Peng Ju Lin (Dept. of Phys., Univ. of Nanking, Nanking, China), L.A.Bursill.
Philos. Mag. A (GB), vol.48, no.2, p.251-63 (Aug. 1983).
High-resolution electron micrographs of {110} domain walls are reported for ferroelectric orthorhombic potassium niobate ($KNbO_3$). Some of the difficulties of interpreting such images are discussed. It is shown that (1) charged 60° and/or 120° domain walls are present, (2) the domain wall structure is incoherent with a spatial periodicity of approximately 800 Å, (3) there are significant ionic displacements localized within ≤15 Å of the walls, (4) there are probably significant changes in electron density over a relatively wider band (~50 Å) and (5) there are small local departures of domain wall orientation from {110}. (11 refs.)

108899 Anomalous domain switching in triglycine sulfate crystals. L.I.Dontsova, N.A.Tikhomirova, L.G.Bulatova, E.S.Popov, A.V.Shil'nikov, L.A.Shuvalov (Engng.-Constructional Inst., Acad. of Sci., Volgograd, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.228-30 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.388-91 (March-April 1983). [received: Sept. 1983]
A detailed study is made of the behavior of residual domains in TGS crystals of various thicknesses (10-0.3 mm) at 20-49°C in quasistatic fields of 0.05-9 kV/cm. Investigation of the dependence of the switched charge, simultaneously with revelation of the domain structure for various values of the external constant electric field (at T=const.), has shown that the total switched charge decreases with increase in the external field; this is correlated with the increase in the area of emergent residual domains on the surface of the crystal. (14 refs.)

Observation of the existence of electrically excited purely mechanical resonance in piezoelectric and ferroelectric materials .... See Entry 108878

Ammonium dihydrogen phosphate (ADP) impurity effects on phase transition and domain-wall freezing in potassium-ammonium dihydrogen phosphate $[(KDP)_{1-x}(ADP)_x]$ crystals .... See Entry 108894

Electrooptic diffraction in polydomain barium-sodium niobate crystals .... See Entry 108924

Electrooptic diffraction of light by antiparallel ferroelectric domains in $Ba_2NaNb_5O_{15}$ crystals .... See Entry 108925

77.90 OTHER TOPICS IN DIELECTRIC PROPERTIES AND MATERIALS

Investigation of the electric double layer on platinum and gold electrodes in a solid electrolyte Ag_4RbI_5 .... See Entry 108031

Surface effects in semiconductors in contact with liquids deduced from conductivity and Hall coefficient measurements .... See Entry 108424

78.00 OPTICAL PROPERTIES AND CONDENSED MATTER SPECTROSCOPY AND OTHER INTERACTIONS OF MATTER WITH PARTICLES AND RADIATION

(for phonon spectra, see 63.)

78.20 OPTICAL PROPERTIES AND MATERIALS

(see also 81.40T Optical properties related to materials treatment; for masers, and lasers see 42.52 and 42.55 respectively)

108900 Optical absorption in InP crystals with point radiation defects. E.Yu.Brailovskii, G.N.Eritsyan, N.E.Grigoryan (Erevan Phys. Inst., Erevan, USSR).
Phys. Status Solidi a (Germany), vol.78, no.2, p.K113-15 (16 Aug. 1983).
The results of optical absorption measurements in InP crystals, obtained directly after irradiation are presented. Non-doped n-InP single crystals ($n_0=10^{16}$ cm^{-3}) grown by the Czochralski method were irradiated with 2.5 MeV electrons at a temperature no more than 290K. A strong additional absorption was observed beyond the main absorption edge of the irradiated samples. In the absorption edge region one can observe an increase of the E_0 parameter in the dependence $\alpha=\alpha_0\exp((h\nu-E_g)/E_0)$ from 8 MeV (in the initial crystals) to 25 meV with a dose of $D=1\times10^{18}$ electrons/cm^2. (5 refs.)

108901 Optics of a planar cholesteric layer (inclined incidence). S.M.Osadchii, V.A.Belyakov (All-Union Sci.-Res. Inst. of Physicotech. & Radiotech. Measurements, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.66-9 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.123-8 (Jan.-Feb. 1983). [received: Sept. 1983]
The optical characteristics of a planar layer of cholesteric liquid crystal are theoretically investigated for propagation of light at an angle to the cholesteric axis. The characteristic solutions of Maxwell's equations in the cholesteric are analyzed and the optical characteristics corresponding to the first order of selective reflection are calculated on the basis of the two-wave approximation of the dynamic theory of diffraction. The qualitative features are analyzed—in particular, the polarization dependences of the optical properties of cholesterics of propagation of light at an angle to the optic axis. (8 refs.)

Otto-Schott-Colloquium on the State of Optical Glass Research 1982 .... See Entry 105025

Degenerate four-wave mixing due to intervalance band transition in *p*-type mercury cadmium telluride .... See Entry 106825

Optical loss increase of phosphor-doped silica fiber at high temperature in the long wavelength region .... See Entry 106871

CW laser-annealing behavior of Se^+-implanted InP investigated by ellipsometry .... See Entry 107755

Application of special-directions method to the optical properties of copper and silver .... See Entry 108277

Optical investigation of MQW system InP-InGaAs-InP .... See Entry 108534

78.20D Optical constants and parameters

108902 Determination of the dispersion and the measurement of the thickness of epitaxial garnet films. Wang Li-xuan (Shanghai Inst. of Metall., Acad. Sinica, China).
Acta Phys. Sin. (China), vol.32, no.4, p.520-4 (April 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)* [received: Sept. 1983]
A technique is proposed for determining the dispersion and measuring the thickness of epitaxial garnet films. Use is made fully of the transmission spectrum obtained by spectrophotometer. When the wavelength is greater than 2 μm so that the absorption and dispersion become negligible, the refractive index at the corresponding wavelength may be calculated from the extrema of the transmittance. According to the condition of interference, the order of interference is calculated and deduced for all interference extrema. The refractive indices of the film at the wavelengths corresponding to the interference extrema may be calculated. Finally the coefficients of Cauchy's dispersion formula are evaluated by the method of least squares, thus the dispersion relation is obtained for this film. Then, in making use of the dispersion relation, the thickness of the film may be calculated. (17 refs.)

108903 Optical properties of a-Si: (Cl, H) films. Liao Xianbo, Yang Xirong, Xu Xuemin, Liu Changling, Kong Guanglin (Inst. of Semiconductors, Acad. Sinica, Beijing, China).
Chin. J. Semicond. (China), vol.4, no.4, p.410-13 (July 1983). In Chinese.
The optical properties of GD a-Si: (Cl, H) films have been measured. The formulae for transmission and reflection coefficients for two layer films with regard to the interference effect are deduced and used to analyse the measured data. The results show that with introduction of chlorine, the optical gap increases and the thermal stability is improved. This can be attributed to the formation of rather strong Si-Cl bonds. (3 refs.)

108904 Optical constants of transition-metal silicides. P.A.Heimann, S.P.Murarka, J.Rosario (Bell Labs., Murray Hill, NJ, USA).
Mater. Lett. (Netherlands), vol.2, no.1, p.31-4 (July 1983).
The authors present values of the indices of refraction and absorption of several transition-metal silicides, measured using an ellipsometer with 632.8 nm light. For cosputtered tantalum silicide, they compare the results of measurements made before and after sintering. For molybdenum silicides, they compare samples which were cosputtered with Si/Mo ratios between 0.47 and 6.5. (8 refs.)

108905 On the real refractive-index change in some *F*-coloured alkali-halide crystals. K.-E.Peiponen, A.Vaittinen, J.Riissanen (Dept. of Math. & Phys., Univ. of Joensuu, Joensuu, Finland).
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.1075-80 (July-Aug. 1983).
The refractive-index change as a function of temperature and frequency will be given for NaCl, KCl and KI crystals which contain *F* colour centres. There exists a frequency value for which the change is independent of the temperature of the sample. (9 refs.)

108906 Argand diagrams and decomposition of the fundamental phianite spectrum into elementary parts. V.I.Vaidanich, N.D.Dovga, E.G.Moroz.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.8, p.45-8 (1983). In Ukrainian.
The Argand diagrams are plotted for the optical functions and effective oscillator parameters are determined for phianite of the $0.9ZrO_2.0.1Y_2O_3$ composition. It is shown that the phianite dispersion curve in the transparent region is determined by the structure of the fundamental spectrum in the vacuum ultraviolet region (6-13 eV). (5 refs.)

108907 Refractive indices of hexagonal ice. R.Onaka, T.Kawamura (Inst. of Appl. Phys., Univ. of Tsukuba, Ibaraki, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2947-53 (Aug. 1983).
The refractive indices of hexagonal ice (Ih) are studied in the wavelength range down to 2537 A, and the wavelength dispersion curves are obtained. From the curves the energy of the representative oscillator is found to be 12.3 eV both for ordinary and extraordinary rays. The temperature dependences of the refractive indices are also studied. It is found that they are mainly due to the thermal dilation of the lattice, and the change in the electronic polarizability is little. This suggests that ice is a molecular crystal in a fairly good approximation. (14 refs.)

108908 Dispersion of optical constants of amorphous $Si_{1-x}Ge_x(H)$ films beyond their absorption edges. K.C.Kao, R.D.McLeod, C.H.Leung, H.C.Card (Dept. of Electrical Engng., Univ. of Manitoba, Winnipeg, Manitoba, Canada), H.Watanabe.
J. Phys. D (GB), vol.16, no.9, p.1801-11 (14 Sept. 1983).
Optical constants of amorphous hydrogenated $Si_{1-x}Ge_x(H)$ films fabricated by radio frequency sputtering have been measured for $0\leq x\leq1$ at wavelengths from 0.35 μm to 2.65 μm using both spectrally-resolved ellipsometry and spectrophotometry. The data include measurements on the refractive index in the high absorption region. The results show that the refractive index, the extinction coefficient, the loss factor and the optical band gap vary approximately linearly with x (the content of Ge). The refractive index and the extinction coefficient are dispersive and exhibit two peaks in their spectra, one above and the other below the optical absorption edge. The first peak is attributed to interband transitions and the second peak to transitions involving localised states in the mobility gap. (34 refs.)

108909 Some optical properties of materials measured at 1.3 μm. N.C.Fernelius, R.J.Harris, D.B.O'Quinn, M.E.Gangl, D.V.Dempsey (Univ. of Dayton Res. Inst., Dayton, OH, USA), W.L.Knecht.
Opt. Eng. (USA), vol.22, no.4, p.411-18 (July-Aug. 1983).
This work surveys the properties of materials at 1.3 μm. The interest in this wavelength has been generated by the development of second generation optical fibers and by the development of the iodine (I*) laser, which operates at 1.315 μm. Most of the data reported were taken by Nd:YAG lasers modified to operate at 1.319 μm. Spectral scans of some less common materials are presented. The effective optical absorption coefficient β_{eff} measured by laser rate calorimetry is given for all materials. The thermo-optic coefficient $\partial n/\partial T$ at 1.3 μm is given for a number of materials. If 1.3 μm results are lacking, values at 1.15 μm are given. Among the lower absorbing materials are KCl, LiF, NaCl, CaF_2, SiO_2, YLF ($LiYF_4$), sapphire (Al_2O_3), MgF_2, BaF_2, and Q-98 phosphate glass. Results on a number of Schott infrared and laser glasses are given, including LG-670, LG-660, LG-750, LG-810, LG-760, LG-680, IRG-7, IRG-9, IRG-3, and IRG-N6. Results are given also on ZnS (normal and water clear), YAG ($Y_3Al_5O_{12}$), ZrO_2, SrF_2, ZnSe, MgO, and CdTe. Some other glasses studied were hafnium fluoride glass, As_2S_3, CORTRAN 9753 and 9754, and Barr and Stroud calcium aluminate glasses BS 39B and BS 37A. The ten lowest absorbing materials had effective optical absorption coefficients β_{eff} between 0.13 and 0.5×10^{-3} cm^{-1}. The lowest $\partial/\partial T$ value measured was -0.06×10^{-5}/°C on Schott LG-660 alkali-Zn-silicate glass. (33 refs.)

108910 The influence of the structure of different arsenic chalcogenide glasses on refractive index and dispersion. W.Burckhardt, A.Feltz (Sektion Chem., Friedrich-Schiller-Univ. Jena, Jena, Germany).
Phys. Status Solidi b (Germany), vol.118, no.2, p.653-60 (1 Aug. 1983).
The refractive index dispersion of different arsenic chalcogenide glasses is analyzed by the use of a two-term Sellmeier dispersion formula. In a region from 3 μm up to the beginning of the absorption edge the wavelength dependence of the refractive index can be described by a single oscillator model. At wavelengths λ_j, determined by $\lambda_{1j}/\lambda_j=$const, the molar refraction of the different glasses is a linear function of $n_{eff}\lambda_1^2$. In representations $R_M=R_M\ (n_{eff})$ and $R_M=R_M\ (\lambda_1^2)$ the influence of the structure of the different glasses is clearly illustrated. For the glass $AsSe_3$ a special short-range order is indicated. (18 refs.)

108911 On the reflectivity for oblique incidence of the uniaxial antiferromagnetic crystals FeF_2, CoF_2, and MnF_2. A.Lehmeyer (Phys. Inst., Westfalischen Wilhelms-Univ., Munster, Germany), L.Merten, K.M.Haussler.
Phys. Status Solidi b (Germany), vol.118, no.2, p.675-9 (1 Aug. 1983).
The combining the dispersion relations of the refractive index and the boundary conditions in the surface the formulae of reflectivity of the antiferromagnetic crystals FeF_2, CoF_2, and MnF_2 can be derived for oblique incidence. This is performed for two important orientations of the surface namely for the surface perpendicular to the optical axis and for a surface which contains the optical axis. The results are six different formulae of reflectivity for oblique incidence. (3 refs.)

108912 Intraband absorption due to alloy scattering in lead chalcogenide semiconductors. K.Siedranski, J.Szatkowski (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Phys. Status Solidi b (Germany), vol.118, no.2, p.871-9 (1 Aug. 1983).
Free carrier absorption allowed by the chemical disorder is calculated for lead chalcogenide mixed semiconductors. It is found that the absorption due to the intervalley transitions may be greater than that due to the intervalley transitions. (13 refs.)

108913 The influence of dipole molecules adsorption on the fine-porous membranes polarizability. R.Alexandrescu, N.Comaniciu, I.N.Mihailescu, I.Morjan (Central Inst. of Phys., Bucharest, Rumania), V.A.Kravcenko, Yu.N.Petrov, V.I.Kuznetsov.
Rev. Roum. Phys. (Rumania), vol.28, no.4, p.339-42 (1983).
The influence of adsorbed dipolar molecules (H_2O, CH_3I, C_5H_5N, C_3H_6O, CH_3CN, $C_6H_5NO_2$) on the optical thickness of fine-porous membranes made of mica and polymer film was studied. A rather rigorous orientation of the adsorbed molecules was evidenced. (4 refs.)

108914 Dielectric function of SmS. I. Optical transitions. G.Guntherodt, J.L.Freeouf, F.Holtzberg (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Solid State Commun. (USA), vol.47, no.9, p.677-80 (Sept. 1983).
The dielectric response function of SmS and SmAs has been determined via a Kramers-Kronig transformation of the room temperature reflectivity in the range from 10^{-2} eV to 22 eV. In SmS the assignment of optical transitions, including those from the (S) 3s core level, has been corroborated by the corresponding ones of SmAs. Reductions of the 4f binding energy are revealed in optical $f \rightarrow d$ transitions as compared to X-ray photoemission data. (17 refs.)

108915 Dielectric function of SmS. II. Infrared response: LO(Γ) phonon softening. B.Hillebrands, G.Guntherodt (II Phys. Inst., Univ. Koln, Koln, Germany).
Solid State Commun. (USA), vol.47, no.9, p.681-2 (Sept. 1983).
For pt.I see ibid., vol.47, no.9, p.677 (1983). The zone-center longitudinal optical phonon of semiconductor SmS shows a 10% softening with respect to that of EuS. This result confirms the lattice-dynamical model prediction and provides first experimental evidence for the existence of an anomalous dipolar charge deformability of the Sm^{2+} ion in SmS. (8 refs.)

108916 Analysis of conditions for additional minimum formation in the linear-cross splitting region in exciton reflection spectra. P.S.Kosobutskii.
Ukr. Fiz. Zh. (USSR), vol.28, no.7, p.1090-1 (July 1983). In Russian.
Investigates the conditions for the appearance of the anomalous slope for the reflectivity curve of a crystal surface without an exciton layer. An expression is obtained which permits one to determine the layer thickness using the energy position of the additional maximum on the reflectivity curve. (3 refs.) *V.G.P.*

108917 Influence of glass structure on refractive index and dispersion. W.Burckhardt (Friedrich-Schiller-Univ. Jena, Jena, Germany).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.2-3, p.205-13 (1983). In German. (Otto-Schott-Colloquium on the State of Optical Glass Research 1982, Jena, Germany, 1982).
The refractive indices of 20 chalcogenide glasses were measured in the range of 1-12 μm according to the principle of minimum deviation. The wavelength dependence of the refractive index was mathematically modelled with a 2-term dispersion formula. For comparison of the different glasses it is necessary to normalize on a constant number of particles. In the range from 3-4 μm up to the energy rich limit of the transparent region the wavelength dependence of the refractive index can be described by a single-oscillator-model. At wavelengths, which are determined by $\lambda_1/\lambda=$const., glasses with the same structure and having a continuous change of structure are situated in the representations $R_M/\Sigma x_i Z_i=f(\lambda_1^2)$ and $-dR_M/d\lambda/\Sigma x_i Z_i=f(\lambda_1)$ on a straight line. A structural influence on the refractive index and dispersion is clearly reflected. (7 refs.)

A new probe of the optical properties of surfaces .... See Entry 105379

Oxide and halide laser glasses .... See Entry 106769

Temperature effects in $AgGaS_2$ nonlinear devices .... See Entry 106812

Nonlinear optical properties of semiconductors due to phonon flows .... See Entry 106823

Gradient index optical materials .... See Entry 106834

Refractive-index dispersion for BaF_2-GdF_3-ZrF_4-AlF_3 glasses .... See Entry 106835

Optics of a chiral liquid crystal far from a Bragg resonance .... See Entry 107544

Bond character and properties of the mixed alkali system Na_2O-K_2O-Al_2O_3-SiO_2 .... See Entry 107554

A new bismuth containing $Bi_{14}B_4O_{31}$ crystal .... See Entry 107650

The coexistence curve of GeH_4 and correction-to-scaling .... See Entry 107891

Structure and bonding of hydrocarbon plasma generated carbon films: an electron energy loss study .... See Entry 108232

Electronic band structure, Fermi surface and optical properties of hexagonal yttrium .... See Entry 108269

Phonon polaritons in the presence of a magnetic field .... See Entry 108308

Impurity states near the fundamental absorption edge in p-$CuInS_2$ .... See Entry 108341

Intracenter transitions in the dominant deep level (EL2) in GaAs .... See Entry 108466

Internal photoemission from quantum well heterojunction superlattices by phononless free-carrier absorption .... See Entry 108528

Nonstoichometric germanium nitride. A new insulating material for MIS microelectronics. II. Composition, properties, and the interface with a semiconductor .... See Entry 108569

Simple theory for surface-plasmon-polariton resonance on sinusoidal metal surface: application to SERS .... See Entry 108943

Optical properties of donor electrons in semimagnetic semiconductors .... See Entry 108947

Some problems concerning infrared emission measurements .... See Entry 108956

Maximum statistical increase of optical absorption in textured semiconductor films .... See Entry 109031

Irradiation-induced photodarkening in As-Se-Cu amorphous films .... See Entry 109032

Hydrogenated amorphous silicon produced by laser induced chemical vapor deposition of silane .... See Entry 109158

A structural study of the tensile drawing behavior of poly(ethylene terephthalate) .... See Entry 109413

78.20E Optical rotatory power

Phonon polaritons in the presence of a magnetic field .... See Entry 108308

Electric-field-induced chirality of octahedral $Cr^{3+}6H_2O$ complexes in alum .... See Entry 108926

78.20F Birefringence

(inc. stress birefringence, flow birefringence, etc)

108918 Temperature dependences of optical birefringence and dielectric constant of $[N(CH_3)_4]_2ZnCl_4$ crystals. O.G.Vlokh, A.V.Kityk, I.V.Kityk, I.I.Polovinko.
Ukr. Fiz. Zh. (USSR), vol.28, no.7, p.1099-100 (July 1983). In Russian.
Investigates the temperature dependencies of optical birefringence and the real part of dielectric constant in $[C(CH_3)_4]_2ZnCl_4$ crystals. It is established that anomalies exist in successive phase transitions from paraelectric to commensurate and ferroelectric to ferroelastic phases. In the incommensurate phase, the birefringence is described by $\delta(\Delta n)\sim(T-T_i)^\gamma$ with critical indices $\gamma=0.53$; 0.75;| for a-, b- and c-cleavages respectively. (11 refs.) *V.G.P.*

108919 Flow birefringence and angles of its orientation in solutions of poly-α-methyl styrene. L.N.Andreeva, E.V.Belyaeva, A.A.Boikov, P.N.Lavrenko, V.N.Tsvetkov.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.8, p.1631-7 (Aug. 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
The flow birefringence of solutions of narrow fractions of poly-α-methyl styrene in tetrabromomethane has been studied. The characteristic angles of orientation are determined. From the values of the characteristic angle of orientation $[\chi/g]$, intrinsic viscosity $[\eta]$ and MM the experimental value of G coefficient was calculated for the theoretical relation: $[\chi/g]=GM[\eta]\eta_0/RT$, where M is the MM value, η_0 is the viscosity of the solvent. The average G value is equal to 0.2. This value for flexible poly-α-methyl styrene (the length of statistical Kuhn segment is equal to 20 Å) twofold exceeds G values predicted by existing theories. (26 refs.)

108920 On the conformation of aromatic polyamide in organic solvent and concentrated sulfuric acid according the data of flow birefringence. I.N.Shtennikova, T.I.Garmonova.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.8, p.1643-8 (Aug. 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
Flow birefringence $[n]/[\eta]$ and orientation angles $[\chi/g]$ of polyamidebenzimidazol molecules in DMAA have been studied in the wide range of molecular masses: $(0.2\text{-}7.5).10^4$. The optical and conformational properties of polymer molecules in DMAA and concentrated sulfuric acid are compared. The conformation of this polymer (kinetically rigid coil) is shown to be practically the same in both solvents. This fact points out the practical absence of the significant role of protonization of molecules during the process of formation of conformations of aromatic polyamides macromolecule in sulfuric acid. (20 refs.)

Highly sensitive instrument for measuring optical birefringence .... See Entry 105362

Nonlinear birefringence in fluids containing nonspherical molecules. I. Response and mode coupling theory .... See Entry 106806

Combined reciprocal and non-reciprocal birefringence in optical monomode fibres .... See Entry 106878

Molecular structure and physical properties of rigid polymers in solutions .... See Entry 107518

Pretransitional effects in the isotropic phase of a lyotropic nematic liquid crystal .... See Entry 107934

Electric-field-induced chirality of octahedral $Cr^{3+}6H_2O$ complexes in alum .... See Entry 108926

78.20H Piezo-, elasto- and acousto-optical effects

108921 Ultrasonic modulation of persistent spectral holes in crystals. H.Lengfellner, T.R.Gosnell, R.W.Tkach, A.J.Sievers (Lab. of Atomic & Solid State Phys., Cornell Univ., Ithaca, NY, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.437-9 (1 Sept. 1983).
Persistent IR spectral holes in $KI:ReO_4^-$ and in $RbI:ReO_4^-$ crystals have been both modulated and erased with 10-MHz ultrasound. This mechanical modulation of the hole depth leads to a new phase-insensitive optical detector for ultrasonic waves in solids. (11 refs.)

108922 Acoustooptical interaction of bounded wave beams. V.I.Balakshii, H.A.Upasena (Dept. of Oscillation Phys., Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.5, p.81-7 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.5, p.71-6 (1982).
Two limiting cases of the acoustooptical interaction of bounded light and ultrasound beams are considered: diffraction of the light beam at a monochromatic acoustic wave and diffraction of a plane light wave at an acoustic wave train. It is shown that, even with the same dimensions of the interaction region, there are significant differences in the structure of the diffracted-light field and in the character of dependence of the diffraction efficiency of the parameters of the acoustic cell. (5 refs.)

108923 Bragg acoustooptical interaction in crystal media. A.S.Zadorin (Tomsk Inst. of Automatic Control Systems & Radio Electronics, Tomsk, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.12, p.1055-61 (Dec. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.12, p.1491-8 (Dec. 1982). [received: Sept. 1983]
Solves a self-consistent problem for Bragg diffraction of plane light waves from elastic oscillations in crystals of any symmetry class. General expressions have been obtained for the amplitude and intensity, and for the quality factor M_2 of the medium. The effect of deviation of the light and acoustic rays from

the wave normals on the efficiency and bandwidth of acoustooptical interaction is determined. (9 refs.)

High-pressure Raman study of liquid and molecular crystal at room temperature. Carbon disulphide .... See Entry 108936

Raman scattering and fundamental absorption in red-HgI_2 under hydrostatic pressure .... See Entry 108942

Light scattering studies of rubidium cyanide under hydrostatic pressure .... See Entry 108955

Pressure dependence of the alexandrite emission spectrum .... See Entry 109012

78.20J Electro-optical effects

108924 Electrooptic diffraction in polydomain barium-sodium niobate crystals. A.L.Aleksandrovskii, A.I.Nagaev (Dept. of Phys., Moscow State Univ., Moscow, USSR).
Phys. Status Solidi a (Germany), vol.78, no.2, p.431-8 (16 Aug. 1983).
Two types of field-driven light diffraction in barium-sodium niobate crystals (BSN) with lamellar domain structure are studied theoretically and experimentally. The relation of these effects to the physical properties of inhomogeneous ferroelectric crystals is investigated. (18 refs.)

108925 Electrooptic diffraction of light by antiparallel ferroelectric domains in $Ba_2NaNb_5O_{15}$ crystals. A.L.Aleksandrovskii, A.I.Nagaev (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.53-7 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.102-8 (Jan.-Feb. 1983). [received: Sept. 1983]
The authors analyzes isotropic and anisotropic electrooptical diffraction of light by a layered domain structure. They study the field and temperature dependences of the diffracted-light intensity. (15 refs.)

108926 Electric-field-induced chirality of octahedral $Cr^{3+}6H_2O$ complexes in alum. H.J.Weber (Inst. of Crystallography, Cologne Univ., Cologne, Germany).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.187-91 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.320-7 (March-April 1983). [received: Sept. 1983]
The author has measured the optical rotation and circular dichroism induced by an electric field in potash, cesium, and methyl ammonium aluminum alums with chromium as impurity between 400 and 700 nm. In this optical region Cr^{3+} has two absorption bands, but the electrogyration effect appears in only one of them—the permitted magnetic dipole band. The induced rotatory power has opposite signs in α and β alums and its absolute magnitude increases with fall of temperature in all the crystals. It is established that the cause of the effect is latent chirality of the H_2O cavity surrounding the central Cr^{3+} ions. The sign of the effect is governed by the orientation of the H_2O octahedra within the unit cell. (21 refs.)

108927 The benitoites $KMgP_3O_9$, $KZnP_3O_9$ and $KCaP_3O_9$: crystal growth, electrooptical and electrostrictive properties. L.Bohaty, J.Liebertz (Inst. fur Kristallographie, Univ. zu Koln, Koln, Germany).
Z. Kristallogr. (Germany), vol.163, no.3-4, p.251-4 (1983). In German.
Single crystals of the isotypic compounds $KMgP_3O_9$, $KZnP_3O_9$, and $KCaP_3O_9$ (benitoite-type) with dimensions up to 35 mm have been grown from the melt. Because of the high viscosity of the melts a special growth method was necessary. The linear electrooptical tensor $[r_{ijk}]$ and the tensor of the linear electrostriction $[d_{ijk}]$ have been determined: $r_{222}=0.17(2)$, $d_{222}=0.51(2)$ ($KMgP_3O_9$); $r_{222}=0.13(3)$, $d_{222}=0.32(3)$ ($KZnP_3O_9$); $r_{222}=-0.23(3)$, $d_{222}=1.83(5)$ ($KCaP_3O_9$) (unit: 10^{-12} m/V, $T=295K$, $\lambda=633$ nm). (8 refs.)

Waveguide light modulators using the Keldysh-Franz effect in gallium arsenide .... See Entry 106867

A new type of modulated structure in a smectic *A* .... See Entry 107540

Electrostrictive and electro-optic properties of urea .... See Entry 108883

Electrooptic effect in anodic Nb_2O_5 films .... See Entry 109030

A study of built-in potential in *a*-Si solar cells by means of back-surface reflected electroabsorption .... See Entry 109888

Electroreflectance and photoinduced charge separation in electrochemically doped trans-polyacetylene liquid junction device .... See Entry 109889

78.20L Magneto-optical effects

108928 Frequency dispersion and angular dependence of an equatorial change in the intensity of light transmitted by iron and cobalt films. A.V.Druzhinin, I.D.Lobov, V.M.Maevskii, G.A.Bolotin (Inst. of Metal Phys., Ural Sci. Centre, Acad. of Sci., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.58-65 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A theory is proposed of the linear (in respect of the magnetization) change in the intensity of light polarized in the plane of incidence as a result of its passage through a three-layer system comprising an equatorially magnetized ferromagnetic film between two nonmagnetic layers. It is shown that this effect appears when the conditions for internal reflection are different for the upper and lower boundaries of the magnetic film. A report is given of a determination of the dependence of this effect on the angle of incidence of light on iron and cobalt films and of a study of its frequency dispersion in the near infrared and visible parts of the spectrum (1-3.1 eV). The results of the measurements are used to calculate the dispersion of the nondiagonal component of the permittivity tensor of an iron film. (14 refs.) *A.T.*

108929 Magneto-optical properties of metallic ferromagnetic materials. K.H.J.Buschow, P.G.van Engen, R.Jongebreur (Philips Res. Labs., Eindhoven, Netherlands).
J. Magn. & Magn. Mater. (Netherlands), vol.38, no.1, p.1-22 (Aug. 1983).
The authors have studied the magneto-optical Kerr rotation in more than 200 metallic systems comprising alloys as well as intermetallic compounds of 3d transition metals. For all these materials the crystal structure, the lattice constants, the room temperature magnetization and the room temperature Kerr rotation at two different wavelengths are specified. For several series of ternary compounds, comprising Heusler alloys Ni_2In-type compounds and $Cr_{23}C_6$ type compounds, they determined the saturation moment at 4.2K. For a number of representative alloys or compounds a study was also made of the wavelength dependence of the complex polar Kerr effect. The values of the Kerr rotation obtained at 633 nm were compared with the corresponding values of the measured magnetization. Systematic trends were observed and have been used to classify metallic systems into systems where the Kerr rotation does not reach values much in excess of 1° and systems where higher values are likely to be found. (23 refs.)

108930 Magneto-optical investigations of a novel superlattice: HgTe-CdTe. Y.Guldner, G.Bastard, J.P.Vieren, M.Voos (Groupe de Phys. des Solides, Ecole Normale Superieure, Paris, France), J.P.Faurie, A.Million.
Phys. Rev. Lett. (USA), vol.51, no.10, p.907-10 (5 Sept. 1983).
Far-infrared magnetoabsorption experiments done in a HgTe-CdTe superlattice are presented. From the results, which are interpreted in terms of interband transitions from valence to conduction subbands, the superlattice band structure has been deduced. These investigations show, in particular, that this superlattice is a quasi zero-energy-gap semiconductor, and yield the first determination of the offset between the HgTe and CdTe valence bands. (8 refs.)

108931 Effect of a finite semiconductor substrate on the Faraday rotation and ellipticity in a metal-oxide-semiconductor system. R.F.O'Connell, G.Wallace (Dept. of Phys. & Astron., Louisiana State Univ., Baton Rouge, LA, USA).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.41-46 (1983).
Studies the effect of a finite semiconductor substrate on the Faraday rotation and ellipticity in a metal-oxide-semiconductor system. The authors find that the multiple reflections within the semiconductor substrate can give an enhancement by factors of up to 2.5 over the case where the semiconductor is considered semi-infinite. In addition, the ellipticity is markedly changed and, in particular, null values may be obtained in contrast with the results obtained without multiple reflections within the semiconductor. (4 refs.)

Combined reciprocal and non-reciprocal birefringence in optical monomode fibres .... See Entry 106878

Pretransitional effects in the isotropic phase of a lyotropic nematic liquid crystal .... See Entry 107934

Phonon polaritons in the presence of a magnetic field .... See Entry 108308

Far-infrared investigations of magnetoplasma effects in Bi in quantizing magnetic fields .... See Entry 108464

Two-dimensional versus three-dimensional motion of inversion electrons in a magnetic field .... See Entry 108570

Magnetic and crystallographic characteristics of $RNiGa_4$ compounds (R-rare earth metal) .... See Entry 108640

Magnetic properties of dysprosium oxisulphate ($Dy_2O_2SO_4$) .. See Entry 108686

Magnetic properties of amorphous sputtered Co_xSi_{1-x} films .... See Entry 108743

Optical absorption and magnetic circular dichroism of MnI_2 .... See Entry 108974

78.20N Thermo-optical effects

Temperature effects in $AgGaS_2$ nonlinear devices .... See Entry 106812

Some optical properties of materials measured at 1.3 μm ..... See Entry 108909

78.30 INFRARED AND RAMAN SPECTRA AND SCATTERING

108932 Mechanism of the 'spillover' of Raman spectral lines and the change of their intensities in α-$LiLO_3$ single crystal under the action of a DC field. Yang Hua-guang, Li Chen-xi, Xu Zheng-yi (Inst. of Phys., Acad. Sinica, Peking, China).
Acta Phys. Sin. (China), vol.32, no.4, p.539-43 (April 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)* [received: Sept. 1983]
The 'spillover' of the Raman spectral lines and the change of their intensities were observed in α-$LiIO_3$ single crystal under the action of a DC field. They are due to the fluctuation of the polarizability tensor and the Raman tensor of α-$LiIO_3$ single crystal during the transportation of ions. The former induces the $o \rightleftharpoons e$ scattering. Subsequently, if this $o \rightleftharpoons e$ scattering light acts as an incident beam to produce Raman scattering, the phenomena mentioned above could occur. The latter brings about the phenomena directly. The former mechanism is predominant. (6 refs.)

108933 One-magnon Raman scattering in $RFeO_3$—magnetic anisotropy and magnon softening. N.Koshizuka, K.Hayashi (Electrotech. Lab., Ibaraki, Japan).
Bull. Electrotech. Lab. (Japan), vol.47, no.4, p.250-60 (1983). In Japanese.
One-magnon Raman scattering spectra of various rare-earth orthoferrites were observed to obtain the magnetic in-plane and out-of-plane anisotropy energy of these systems. Furthermore, detailed temperature dependences of the scattering spectra were measured to study magnon-softening phenomena in $ErFeO_3$, $SmFeO_3$, $Er_{0.7}Sm_{0.3}FeO_3$ and $DyFeO_3$. It has been made clear that the softening behavior is different between rotational- and abrupt-type spin-reorientation systems because of different anisotropy energy terms which contribute to the spin-orientation transitions. From temperature dependences of magnon frequencies in $YFeO_3$ with no spin-reorientation, thermal behaviors of single-ion anisotropy energy of Fe^{3+} ions were obtained. It turns out that the conventional two-sublattice model of $RFeO_3$ is not a good approximation to understand the softening behaviors near the spin-reorientation transition temperatures. It is considered necessary to take into account the role of the Fe^{3+}-R^{3+} exchange interactions in developing the spin-wave mode theory of $RFeO_3$. (28 refs.)

108934 Far-infrared powder spectrum of $(N(CH_3)_3D)(I)(TCNQ)$. J.E.Eldridge, N.Fortier, F.E.Bates (Dept. of Phys., Univ. of British Columbia, Vancouver, BC, Canada), J.S.Miller.
Can. J. Phys. (Canada), vol.61, no.9, p.1271-7 (Sept. 1983).
Presents the powder absorption spectrum of (TMA)(I)(TCNQ) in the far-infrared as a function of temperature. Below 160K new absorption features appear and others increase in intensity. This behaviour supports the electron- and neutron-diffraction evidence of a distortion on the TCNQ chains below the first phase-transition temperature. Effects due to the second phase transition at 89K are also observed. The results of a group-theoretical analysis are presented. These show that totally-symmetric internal modes a_g are to be expected in the infrared spectra of this compound even in the undistorted phase. (35 refs.)

108935 Surface-enhanced Raman scattering of polymethine dyes on silver colloidal particles. K.Kneipp, G.Hinzmann, D.Fassler (Chem. Dept., Friedrich-Schiller-Univ., Jena, Germany).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.503-6 (19 Aug. 1983).
SERS was observed from adsorbed cationic cyanine and neutral merocyanine dyes, whereas the tested oxonol dye did not show any adsorption on the silver colloids. A comparison between Raman scattering of the first three representatives of the homologous series of one dye and Raman experiments performed on the same dyes in solution confirms the existence of SERS. (9 refs.)

108936 High-pressure Raman study of liquid and molecular crystal at room temperature. Carbon disulphide. H.Shimizu, T.Ohnishi (Dept. of Electrical Engng., Gifu Univ., Gifu, Japan).

Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.507-11 (19 Aug. 1983).

The Raman spectra of liquid and crystalline CS_2 were measured at pressures up to 45 kbar and room temperature. The pressure dependences of the internal modes (ν_1 and $2\nu_2$) and the four librational lattice modes are reported. Comparison of the spectrum of high-pressure crystals at 300K with that of the low-temperature crystals at 1 bar indicates that the structure of each crystal resembles mutually. (14 refs.)

108937 A new assignment of the Raman spectrum of tetracyanoethylene anion dimer, $(TCNE^-)_2$. K.H.Michaelian (Energy, Mines & Resources Canada, CANMET/CRL, Sherwood Park, Alberta, Canada), K.E.Rieckhoff, E.M.Voigt, S.Matsuzaki, T.Mitsuishi, K.Toyoda.

Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.512-16 (19 Aug. 1983).

Recently published resonance Raman data for $(TCNE^-)_2$ ethanol, are reassigned in light of earlier results for neutral or complexed TCNE and for $(TCNE^-)_2$ in 2-methyltetrahydrofuran. Counterion and solvent influence are discussed. (21 refs.)

108938 Quantum beating of vibrational factor group components in molecular solids. S.Velsko, J.Trout, R.M.Hochstrasser (Dept. of Chem., Univ. of Pennsylvania, Philadelphia, PA, USA).

J. Chem. Phys. (USA), vol.79, no.5, p.2114-20 (1 Sept. 1983).

The authors report the first observation of coherent Raman induced quantum beats from exciton states in molecular crystals. The paper describes the relevant crystal optics and phasematching conditions needed to ensure coherent excitation of more than one Raman transition in a anisotropic solid. The study of the 991 cm^{-1} mode of C_6H_6 at 1.6K has allowed the identification of two nearby (0.6 cm^{-1}) factor group components and their lifetimes. The larger damping of the weaker $A_g \rightarrow B_{2g}$ transition suggests that intraband scattering is operative. (20 refs.)

108939 Spectroscopic studies of molecular interactions of oxygen-16 and oxygen-18 in the high-density ϵ-phase. B.I.Swanson, S.F.Agnew, L.H.Jones, R.L.Mills, D.Schiferl (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).

J. Phys. Chem. (USA), vol.87, no.14, p.2463-5 (7 July 1983).

Infrared and Raman spectra were obtained for solid $^{16}O_2$ and $^{18}O_2$ as a function of pressure, using diamond-anvil cells. When both isotopes are compressed into the ϵ-phase near 9.9 GPa, a strong infrared band appears in the O-O stretch region, 48 cm^{-1} lower than the Raman-active O-O stretch. As pressure is increased, the infrared absorption shifts to lower frequency, eventually splitting into two bands at 16.0 GPa. Two combination modes, which also shift to lower frequency with increasing pressure, are observed in the 3000-cm^{-1} region of the IR spectra. The ϵ-phase also exhibits a second Raman mode around 130 cm^{-1}, which shifts to higher frequency with pressure. The results indicate that the O-O bond weakens at the expense of forming O_2-O_2 intermolecular interactions in the ε-phase. The spectroscopic results show that the structure of the ϵ-phase is centric with, most likely, four molecules per primitive cell. (16 refs.)

108940 Surface-enhanced resonance Raman spectroscopy of adsorbates on semiconductor electrode surfaces: tris(bipyridine)ruthenium(II) adsorbed on silver-modified n-GaAs (100). R.P.Van Duyne, J.P.Haushalter (Dept. of Chem., Northwestern Univ., Evanston, IL, USA).

J. Phys. Chem. (USA), vol.87, no.16, p.2999-3003 (4 Aug. 1983).

The first observations of surface-enhanced resonance Raman scattering (SERRS) from tris(bipyridine)ruthenium(II), $Ru(bpy)_3{}^{2+}$, at monolayer (or less) coverage on n-GaAs(100) semiconductor (SC) electrodes modified by the electrodeposition of ca. 100 monolayers of Ag metal are reported. In addition to the SERRS studies, the photoelectrochemical and surface microstructural properties of $Ag/GaAs/Ru(bpy)_3{}^{2+}$ electrodes were studied by cyclic voltammetry (CV) and scanning electron microscopy (SEM). (41 refs.)

108941 Surface-enhanced Raman spectroscopy of platinum. II. Enhanced light scattering of chlorine adsorbed on platinum. B.H.Loo (Dept. of Chem., Univ. of Alabama, AL, USA).

J. Phys. Chem. (USA), vol.87, no.16, p.3003-7 (4 Aug. 1983).

For pt.I see Solid State Commun., vol.43, p.349 (1982). Surface-enhanced Raman scattering has been observed from electrogenerated chorine adsorbed on a platinum electrode with 488-, 496.5-, and 514.5-mm Ar^+ and 647.1- and 676.4-nm Kr^+ laser excitation wavelengths. Two vibrational features at 509 and 541 cm^{-1} with an approximate intensity ratio of 1:2 are assigned to the surface vibrations of bridged and linear chlorine on platinum, respectively. This is the first report of a surface vibrational spectrum of molecular chlorine adsorbed on a metal surface. (37 refs.)

108942 Raman scattering and fundamental absorption in red-HgI_2 under hydrostatic pressure. N.Kuroda, T.Iwabuchi, Y.Nishina (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).

J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2419-27 (July 1983).

The Raman scattering and optical absorption spectra have been measured under hydrostatic pressure up to 1.67 GPa in the layer compound red-HgI_2. The Raman spectrum shows that the bending force of HgI_4 tetrahedra is too weak for a layer to vibrate rigidly in the so-called rigid-layer mode. The bending force increases rapidly with pressure, whereas the van der Waals force remains unchanged. These characteristics originate from the fact that the bond ionicity is extremely high and sensitive to pressure. The fundamental absorption edges exhibit red shifts, giving an evidence that the ionicity decreases with pressure. Anisotropy in elastic constants is also discussed in relation to the nature of chemical bondings. (25 refs.)

108943 Simple theory for surface-plasmon-polariton resonance on sinusoidal metal surface: application to SERS. M.Yamashita, M.Tsuji (Dept. of Appl. Sci., Kyushu Univ., Fukuoka, Japan).

J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2462-71 (July 1983).

The field enhancement for a *p*-polarized incident light near a sinusoidal grating surface arising from surface-plasmon-polariton excitation is studied by an improved first-order perturbation theory in which the importance of the back-scattering terms is taken into account. The dependences of the reflectivity and the enhancement factor on the amplitude of the grating are discussed. The maximum enhancement factor and the most suitable grating amplitude are calculated as functions of the frequency of the incident light for various grating periodicities. Under certain circumstances, the field enhancement may achieve above 10^3 for Ag gratings near 1.3 eV of the incident-light frequency. It means 10^6 times enhancement of the Raman scattering (SERS) of molecules adsorbed on the metallic grating surface. (35 refs.)

108944 Complete first-order Raman spectra of the pyrite structure compounds FeS_2, MnS_2 and SiP_2. H.Vogt, T.Chattopadhyay, H.J.Stolz (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).

J. Phys. & Chem. Solids (GB), vol.44, no.9, p.869-73 (1983).

The first-order Raman spectra of FeS_2, MnS_2 and SiP_2 are measured at room temperature. The frequencies of all Raman-active phonons are obtained. The authors describe the displacement patterns and discuss the extent to which the concept of a molecular crystal can be applied. (19 refs.)

108945 Spectroscopic study of thermal cure of R-2M polymer binder. N.I.Sushko, N.I.Makarevich.

J. Appl. Spectrosc. (USA), vol.37, no.5, p.1265-9 (Nov. 1982). Translation of *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.776-80 (Nov. 1982). [received Sept. 1983]

Glass-fiber reinforced plastics are composite materials based on glass-fiber reinforced fillers and cured polymer binders. The role of a binder in the glass-fiber reinforced plastics consists mainly in uniting separate glass fibers into a monolithic material. The binder also imparts special physicochemical properties to the glass-fiber reinforced plastic. Thermoreactive (polyester epoxide, phenol-formaldehyde, organosilicon) and also thermoplastic polymers (polyamides, polyolefins, polystyrene) are used as polymer binders. In Soviet industry, phenol-formaldehyde R-2M resin is widely used for the preparation of glass-fiber molding materials. Glass-fiber materials AG-4V, AG-4S, DSV and others are prepared from it. To clarify the characteristic features of the thermal cure of the R-2M binder, the authors studied the changes in the IR absorption spectra of the R-2M binder and BP-4 adhesive during heat treatment. (5 refs.)

108946 Study of acid properties of ferrierite surface by IR spectroscopy. V.S.Komarov, L.N.Malashevich, N.A.Akulich, M.F.Savchits.

J. Appl. Spectrosc. (USA), vol.37, no.5, p.1269-71 (Nov. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.780-4 (Nov. 1982) [received: Sept. 1983]

There are several data in the literature on the study of physicochemical adsorptional, and catalytic properties of synthetic zeolite ferrierite with a high silicon content, with the ratio $SiO_2/Al_2O_3=10$, and a superhigh-silicon zeolite with ratio $SiO_2/Al_2O_3=$ 20-30. The study of the catalytic properties of this zeolite showed that it has a fairly high activity in the cracking reaction of n-hydrocarbons. It was therefore interesting to study the nature of the acid centers on the ferrierite surface, closely related to its catalytic activity. (14 refs.)

108947 Optical properties of donor electrons in semimagnetic semiconductors. T.Dietl (Inst. of Phys., Polish Acad. of Sci., Warsaw, Poland).

J. Magn. & Magn. Mater. (Netherlands), vol.38, no.1, p.34-44 (Aug. 1983).

The cross section of the spin-flip Raman scattering and the absorption coefficient of the electric-dipole spin-resonance of donor electrons in $Cd_{1-x}Mn_xSe$ are calculated. The exchange induced spin-splitting of a donor level is described taking into account three sources of a local magnetization; external magnetic field, thermodynamical fluctuations of magnetization and molecular field of the donor electron (bound magnetic polaron). The theory takes into account the selection rules appropriate for the hexagonal CdMnSe. The role played by fluctuations of composition is considered. It is suggested that a spin-flip line is inhomogeneously broadened by thermodynamical fluctuations of magnetization and additionally, in high fields, by fluctuations of the composition. (26 refs.)

108948 Enhanced Raman scattering from silicon microstructures. D.V.Murphy, S.R.J.Brueck (Lincoln Lab., MIT, Lexington, MA, USA).

Opt. Lett. (USA), vol.8, no.9, p.494-6 (Sept. 1983).

Electromagnetic-structure-resonance enhancement of scattering from Si phonon modes is reported for a number of submicrometer structures. Enhancements of $\gtrsim 100$ over the Raman intensity from bulk Si are observed for ~ 0.1-μm-diameter Si spheres. An analytic calculation of the Raman intensity for this geometry is in good qualitative agreement with the experiment and demonstrates that the enhancement arises from the coupling of both the incident and the scattered fields with the low-order-structure resonances in this high-index dielectric. (13 refs.)

108949 A Raman study of compositional disorder in defect chalcopyrites. C.Razzetti (Istituto de Fisica, Univ. di Parma, Parma, Italy), P.P.Lottic L.Zanotti, M.Curti.

Phys. Status Solidi b (Germany), vol.118, no.2, p.743-9 (1 Aug. 1983).

The growth and Raman scattering results obtained for $ZnGa_{2x}In_{2(-x)}S_4$ $Zn_xCd_{1-x}Ga_2S_4$, and $CdGa_{2x}In_{2(1-x)}S_4$ tetragonal pseudoternary compounds are given and discussed. The phonon spectra display one- and two-mode behaviour. For $Zn_xCd_{1-x}Ga_2S_4$ compounds a virtual crystal model seems to describe the observed one-mode behaviour. (12 refs.)

108950 Directional dependence of extraordinary infrared oscillator parameters of $TlGaS_2$-type layer crystals. N.M.Gasanly, A.S.Ragimov V.I.Tagirov (Dept. of Phys., Azerbaijan State Univ., Baku, Azerbaidzhan SSR).

Physica B & C (Netherlands), vol.122B+C, no.1, p.28-34 (Sept. 1983).

The directional dispersion of IR-active modes of $TlGaS_2$, $TlGaSe_2$ and TlInS layer single crystals has been investigated, depending on the angle between the phonon wave vector *q* and the optical *c*-axis. Owing to the possibility o preparation crystals with various orientations of reflecting surfaces with respect to the optical *c*-axis, it was of interest to check the applicability of the generalized Born and Huang theory of long-wave optical vibrations in uniaxia crystals to $TlGaS_2$-type layer crystals. (16 refs.)

108951 Anharmonic effects in light scattering due to optical phonons in silicon. M.Balkanski, R.F.Wallis, E.Haro (Lab. de Phys. des Solides, CNRS Univ. Pierre et Marie Curie, Paris, France).

Phys. Rev. B (USA), vol.28, no.4, p.1928-34 (15 Aug. 1983).

Systematic measurements by light scattering of the linewidth and frequency shift of the $\vec{q}=0$ optical phonon in silicon over the temperature range of 5-1400K are presented. Both the linewidth and frequency shift exhibit a quadratic dependence on temperature at high temperatures. This indicates the necessity of including terms in the phonon proper self-energy corresponding to four-phonon anharmonic processes. (13 refs.)

108952 B_{1g} mode softening in FeF_2. D.J.Lockwood, R.S.Katiyar V.C.Y.So (Phys. Div., Nat. Res. Council, Ottawa, Ontario, Canada).

Phys. Rev. B (USA), vol.28, no.4, p.1983-7 (15 Aug. 1983).

Experiments are reported for the temperature dependence of phonon Raman scattering in FeF_2. The B_{1g} phonon exhibits anomalous frequency softening with decreasing temperature for temperatures in the range $T_N=78$-340K This softening is less marked for temperatures below T_N because of spin-lattice effects resulting from the antiferromagnetic ordering. In the higher-temperature region the square of the B_{1g}-phonon frequency is proportional to temperature, which is suggestive of a virtual structural phase transition However, consideration of other work on the pressure dependences of the Raman-active modes in similar compounds leads the authors to conclude that the mode softening results largely from the lattice thermal contraction. This contraction disproportionally influences the forces between the nearest-neighbor fluorine ions in adjacent planes perpendicular to the *c* axis. (1 refs.)

108953 Theoretical study of the infrared absorption in trans-$(CH)_x$ and trans-$(CD)_x$. D.Rakovic (Faculty of Electrical Engng., Belgrade, Yugoslavia), I.Bozovic, S.A.Stepanyan, L.A.Gribov.
Phys. Rev. B (USA), vol.28, no.4, p.1997-2000 (15 Aug. 1983).
A calculation of the vibration spectra of trans-$(CH)_x$ and trans-$(CD)_x$ is presented; it includes for the first time the out-of-plane motions and the infrared (IR) absorption intensities. To obtain a reliable set of transferable parameters, extensive simultaneous optimizations of both the force constants and the electro-optical parameters were performed to solve the inverse spectral problem for several short polyenes. The calculations evince a novel major effect in trans-polyacetylene: the A_u in-plane C-H bending mode is expected to give rise to the strongest IR absorption band at ~ 1300 cm^{-1} but its intensity is in fact dramatically reduced. The same effect is seen in the deuterated polymer. Lowering of the resonant Raman frequencies and the IR band disappearance are both believed to be caused by coupling of the vibrations to the π-electron system. For the IR case this is probably caused by the large dipole moments of the vibrating C-H bonds. (24 refs.)

108954 Light scattering from vibrational modes in GaAs-$Ga_{1-x}Al_xAs$ superlattices and related alloys. J.Sapriel, J.C.Michel, J.C.Toledano (CNET, Bagneux, France), R.Vacher, J.Kervarec, A.Regreny.
Phys. Rev. B (USA), vol.28, no.4, p.2007-16 (15 Aug. 1983).
Raman and Brillouin scattering investigations are performed on GaAs-$Ga_{1-x}Al_xAs$ superlattices which have been fully characterized by means of X-ray diffraction. Six superlattice samples with periods ranging from 45 to 250 Å and with an aluminum concentration x around 0.3 have been investigated by means of conventional Raman scattering. A doublet of lines due to the superlattice effect appears on the spectra. These Raman lines of symmetry A_1 are located on either side of the theoretical value corresponding to the first folded mode at $k=0$ of the longitudinal-acoustic branch. The crystalline quality of the GaAs layers of the superlattices has also been studied through comparisons between disorder-activated transverse-acoustic modes and second-order Raman lines. Precise measurements on surface-acoustic-wave velocity have been performed by means of a high-contrast and high-sensitivity Brillouin experimental setup. Several $Ga_{1-x}Al_xAs$ epitaxial layers with $0<x<0.8$ have been studied and the velocity variations in the [100] and [110] directions have been determined. The elastic constants of $Ga_{1-x}Al_xAs$ undergo small decrease with increasing values of x. Concerning the Brillouin measurements in GaAs-$Ga_{1-x}Al_xAs$ superlattices, the surface-wave velocities are slightly higher than in the corresponding mean homogeneous medium. Possible stresses in the alternating layers could be at the origin of this difference. (29 refs.)

108955 Light scattering studies of rubidium cyanide under hydrostatic pressure. W.Dultz, E.Rehaber (Fakultat fur Phys., Univ. Regensburg, Regensburg, Germany).
Phys. Rev. B (USA), vol.28, no.4, p.2114-18 (15 Aug. 1983).
The Raman and Brillouin spectra of RbCN were measured at pressures up to 0.8 GPa and at temperatures down to 80K. The phase diagram of RbCN was obtained by using the change of the spectra at a phase transition as indicator for the phase line. The Raman spectra of the different phases of RbCN show a similarity to the spectra of the high-pressure phases of KCN and the assignment of several Raman bands with the help of inelastic neutron-scattering data supports this expected correspondence. An introduction of pressure into the Landau-type expansion to describe the pressure dependence of the elastic constant C_{44} is discussed. (32 refs.)

108956 Some problems concerning infrared emission measurements. P.Baraldi, G.Fabbri (Lab. di Chimica Fisica Applicata, Istituto di Chimica Fisica, Univ. di Modena, Modena, Italy).
Spectrochim. Acta Part A (GB), vol.39A, no.8, p.669-75 (1983).
Some emission spectra of supported samples recorded with two experimental arrangements have been discussed. The existence is pointed out of a background emissivity which causes spectra with bands in relief to be recorded only in an optimum thickness range. The experimental behavior observed is in good agreement with the predictions based on some relationships here reported. Application of the latter to emissivity measurements is shown to supply optical constants consistent with the ones obtained by other techniques. (15 refs.)

108957 Spectroscopic characteristics of the ν_{OH} vibration of polychlorophenols in the solid state. J.-P.Bayle, J.Jullien, H.Stahl-Lariviere (Lab. de Chimie Structurale Organique, Univ. Paris-Sud, Orsay, France), N.le Calve, B.Pasquier.
Spectrochim. Acta Part A (GB), vol.39A, no.8, p.677-88 (1983).
Hydroxyl stretching bands of solid chlorophenols at room and liquid nitrogen temperature have been studied by infrared spectroscopy. A complete interpretation of ν_{OH} region is given for six dichlorophenols and pentachlorophenol for which crystal structures are known. The ν_{OH} region can be explained in terms of different hydrogen bonds and correlation field splittings. Moreover, Fermi resonances arise if ν_{OH} is lower than 3300 cm^{-1}. Isotopically diluted crystals have been used in order to eliminate vibrational coupling. The resulting -OH stretching frequencies can be correlated with the corresponding O...O distances. The usual correlation is obtained except for phenols having two chlorines in ortho position. Except in 3,4,5-trichlorophenol for which an O...O distance of about 2.7 Å can be suggested, a small $\Delta\nu_{OH}$ shift is observed in tri- and tetrachlorophenols, which should be consistent, rather long ($\simeq 3$ Å) O...O distances. (36 refs.)

108958 Raman studies on local structural disorder in silicon-based amorphous semiconductor films. A.Morimoto, S.Oozora, M.Kumeda, T.Shimizu (Dept. of Electronics, Kanazawa Univ., Kanazawa, Japan).
Solid State Commun. (USA), vol.47, no.10, p.773-7 (Sept. 1983).
Raman scattering and ESR measurements were carried out for amorphous Si and amorphous Si-based alloy systems such as Si-N and Si-C. A pronounced broadening of the Si-Si TO-like band of Raman spectra is observed with an increase in the N or C content for amorphous Si-N and Si-C alloy systems. The broadening of the TO-like band for amorphous Si system as well as amorphous Si-N and Si-C systems has a good correlation with an increase in the density of dangling bonds derived from ESR measurements. The fact suggests that dangling bonds are produced in order to relax the local strain due to structural constraint and lower the total energy. (15 refs.)

108959 Raman spectra of low-lying longitudinal model of KH_2PO_4 and KD_2PO_4 in ferroelectric phase. Y.Tominaga (Dept. of Phys., Ochanomizu Univ., Tokyo, Japan), M.Kasahara, H.Urabe, I.Tatsuzaki.
Solid State Commun. (USA), vol.47, no.10, p.835-7 (Sept. 1983).
The origin of the low-lying modes of KH_2PO_4 and KD_2PO_4 in the ferroelectric phase has been clarified by the $z(xy)\bar{z}$ Raman scattering experiments. The '*S*-mode', which has been usually assigned to the proton tunneling mode in KH_2PO_4 at $T<T_c$, has been found in the $z(xy)\bar{z}$ spectrum of KH_2PO_4 in contrast to the $x(yx)y$ spectrum. It has been found that the frequency of the '*S*-mode' of KD_2PO_4 is higher than that of KH_2PO_4. From the present Raman spectroscopy, it is concluded that the '*S*-mode' is assigned to the libration mode of the PO_4 tetrahedrons. (14 refs.)

108960 Observation of disappearance of cooperative Jahn-Teller distortion in the two-dimensional magnetic system $K_2Cu_xZn_{1-x}F_4$ by Raman scattering experiments. Y.Natsume, I.Yamada (Dept. of Phys., Chiba Univ., Chiba, Japan).
Solid State Commun. (USA), vol.47, no.10, p.839-42 (Sept. 1983).
Raman spectra in the two-dimensional diluted system $K_2Cu_xZn_{1-x}F_4$ are reported. The problem how the cooperative Jahn-Teller distortion (whose existence in the *c*-plane is well confirmed for K_2CuF_4) is destroyed with decreasing x is discussed on the basis of observed behaviours of Stokes lines for some characteristic vibrational modes in spectra. (13 refs.)

Microfabrication as a scientific tool ......See Entry 105316

Raman difference spectroscopy ......See Entry 105387

Infrared spectra of hydrogen-bonded salicylic acid and its derivatives: methyl salicylate ......See Entry 106400

On the vibrational frequency correlation in liquids: Raman study of aqueous thiocyanate solutions ......See Entry 106407

On structure of liquid polyethylene. 'Computer experiment' and IR-spectroscopy data ......See Entry 107519

Bond character and properties of the mixed alkali system Na_2O-K_2O-Al_2O_3-SiO_2 ......See Entry 107554

Alkylammonium hexachlorostannates(IV), $(R_nNH_{4-n})_2SnCl_6$: crystal structure, infrared spectrum and hydrogen bonding ......See Entry 107660

Temperature processing effects in proton-implanted *n*-type GaAs ......See Entry 107722

Infrared investigation of lattice vibration in black phosphorus ......See Entry 107841

Longwave optical phonons in $ZnTe_{1-x}S_x/_2Se_x/_2$ solid solutions ......See Entry 107845

Vibrational spectra of hydrogen in silicon and germanium ......See Entry 107853

Characterisation of the polymorphic component of 2-fluoronaphthalene ......See Entry 107921

Crystallization and phase transitions in lanthanide-α-aminoacid systems ......See Entry 107931

Thermal analysis of complex sulfates of hafnium and sodium ......See Entry 107994

Disorder phenomena in β-alumina ......See Entry 108034

Specimens in the MnO-Fe_2O_3-H_2O system ......See Entry 108164

Structural organisation of amorphocrystalline films of lead tin telluride during annealing in vacuo and in oxygen ......See Entry 108224

Ionization of the direct-gap exciton in photoexcited germanium ......See Entry 108299

Electron-phonon coupling detection in infrared spectra of ion-radical salts based on dibenztetrathiofulvalen ......See Entry 108311

Infrared conductivity from spin and charge density waves: $(TMTSF)_2X$ ......See Entry 108404

Far-infrared investigations of magnetoplasma effects in Bi in quantizing magnetic fields ......See Entry 108464

Two-dimensional versus three-dimensional motion of inversion electrons in a magnetic field ......See Entry 108570

Dielectric function of SmS. II. Infrared response: LO(Γ) phonon softening ......See Entry 108915

Magneto-optical investigations of a novel superlattice: HgTe-CdTe ......See Entry 108930

Effect of a finite semiconductor substrate on the Faraday rotation and ellipticity in a metal-oxide-semiconductor system ......See Entry 108931

Vibrational absorption bands for implanted nitrogen in crystalline silicon ......See Entry 108980

Oxygen vacancies in lithium niobate ......See Entry 108981

Absorption spectrum of Ni^{2+} doped in NH_4Br single crystal ......See Entry 108982

Nickel centers in strontium tartrate tetrahydrate single crystals ......See Entry 108984

Oxygen and carbon measurements on silicon slices by the IR method ......See Entry 108985

Spectroscopic properties of Er^{3+} ions in Li(Er, Gd)P_4O_{12} single crystals—fluorescence, Raman and infrared spectra ......See Entry 108992

Resonant Raman scattering and hot luminescence at the indirect exciton in BiI_3 ......See Entry 108997

Infrared transmission spectra of $CuInSe_2$ thin films ......See Entry 109029

Preparation and properties of single crystals of some cadmium-containing indium, thallium, and cesium halides ......See Entry 109133

High conductive carbon films obtained by plasma CVD ......See Entry 109164

A structural study of the tensile drawing behavior of poly(ethylene terephthalate) ......See Entry 109413

78.35 BRILLOUIN AND RAYLEIGH SCATTERING

108961 On the quantum statistics of Brillouin scattering. A.Pieczonkova (Inst. of Phys., Czechoslovak Acad. Sci., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.8, p.923-9 (1983).
The statistical properties of photon and phonon fields in Brillouin scattering with intense pumping are analysed, for the case of prevailing Stokes interaction. The effect of antibunching of photons is demonstrated using the photon number distribution and its factorial moments. The time dependence of the integrated intensity (of the first factorial moment) of photon and phonon modes is discussed from the viewpoint of the strength of anti-Stokes interaction. (9 refs.)

108962 A new look at the enhanced low-angle scattering in moderately concentrated polymer solutions. J.-M.Guenet, N.F.F.Willmott, P.A.Ellsmore (H.H. Wills Phys. Lab., Bristol Univ., Bristol, England).
Polym. Commun. (GB), vol.24, no.8, p.230-3 (Aug. 1983).
In the light of the recent discovery by Tan et al. (Macromolecules, vol.16, p.28, 1983) of the gelation ability of some atactic polystyrene solutions at low temperature above the UCST, the present authors reexamine the enhanced scattering observed at small angles in moderately concentrated solutions. Some results gained from light scattering experiments are presented, showing that there seems to be a correlation between these two phenomena: i.e. no abnormal scattering effect when dealing with a solvent preventing gelation

whereas abnormal scattering when using a solvent promoting the gelation. The results are discussed and a tentative explanation is given. (16 refs.)

108963 Rayleigh and Brillouin scattering in $RbH_3(SeO_3)_2$ near the phase transition temperature. A.Sakai, T.Yagi (Dept. of Phys., Kyushu Univ., Fukuoka, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2544-9 (July 1983).
Rayleigh and Brillouin scattering spectra of $RbH_3(SeO_3)_2$ have been observed around the phase transition temperature T_c. The temperature dependence of the Brillouin frequency shifts shows a small anomaly near T_c in all the three principal directions. The sound-velocity dispersion is found only in the c_{55} transverse mode. The intensity of the Rayleigh component is insensitive to temperature even just near T_c. The existence of dynamic clusters above T_c is discussed and its characteristic frequency is roughly estimated, while static clusters are concluded not to exist in the same temperature region. (19 refs.)

108964 Method of measuring the kinetic and thermodynamic properties in binary stratified systems by means of scattered light spectra. S.V.Kazakov, N.I.Chernova (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
J. Eng. Phys. (USA), vol.44, no.1, p.55-9 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.67-71 (Jan. 1983). [received: Sept. 1983]
A method and results of investigating the kinetic and thermodynamic parameters of the mutual diffusion coefficient in binary stratified liquid mixtures are described. (12 refs.)

108965 Heterodyne correlation of scattered light from a Sr^{++}-doped NaCl crystal. A feasibility study. D.Sahoo (Materials Sci. Labs., Reactor Res. Centre, Kalpakkam, Tamil Nadu, India).
Phys. Status Solidi b (Germany), vol.118, no.2, p.623-30 (1 Aug. 1983).
A theoretical calculation of the heterodyne correlation function of scattered light is presented for a (suitably heated-treated) NaCl crystal doped with 250 ppm divalent Sr^{++} impurities. It is assumed that the impurity-vacancy complexes (A_1) diffuse and aggregate to form dimers (A_2) and trimers (A_3) by the reactions $A_1+A_1 \rightleftharpoons A_2$ and $A_2+A_1 \rightleftharpoons A_3$. Light scattering arises arises due to fluctuations in concentrations of A_1, A_2, and A_3. The correlation function, calculated under equilibrium conditions is a sum of three decaying exponentials. It reduces to 85% (or its initial value) in 10 ms at 800K, to 30% in 10 s at 600K, and to 6% in 10 s at 500K, thus indicating the feasibility of the experiment at relatively high temperatures. (10 refs.)

108966 Theory of light scattering in cholesteric blue phases. R.M.Hornreich, S.Shtrikman (Dept. of Electronics, Weizmann Inst. of Sci., Rehovot, Israel).
Phys. Rev. A (USA), vol.28, no.3, p.1791-807 (Sept. 1983).
A comprehensive analysis of elastic light scattering in cholesteric liquid-crystal systems, based upon the Mueller matrix approach, is given. Emphasis is placed upon analyzing the polarization state of the scattered light for arbitrarily polarized incident radiation. The theory is applied to the ordered cholesteric blue phases BPI and BPII, which exhibit long-range orientational ordering. Both the polycrystalline and single-crystal cases are considered and the role played by optical activity is studied. It is shown how light-scattering studies yield information on the structural properties of the ordered phases. The quasielastic light scattering due to excitations in the disordered phase is also analyzed in the harmonic approximation. It is shown that this scattering cannot explain the strong anomalous scattering observed in the amorphous BPIII phase. (25 refs.)

108967 Low-angle laser light scattering from polystyrene solutions: intensity measurements and photon correlation spectroscopy. E.Ozdemir, R.W.Richards (Dept. of Pure & Appl. Chem., Univ. of Strathclyde, Glasgow, Scotland).
Polymer (GB), vol.24, no.9, p.1097-102 (Sept. 1983).
Light scattering measurements have been made on polystyrenes with a range of molecular weights in toluene and for one polystyrene in a range of solvents including a theta solvent. Intensity data were used to calculate second virial coefficients and molecular weights, whilst photon correlation spectroscopy was used to calculate diffusion coefficients. All measurements were made at 30°C and at a scattering angle of ca.4°. The data were used to examine current theories of polymer diffusion and the relation between hydrodynamic radius (R_H) and radius of gyration ($\langle s^2\rangle^{1/2}$). The results support accepted theories of polymer diffusion, but suggest that the relation between R_H and $\langle s^2\rangle^{1/2}$ requires further analysis. (36 refs.)

108968 Use of phase Fourier spectroscopy to investigate dynamic scattering of light in nematic liquid crystals. V.L.Pankov, V.N.Strekalov, V.P.Tychinskii (Inst. of Radio Engng., Electronics & Automatics, Moscow, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.205-8 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.351-7 (March-April 1983). [received: Sept. 1983]
Phase Fourier spectroscopy is used to investigate the low-frequency spectra of phase fluctuations of light scattered by a liquid crystal with a resolution of 10^{-3} Hz. In the transitional region from a stationary domain structure to the dynamic scattering regime, there are periodic disturbances in the nematic liquid crystal with a characteristic frequency of 0.3-0.5 Hz. (17 refs.)

Nonlinear absorption of electromagnetic waves in crystals with large dielectric constant caused by SBS .... See Entry 106824

Fluctuations and scattering of light in nematic liquid crystals .... See Entry 107545

Viscoelastic properties of liquid pentachlorobiphenyl under pressure using depolarized light scattering .... See Entry 107794

Elastic constants of GaS and GaSe layered crystals determined by Brillouin scattering .... See Entry 107804

Light scattering from vibrational modes in GaAs-$Ga_{1-x}Al_xAs$ superlattices and related alloys .... See Entry 108954

Light scattering studies of rubidium cyanide under hydrostatic pressure .... See Entry 108955

78.40 VISIBLE AND ULTRAVIOLET SPECTRA

108969 Polarized emission of $[Ru(bpy)_3](PF_6)_2$ single crystals. H.Yersin, E.Gallhuber (Inst. fur Phys. & Theoretische Chem., Univ. Regensburg, Regensburg, Germany), A.Vogler, H.Kunkely.
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4155-6 (29 June 1983).
Polarized emission spectra of single-crystal $[Ru(bpy)_3](PF_6)_2$ are reported for the first time. The spectra are recorded in the temperature range from $T=243$ to 343K. A new $\mathbf{E}\|\mathbf{c}$-polarized emission band is found, situated 650 $cm^{-1}\pm 20\%$ above the main emission peak maximum. The corresponding emitting state is assigned to A_2' (in D_3'). The $\mathbf{E}\perp\mathbf{c}$-polarized emission results from one or more E′ states and is by a factor of about 20 more intense than the $\mathbf{E}\|\mathbf{c}$-polarized emission. (19 refs.)

108970 Absorption spectra, energy levels, and crystal-field analysis of trivalent neodymium in the γ phase of neodymium sesquisulfide (γ-Nd_2S_3). J.B.Gruber (Depts. of Phys. & Chem., Portland State Univ., Portland, OR, USA), R.P.Leavitt, C.A.Morrison.
J. Chem. Phys. (USA), vol.79, no.4, p.1664-8 (15 Aug. 1983).
The authors report absorption spectra of Nd^{3+} in the γ phase of Nd_2S_3. Energy levels of all manifolds from the ground state ($^4I_{9/2}$) through $^2H_{11/2}$ (15616 cm^{-1}) were determined from the spectra. A best least-squares fit of the experimental levels was made with a crystal-field Hamiltonian of S_4 symmetry, resulting in the following crystal-field parameters B_{km} (in cm^{-1}): $B_{20}=-209$, $B_{40}=402$, $B_{44}=1236$, $B_{60}=-774$, $RB_{64}=-423$, and $IB_{64}=103$. The r.m.s. deviation between calculated and experimental levels is 8.7 cm^{-1}. A total of 50 levels was included in the fit (out of a possible 53 within the manifolds considered). The results are shown to be consistent with an effective point-charge model for the γ-Nd_2S_3 lattice in which Nd^{3+} vacancies are distributed randomly. (26 refs.)

108971 Dynamic light scattering of polystyrene latex in the ordered state. S.Sasaki (Dept. of Phys. & Macromolecular Chem., Univ. of Leiden, Leiden, Netherlands), N.Imai.
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2571-80 (July 1983).
A Laue pattern is observed for the ordered array of polystyrene latex particle. The pattern corresponds well to a fcc lattice. The time correlation of intensity of scattered light, $g^{(1)}(\tau)$, is also measured and analyzed. The intensity fluctuation of Laue spot shows a long time-correlation which can be approximately expressed as $g^{(1)}(\tau)\sim(\tau)^{-0.61}$ at longer correlation time. The fact that decay constants, Γ, of $g^{(1)}(\tau)$ show maximum at the half of the scattering angle of the Laue condition indicates that the movement of particle is correlated with each other.

108972 Optical absorption near the fundamental absorption edge in some vanadate glasses. C.A.Hogarth, A.A.Hosseini (Dept. of Phys., Brunel Univ., Uxbridge, England).
J. Mater. Sci. (GB), vol.18, no.9, p.2697-705 (Sept. 1983).
The fundamental absorption edges of some samples of V_2O_5-P_2O_5 and V_2O_5-P_2O_5-TeO_2 glasses were measured in the short wavelength part of the visible region, and it was found that the fundamental absorption of these glasses is dependent on composition and arises from direct forbidden transitions and occurs at a photon energy in the range 1.9 to 2.6 eV, depending on composition. (9 refs.)

108973 Study of the thermal stability of textile materials (fibers) by spectroscopic techniques. A.S.Kozeruk, S.G.Guminetskii.
J. Appl. Spectrosc. (USA), vol.37, no.5, p.1281-5 (Nov. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.795-800 (Nov. 1982). [received: Sept. 1983]
The authors study the influence of elevated temperatures on the spectral shape and the magnitude of the absorption coefficients (A) of several of the undyed fibers most widely employed. Since fibers very effectively scatter light incident on them, due to their disperse nature, measurements of the absorption coefficients were carried out using a high temperature integral photometer. Undyed fibers may luminesce under the action of ultraviolet radiation. They have also observed this, and find that the intensity of this luminescence varies as the temperature is raised. In order to avoid this emission, which impedes the measurement of the absorption coefficients of fibers in the 'pure' form in the spectral region $\lambda<400$ nm, they employed a glass filter (transmission region $\lambda=240$-400 nm), which was placed directly in front of the photomultiplier cathode. (11 refs.)

108974 Optical absorption and magnetic circular dichroism of MnI_2. H.J.W.M.Hoekstra, P.R.Boudewijn, H.Groenier, C.Haas (Lab. of Inorganic Chem., Univ. Groningen, Groningen, Netherlands).
Physica B & C (Netherlands), vol.121B+C, no.1-2, p.62-80 (1983).
Absorption and magnetic circular dichroism (MCD) spectra of single crystals of MnI_2 in the spectral region 16000-30000 cm^{-1} at temperatures between 1.5 and 300K are reported. The observed bands are due to d-d transitions of the Mn^{2+} ions. Parameters of the electron repulsion, the cubic crystal field and the spin orbit coupling are deduced from the spectra. The transitions are induced by vibronic interactions with ungerade phonons and by exchange interactions between neighbouring ions. The relative contribution of these two mechanisms is different for different transitions. MCD parameters calculated for a trigonally-anisotropic coupling of Mn^{2+} with ungerade phonons are compared with the observed spectra. A detailed assignment is given for the fine structure of the $^6Ag_{1g}\rightarrow{}^4A_{1g}$, ^4E_g transitions. These transitions show the effects of exciton diffusion, with an effective exciton hopping integral of 9 cm^{-1}. (40 refs.)

108975 Excitonic reflectance of GaAs crystals cleaved in liquid helium. L.Schultheis, I.Balslev (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Phys. Rev. B (USA), vol.28, no.4, p.2292-5 (15 Aug. 1983).
The authors report optical reflectance spectra near the $n=1$ excitonic resonance of GaAs. The experimental results from crystals cleaved in liquid helium and exposed to air exhibit noticeable changes of the line shape. Comparison with a model based on the adiabatic approximation indicates that line-shape distortions by surface electric fields are unavoidable for air-exposed GaAs surfaces. (20 refs.)

108976 Study of the 2.4 and 2.6 eV absorption bands in CdMnTe. J.P.Lascaray, J.Diouri, M.El Amrani, D.Coquillat (Univ. Sci. & Tech. du Languedoc, Montpellier, France).
Solid State Commun. (USA), vol.47, no.9, p.709-12 (Sept. 1983).
Two absorption bands, located around 2.4 and 2.6 eV, are observed in highly Mn-doped CdMnTe absorption spectra. They are studied in the temperature range 5 to 300K. The strong similarity between these results and previous data in Mn compounds suggest an intra-Mn nature of the transitions responsible for the two bands. From this point of view, different hypotheses involving $Mn^{2+}(^4G)$ excited state split by the crystal field are advanced and compared with available data. (16 refs.)

108977 Absorption and dispersion of optical glass intrinsic absorption in vacuum ultraviolet region. T.Izumitani, S.Hirota.
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.2-3, p.227-37 (1983). In English. (Otto-Schott-Colloquium on the State of Optical Glass Research 1982, Jena, Germany, 1982).
The intrinsic absorption spectrum of glass in the vacuum ultraviolet region was measured in order to correlate dispersion to absorption of glass. The absorption wavelength of bridging oxygen, non-bridging oxygen and non-noble type cations such as Pb^{2+} was confirmed by reflection spectra in R_2O-RO-SiO_2 glasses, and by the absorption spectra in thin film BaO-$R_{m/n}O$-$B_{2/3}O$ glasses. The absorption wavelengths of bridging oxygen ions are found at 11.6 eV and 10.4-9.5 eV, those of non-bonding oxygen ions are found in the range of 9-7 eV. The oscillator strength of bridging oxygen ions is significantly higher than that of non-bridging oxygen ion. (7 refs.)

A single crystal of $YAlO_3$:Ce^{3+} as a fast scintillator in SEM .... See Entry 105431

Bond character and properties of the mixed alkali system Na_2O-K_2O-Al_2O_3-SiO_2 .... See Entry 107554

Broadening of electronic spectra at the critical point of a binary polar mixture .... See Entry 107861

Liquid crystals—a simple spectroscopic method for determining the phase transitions .... See Entry 107937

Electronic structure of anisotropic semiconductors: optical properties and behaviour under hydrostatic pressure .... See Entry 108280

Effect of optical-phonon scattering on the energy distribution of hot electrons in semiconductors at low temperature .... See Entry 108431

Structure of active centers in manganese-doped single crystals of yttrium titanate $Y_2Ti_2O_7$ .... See Entry 108773

Argand diagrams and decomposition of the fundamental phianite spectrum into elementary parts .... See Entry 108906

On the reflectivity for oblique incidence of the uniaxial antiferromagnetic crystals FeF_2, CoF_2, and MnF_2 .... See Entry 108911

Dielectric function of SmS. I. Optical transitions .... See Entry 108914

Analysis of conditions for additional minimum formation in the linear-cross splitting region in exciton reflection spectra .... See Entry 108916

Raman scattering and fundamental absorption in red-HgI_2 under hydrostatic pressure .... See Entry 108942

Oxygen vacancies in lithium niobate .... See Entry 108981

Cobalt centres in ammonium chloride: optical absorption studies .... See Entry 108983

Nickel centers in strontium tartrate tetrahydrate single crystals .... See Entry 108984

Influence of elementary structure defects on the optical properties of glasses .... See Entry 108986

Spectral investigations of the anthracene-carbazole system .... See Entry 109006

Heteroepitaxial growth of CdTe on GaAs by laser assisted deposition .... See Entry 109166

The effect of ammonia ions on the absorption and fluorescence of an oxazine dye .... See Entry 109778

78.45 STIMULATED EMISSION

(see also 42.65C in nonlinear optics)

108978 New inorganic material with a high concentration of Nd^{3+} ions for obtaining stimulated emission at the $^4F_{3/2}\rightarrow{}^4I_{11/2}$ and $^4F_{3/2}\rightarrow{}^4I_{13/2}$ transitions. A.A.Kaminskii, S.E.Sarkisov, B.V.Mill', G.G.Khodzhabagyan (A.V. Shubnikov Inst. of Crystallography, Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1189-91 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1396-7 (Aug. 1982).
A series of $(La_{1-x}Nd_x)_3Ga_5SiO_{14}$ crystals with $x=0.0001$ to 1.0 with a [0001] ($\|$c) orientation, a weight up to 150 g, and a diameter equal to 20-25 mm was grown from Pt crucibles measuring 42×43 mm and containing 300-350 g of a melt of stoichiometric composition by the Czochralski method on a Malvern MRS-2 automated apparatus. The experiments were carried out in a flowing atmosphere of a mixture of 3% O_2+97% N_2. The melting point of the entire $(La_{1-x}Nd_x)_3Ga_5SiO_{14}$ series is close to 1470°C. The neodymium entry factor is equal to unity. The X-ray diffraction characteristics of $La_3Ga_5SiO_{14}$ are: $\alpha=8.162$, $c=5.087$ Å; and $\rho=5.754$ g/cm^3. The values for $Nd_3Ga_5SiO_{14}$ are: $\alpha=8.064$, $c=5.056$ Å, and $\rho=6.024$ g/cm^2. The parameters of the crystals of the solid solutions have the corresponding intermediate values. The concentration of the Nd^{3+} ions in $Nd_3Ga_5SiO_{14}$ is 1.05×10^{22} cm^{-3}. The experiments on the excitation of stimulated emission were carried out at 300K with the use of an ISP-250 Xe lamp. The preliminary complex luminescence-absorption investigations of $La_3Ga_5SiO_{14}$-Nd^{3+} made it possible to determine spectroscopy characteristics. (6 refs.)

108979 Growth and stimulated emission spectroscopy of $Ca_3Ga_2Ge_3O_{12}$-Nd^{3+} garnet crystals. A.A.Kaminskii (A.V. Shubnikov Inst. of Crystallography, Acad. of Sci., Moscow, USSR), B.V.Mill, A.V.Butashin.
Phys. Status Solidi a (Germany), vol.78, no.2, p.723-32 (16 Aug. 1983).
Physical-chemical conditions of synthesis are found and a set of $Ca_3Ga_2Ge_3O_{12}$ single crystals with the concentration of Nd^{3+}ions from 0.05 till 16 at.% for the experiment on the stimulated emission generation is grown by the Czochralski technique using platinum crucibles. The formation of macrodefects as a function of crystal growth conditions is investigated. On the case of detailed concentration and temperature investigations of the luminescence and stimulated emission in the $^4F_{3/2}\rightarrow{}^4I_{11/2}$ and $^4F_{3/2}\rightarrow{}^4I_{13/2}$ channels the formation of activator centres of Nd^{3+} in $Ca_3Ga_2Ge_3O_{12}$ is analyzed. The way to improve the generation parameters of Nd^{3+} ions by coactivating Cr^{3+} sensitizer ions into $Ca_3Ga_2Ge_3O_{12}$ is discussed. The possibility to excite stimulated emission also for the chromium ions in the red region of the spectrum is noted. The perspective of using multication garnets with heterovalent isomorphism to produce disorder laser garnet crystals doped with Nd^{3+} ions is pointed out. (31 refs.)

78.50 IMPURITY AND DEFECT ABSORPTION IN SOLIDS

108980 Vibrational absorption bands for implanted nitrogen in crystalline silicon. H.J.Stein (Sandia Nat. Labs., Albuquerque, NM, USA).
Appl. Phys. Lett. (USA), vol.43, no.3, p.296-8 (1 Aug. 1983).
Infrared absorption bands for ^{15}N in crystalline silicon have been observed for the first time. Isotopic substitution experiments were performed by N^+ ion implantation into crystalline silicon to confirm the role of nitrogen in absorption bands at 764 and 962 cm^{-1} for ^{14}N and at 748 and 937 cm^{-1} for ^{15}N. Laser annealing increases the intensity of the higher frequency band. The 962-cm^{-1} band frequency is close to Si-N stretch frequencies for planar bonded N in crystalline Si_3N_4. It is suggested that the lower frequency band is associated with a mode that is made IR active by local distortion, consistent with a distorted substitutional N center identified by Brower (1982) in electron paramagnetic resonance studies on laser-annealed nitrogen-implanted Si. (14 refs.)

108981 Oxygen vacancies in lithium niobate. K.L.Sweeney, L.E.Halliburton (Phys. Dept., Oklahoma State Univ., Stillwater, OK, USA).
Appl. Phys. Lett. (USA), vol.43, no.4, p.336-8 (15 Aug. 1983).
Optical absorption peaks at 760 and 500 nm in $LiNbO_3$ are assigned to oxygen vacancies containing one and two electrons, respectively. The 500-nm band appears after annealing above approximately 500°C in a vacuum, i.e. a reducing atmosphere, and continues to grow with increasing anneal temperature. Optical bleaching near 77K destroys the band at 500 nm and produces both a band at 760 nm and a Nb^{4+} electron spin resonance spectrum. The spectral dependence of the bleaching light required to convert the 500-nm band to the 760-nm band is determined. (10 refs.)

108982 Absorption spectrum of Ni^{2+} doped in NH_4Br single crystal. T.R.Griffiths (Dept. of Inorganic and Structural Chem., Univ. of Leeds, Leeds, England), S.V.J.Lakshman, A.V.Rajulu.
J. Crystallogr. & Spectrosc. Res. (USA), vol.13, no.4, p.253-62 (Aug. 1983).
The optical absorption spectrum of Ni^{2+} doped in NH_4Br single crystals has been studied at room and liquid-air temperatures. The observed ambient bands at 6300, 11600, 13400, 18500 and 20000 cm^{-1} have been assigned, respectively, to the transitions $^3A_2(F)\rightarrow{}^3T_2(F)$, $^3T_1(F)$, $^1E(D)$, $^1T_2(D)$, and $^3T_1(P)$. The crystal field parameters evaluated are $D_q=630$ cm^{-1}, $B=850$ cm^{-1}, and $C=3600$ cm^{-1}. In assigning the location of Ni^{2+} ions within the lattice, evaluations are made of the (limited) extant comparable data. It is then concluded that Ni^{2+} enters an octahedral interstitial, rather than a substitutional, site. It is surrounded by four bromide ions, in a plane, with two polarized water molecules at the opposing fifth and sixth positions. (19 refs.)

108983 Cobalt centres in ammonium chloride: optical absorption studies. B.Rambabu (Dept. of Phys., Indian Inst. of Technol., Madras, India), C.Ramasastry, B.V.R.Chowdari.
Phys. Status Solidi b (Germany), vol.118, no.2, p.541-9 (1 Aug. 1983).
The optical absorption data for Co^{2+} ions in NH_4Cl single crystals grown under different conditions and measured in the temperature range of 300 to 10K are presented. The observed absorption spectrum is interpreted by considering the absorption within the crystal field levels determined mainly by the ligands of octahedral coordination. The spectrum at low temperatures is considered to be due to two different centres in which the Co^{2+} ion occupies an interstitial position, i.e. the centre of a square of four Cl^- ions with either two NH_3 ions or H_2O ions on either side of the square. In addition to these, the stabilization of a centre in which a Co^{2+} ion occupies an edge centre position at room temperature is also suggested. The crystal field parameters for the cobalt centres stable at low temperature are evaluated. (23 refs.)

108984 Nickel centers in strontium tartrate tetrahydrate single crystals. N.Satyanarayana, K.Hariharan, S.Radhakrishna (Dept. of Phys., Indian Inst. of Technol., Madras, India).
Physica B & C (Netherlands), vol.122B+C, no.1, p.67-73 (Sept. 1983).
Optical absorption of Ni^{2+} doped in strontium tartrate tetrahydrate ($SrTr.4H_2O$) has been studied at room temperature (300K) and at liquid nitrogen temperature (80K). Polarised absorption studies along the three crystallographic axes have also been carried out. The spectrum shows the characteristic features of Ni^{2+} in a distorted octahedral field. A good fit between calculated and experimental band positions has been obtained. The crystal field parameters Dq, B and C are calculated by using the energy matrices and energy equations ($Dq=850$ cm^{-1}, $B=930$ cm^{-1} and $C=4000$ cm^{-1}) and the crystal field transitions are assigned. A correlation of the ESR and observed changes in optical absorption spectra after irradiation indicates the formation of Ni^{3+}. (16 refs.)

108985 Oxygen and carbon measurements on silicon slices by the IR method. P.Stallhofer, D.Huber (Wacker Chemitronic, Burghausen, Germany).
Solid State Technol. (USA), vol.26, no.8, p.233-7 (Aug. 1983).
Oxygen has recently attracted a lot of attention in the manufacture of silicon semiconductors due to its inherent potential for denuded zone formation and positive defect engineering. Its concentration is measured by the infrared absorption method which, as an optical method, also depends on the transmission or reflection conditions of the wafer surfaces, i.e. polished or back damaged surfaces. These different surface conditions modify the transmission formula for the calculation of the exact oxygen content. The exact equations are given for most examples of today's state-of-the-art silicon wafer technology. (7 refs.)

108986 Influence of elementary structure defects on the optical properties of glasses. J.R.Zakis, A.R.Silin.
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.2-3, p.185-92 (1983). In Russian. (Otto-Schott-Colloquium on the State of Optical Glass Research 1982, Jena, Germany, 1982).
The common rules of the influence of elementary structure defects on optical glass properties are discussed and models of these defects in the simple silicate glasses are given. The simplest intrinsic defects in the fused silica are the stabilized components of the broken Si-O bond. The optical and ESR of E centers are causes by neutral threefold coordinated silicon atoms. Neutral non-bridging oxygen atoms are responsible for the absorption at 4.75 and 2.0 eV and red luminescence at 1.9 eV excited in these absorption bands. The geometric model of this center consists of an isolated non-bridging oxygen atom, displaced from the threefold symmetry axis of the tetrahedron and rotating around it (dynamic Jahn-Teller effect). The non-bridging oxygen atoms are also the elementary defects in sodium silicate glasses and give rise for the induced absorption at 2.0 eV. (29 refs.)

Recent advances in optical fiber materials .... See Entry 106836

Ferroelastic phase transition in $BiVO_4$: V. Temperature dependence of Bi^{3+} displacement and spontaneous strains .... See Entry 107918

Intracenter transitions in the dominant deep level (EL2) in GaAs .... See Entry 108466

Structure of active centers in manganese-doped single crystals of yttrium titanate $Y_2Ti_2O_7$ .... See Entry 108773

On the real refractive-index change in some *F*-coloured alkali-halide crystals .... See Entry 108905

Optical absorption and thermoluminescence of KCl single crystals coloured under DC fields .... See Entry 109027

78.55 PHOTOLUMINESCENCE

108987 Photoluminescence associated with thermally induced microdefects in Czochralski-grown silicon crystals. M.Tajima (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany), U.Gosele, J.Weber, R.Sauer.
Appl. Phys. Lett. (USA), vol.43, no.3, p.270-2 (1 Aug. 1983).
Photoluminescence in the photon energy range 0.7-1.2 eV is investigated for commercial Czochralski-grown Si crystals subjected to isothermal annealing at 650°C for 1-450 h. A strong and sharp line appears at 0.903 eV at certain annealing stages, regardless of the sources and the conductivity type of starting materials. The intensity dependence of the 0.903-eV line on the annealing time coincides with the concentration dependence expected for Si self-interstitials emitted during the oxygen precipitation process. This is experimental evidence that microdefects responsible for this line are correlated with Si self-interstitials. (20 refs.)

108988 Photoluminescence of GaAs-Al$_x$Ga$_{1-x}$As multiple quantum well structure under high excitations. Z.Y.Xu, V.G.Kreismanis, C.L.Tang (Cornell Univ., Ithaca, NY, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.415-17 (1 Sept. 1983).
Allowed transitions between the $n=1$, 2, and 3 subbands of the conduction and valence bands of a multiple quantum well heterostructure of GaAs-Al$_{0.6}$Ga$_{0.4}$As are seen in spontaneous emission under high excitations. The observed peaks agree very well with the calculated locations of the peaks when the finite depth of the potential well and the nonparabolicity of the conduction band are taken into account. The same basic features are seen under CW or picosecond pulse excitation and at room temperature, 77K, or 4.2K. (6 refs.)

108989 Effect of growth temperature on the photoluminescent spectra of undoped AlGaAs grown by metalorganic-chemical vapour deposition. K.Mohammed, J.L.Merz (Dept. of Electrical & Computer Engng., Univ. of California, Santa Barbara, CA, USA), D.Kasemset.
Mater. Lett. (Netherlands), vol.2, no.1, p.35-8 (July 1983).
A detailed investigation of the effect of substrate growth temperature on the optical properties of AlGaAs grown by metalorganic-chemical vapour deposition is reported, using room- and low-temperature photoluminescence. A monotonic increase in band-to-band photoluminescence is observed as the growth temperature is increased from 700 to 800°C. At the same time, however, an increase in the incorporation of C and Ge acceptors is observed. (13 refs.)

108990 Quantum yield of the guest in the linear chain of molecules. I.Barvik, V.Szocs (Inst. of Phys., Charles Univ., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.9, p.1016-23 (1983).
Calculation of the quantum yield of the quest in linear finite chains, based on the exact expressions for coherent memory functions, is reported. Illustrative numerical results are given to show the effect of inhomogeneities, boundaries and related magnitudes of relevant parameters on the result. (11 refs.)

108991 Exciplex and heteroexcimer emission from pyrene crystals doped with anthracene derivatives. G.E.Berkovic, Z.Ludmer (Dept. of Structural Chem., Weizmann Inst. of Sci., Rehovot, Israel).
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.102-4 (26 Aug. 1983).
Excited-state interactions in pyrene crystals doped with various anthracene derivatives are examined. Both donor-acceptor and heteroexcimer-type exciplexes, formed between host and guest molecules, are found. The exciplex ground state is found to be less repulsive than that of the pyrene excimer. (19 refs.)

108992 Spectroscopic properties of Er^{3+} ions in Li(Er, Gd)P$_4$O$_{12}$ single crystals—fluorescence, Raman and infrared spectra. Z.Mazurak, J.Hanuza, K.Hermanowicz, B.Jezowska-Trzebiatowska (Inst. for Low Temperature & Structure Res., Polish Acad. of Sci., Wroclaw, Poland), D.Schultze, C.Waligora.
Chem. Phys. (Netherlands), vol.79, no.2, p.255-67 (1 Sept. 1983).
Spectroscopic investigations of Er^{3+} ions doped in a monoclinic LiGdP$_4$O$_{12}$ crystal, have been carried out. From an analysis of the luminescence and Raman spectra, the Stark splittings of the ^{4}I$_{15/2}$, ^{4}I$_{11/2}$, ^{4}S$_{3/2}$, ^{2}F$_{9/2}$ and ^{4}F$_{7/2}$ manifolds of the Er^{3+} ions were determined with high accuracy. On the basis of the infrared and Raman spectral investigations, structural information has been obtained for the Er^{3+} centers and their oxygen environment. Such characteristics are essential for a theoretical description of functional properties of possible laser materials based on the above-mentioned medium. (17 refs.)

108993 Temperature-independent photoluminescence in amorphous Si$_{1-x}$C$_x$:(F,H) films with low defect density. A.Morimoto, T.Miura, M.Kumeda, T.Shimizu (Dept. of Electronics, Faculty of Technol., Kanazawa Univ., Kanazawa, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.6, p.908-11 (June 1983).
Photoluminescence and electron spin resonance measurements were carried out on an amorphous silicon-carbon alloy film containing both F and H (a-Si$_{1-x}$C$_x$:(F,H)) prepared by the glow discharge decomposition of a mixture of SiH$_4$ and CF$_4$ gas. The a-Si$_{1-x}$C$_x$:(F,H) film, which had a wide optical gap (about 2.8 eV), had a smaller spin density and a photoluminescence with a higher intensity at room temperature and with a weaker temperature dependence than the a-Si$_{1-x}$C$_x$:H film with a similar optical gap. The temperature-independent photoluminescence appears to be due to an increase in the width of the band tail caused by the incorporation of F atoms. (21 refs.)

108994 Review of the effect of external action (heat treatment, deformation, irradiation) on the luminescence of GaAs. K.D.Glinchuk, K.Lukat, A.V.Prokhorovich.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.1, p.39-54 (1982). In Russian.
Information published since 1966 is discussed under the headings: general analysis of the changes in intensity, damping kinetics, and quantum effectiveness of the luminescence of GaAs under external effects; changes in the luminescence properties of GaAs during plastic deformation; and changes in the luminescence properties of GaAs on irradiation with high energy particles. (80 refs.) *N.F.S.*

108995 Energy and phase relaxation of phosphorescent *F* centers in CaO. M.Glasbeek, D.D.Smith, J.W.Perry, W.R.Lambert, A.H.Zewail (Arthur Amos Noyes Lab. of Chem. Phys., California Inst. of Technol., Pasadena, CA, USA).
J. Chem. Phys. (USA), vol.79, no.5, p.2145-9 (1 Sept. 1983).
The authors study the temperature-induced inhomogeneous broadening of the no-phonon line in the emission spectrum of the *F* center in CaO. The linewidth can be fitted to $\bar{n}(\bar{n}+1)$, where $\bar{n}$ is the thermally averaged occupation number of phonons with a frequency of 90 cm^{-1}. The results are characteristic of elastic scattering of pseudolocalized phonons at the defect site. These phonons also appear to dynamically couple the Jahn-Teller components of the *F* center in the photoexcited $^3T_{1u}$ state and thus gives rise to a temperature dependence of the lifetime of this phosphorescent state. Finally, from experiments using laser-selective excitation it is concluded that the zero-phonon emission peaking at 571.1 nm does not originate in the *F* center. (16 refs.)

108996 Non-radiative recombination processes and related phenomena in Ge doped As$_2$Se$_3$ glasses. M.Kitamura, T.Ogawa, T.Arai (Inst. of Appl. Phys., Univ. of Tsukuba, Ibaraki, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2561-70 (July 1983).
The photoacoustic and the conventional optical absorption spectra of (As$_2$Se$_3$)$_{100-x}$Ge$_x$ (x=0, 1, 5, 10) glasses were observed at room temperature. The non-radiative recombination processes of these materials were analyzed based on the existence of electron-phonon coupling. The authors found that the non-radiative recombination processes and the photostructural change (PSC) are very well explained by an adiabatic potential and that, in total photon intensity (I_0t) dependence of PSC, the increasing of the sample temperature due to increasing the value of I_0t is very important.

108997 Resonant Raman scattering and hot luminescence at the indirect exciton in BiI$_3$. T.Karasawa, K.Miyata, T.Komatsu, Y.Kaifu (Dept. of Phys., Osaka City Univ., Osaka, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2592-602 (July 1983).
Secondary emission (SE) spectra under excitation around the indirect exciton edge of BiI$_3$ crystals are studied at liquid helium temperatures (LHeT). The spectra consist of one-phonon non-resonant Raman scattering lines and two- and multi-phonon resonant Raman scattering (RRS) lines associated with hot luminescence (HL) bands due to phonon assisted exciton recombinations. Detailed results on excitation-energy and temperature dependences of the spectra are presented. The RRS cross sections are analyzed on the basis of exciton damping processes near the exciton band bottom, and the HL line shapes are discussed on quasi-thermal equilibrium distribution under the same relaxation mechanisms.

108998 Origins of impurity-perturbed fluorescent lines of MnF$_2$. S.Saito, Y.Tanabe (Dept. of Appl. Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2936-46 (Aug. 1983).
Electronic excitation ($^6A_{1g}\rightarrow{}^4T_{1g}$) energies in MnF$_2$ with Mg or Ca impurity are studied. The inverse of the force constant matrix (static limit of Green's function) is calculated accurately by the double exponential formula, and the distortions of the lattice around the impurity are obtained from the condition for the lattice to be stable in the harmonic approximation. They are rendered into the normal coordinates of the [MnF$_6$]$^{4-}$ complexes containing the Mn^{2+} ion first, second or third nearest to the impurity, and the variations of their excitation energies due to the distortion of the A_{1g}, $E_{g\theta}$ and $T_{2g\zeta}$ mode are calculated. Effects of these three modes are obtained from the comparison between the observed variation of the excitation energies and the lattice distortion under uniaxial stress, which is calculated from the condition of the minimum potential energy per unit cell.

108999 Intense white photoluminescence in ZnO thin film formed by anodization. H.Nanto (Dept. of Electronics, Kanazawa Inst. of Technol., Ishikawa, Japan), T.Minami, S.Takata.
J. Mater. Sci. (GB), vol.18, no.9, p.2721-6 (Sept. 1983).
Intense white photoluminescence (PL) at room temperature has been observed in ZnO thin films formed by anodization at 26°C. The PL depends on the preparation conditions of the films. The PL is attributed to radiative recombination between localized electrons and holes in gap states which are formed by native defects in the films. It is suggested that the anodized ZnO films might be useful for optoelectronic devices, since the low temperature anodization process used is inexpensive and fast. (34 refs.)

109000 Time-dependent concentration depolarization: a Monte Carlo study. G.L.Hilmes, H.H.Harris, J.P.Riehl (Dept. of Chem., Univ. of Missouri, St. Louis, MO, USA).
J. Lumin. (Netherlands), vol.28, no.2, p.135-46 (May-July 1983).
The phenomenon of time-dependent concentration depolarization is examined by a Monte Carlo procedure. The method described is general and versatile, and allows one to arbitrarily choose absorption and emission molecular polarizations, energy transfer mechanisms, and radial and orientational distribution functions. Comparison is made with recent theoretical results on time-dependent depolarization, and with experimental results on the 'steady-state' depolarization of the phosphorescence of phenanthrene-d$_{10}$. Good agreement is obtained for a wide range of concentrations. (21 refs.)

109001 Study of the photoluminescence spectrum in high purity CdTe. J.E.Espinosa, J.M.Gracia, H.Navarro, A.Zehe (Inst. de Ciencias, Univ. Autonoma de Puebla, Puebla, Mexico), R.Triboulet.
J. Lumin. (Netherlands), vol.28, no.2, p.163-76 (May-July 1983).
A study of the photoluminescence produced by a high purity sample of n-type CdTe of $|N_D-N_A|<10^{14}$ impurities per cm^3 was done at several temperatures, varying from 10 to 35K. Several sharp lines were observed in the spectral region between 1.5 to 1.6 eV plus the well-known 1.4 eV band with several well-defined structures on it. The observed temperature behaviour of the line positions, linewidths and relative intensities allowed the authors to establish the presence of a new transition, located at 10K 21.3 MeV below in energy from the free exciton (FE) line, as well as its first phonon replica. Its nature seems to be transitions originating from the conduction band to an acceptor level, 32 MeV above the valence band. These two lines appear at the same position where previous works had reported the first and second phonon replicas of the FE. A scheme of impurity levels is proposed to explain the observed transitions in terms of previously established levels and this new acceptor level. (16 refs.)

109002 Laser induced emission spectra of Pr^{3+} in CaF$_2$ at low temperatures. J.Chrysochoos, P.W.M.Jacobs, M.J.Stillman (Dept. of Chem., Univ. of Western Ontario, London, Ontario, Canada), A.V.Chadwick.
J. Lumin. (Netherlands), vol.28, no.2, p.177-90 (May-July 1983).
The luminescence spectra of Pr^{3+} in CaF$_2$, excited with the 4765.05 Å line of the argon ion laser at low temperatures, consist of many more emission lines than the maximum allowed via the ^{3}P$_0\rightarrow{}^3$H$_{4,5,6}$; ^{3}F$_{2,3,4}$ transitions of a single Pr^{3+}-site. Based upon their intensity, appropriate splittings and concentration dependence, these emission lines are divided into three groups, attributed to difference sites of Pr^{3+} in CaF$_2$. The existence of Pr^{3+} ions in defect sites of different symmetries is supported by theoretical calculations. The laser emission spectra of Pr^{3+} at low temperatures are compared with room temperature emission spectra obtained with excitation of the ^{3}P$_0$ state alone, and with low temperature spectra of Pr^{3+} in different hosts, reported in the literature. (40 refs.)

109003 Radiative recombination in iridium-doped silver bromide single crystals. J.P.Spoonhower, C.A.Hamer (Res. Labs., Eastman Kodak Co., Rochester, NY, USA).
J. Lumin. (Netherlands), vol.28, no.2, p.191-201 (May-July 1983).
The infrared emission spectrum of iridium-doped silver bromide results from a process that is competitive with the visible emission due to iodide centers in pure AgBr crystals. The emitting species is Ir^{3+}, and experiments are described which help elucidate the nature of the radiative processes involved. (12 refs.)

109004 Low-temperature decay-time measurements on the luminescence of calcium tungstate (CaWO$_4$). G.Blasse, G.Bokkers (Phys. Lab., State Univ. of Utrecht, Utrecht, Netherlands).
J. Solid State Chem. (USA), vol.49, no.1, p.126-8 (Aug. 1983).
The emission and excitation spectra of the blue tungstate luminescence were identical with those reported in the literature. The luminescence intensity is temperature independent up to 280K, and so the decay times of the luminescence of CaWO$_4$ are plotted as a function of temperature. Above 5K all decay curves are single exponential, and below 5K the decay curves are biexponential. In this temperature region there is a slow (τ_s) and a fast (τ_f) decay time. (10 refs.)

109005 Luminescence of tin-activated calcium orthophosphates. M.D.Khalupovskii, V.K.Ishunin.
J. Appl. Spectrosc. (USA), vol.37, no.5, p.1253-6 (Nov. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.762-6 (Nov. 1982). [received: Sept. 1983]
Tin-activated alkaline-earth orthophosphates with the β-$Ca_3(PO_4)_2$ structure have long attracted attention on the one hand because of the major practical importance of various luminophors of this class and on the other because of features of the luminescence. One of the features of tin-activated calcium orthophosphates is that the spectrum contains two bands: the shortwave α one and the longwave β one, whose nature has not so far been defined. It has been suggested that the α and β bands are due to transitions from different excited levels of the Sn^{2+} ion. There has recently been discussion of the scope for interpreting the α and β bands of Sn^{2+} in alkaline-earth orthophosphates as A_T and A_X bands, which are the bands into which the luminescence spectrum is considered to be split as a consequence of the Jahn-Teller effect, but no definite conclusions were reached, evidently on account of deficiency in the experimental data. The authors have derived additional data on the luminescence of these phosphors by more detailed examination of the excitation and luminescence spectra. (7 refs.)

109006 Spectral investigations of the anthracene-carbazole system. N.N.Malykhina, V.A.Lisovenko.
J. Appl. Spectrosc. (USA), vol.37, no.5, p.1257-61 (Nov. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.766-71 (Nov. 1982). [received: Sept. 1983]
An investigation of the binary system anthracene-carbazole is of interest from several standpoints. In the first place, carbazole is one of the most widespread impurities in anthracene, which is evidently explained by the isomorphism of these molecules. But since the singlet level of carbazole is situated at a higher energy value than the singlet level of anthracene, it cannot be detected directly by spectral methods. However, carbazole may appear indirectly, for example, leading to local states. A study of the spectral properties of the anthracene-carbazole system in a wide range of concentrations is also of independent interest. This task is facilitated by the fact that the phase diagram of this system is known in the region of concentrations from 0 to 100%. For the experiments, the authors used anthracene and carbazole subjected to purification by zone melting of 100 and 150 zones, respectively. The concentration of impurities was determined according to weighed samples. An anthracene-carbazole mixture was melted in a 200 μ thick quartz cuvette. The fluorescence spectra were excited through a filter with transmission maximum in the region of 313 nm and recorded on a spectrometer with a photoelectric attachment at the temperature of liquid helium. (4 refs.)

109007 Fine structure of the bands in the low-temperature spectra of sodium uranyl acetate. V.N.Boikov, A.N.Krasovskii, D.S.Umreiko.
J. Appl. Spectrosc. (USA), vol.37, no.5, p.1277-81 (Nov. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.790-5 (Nov. 1982). [received: Sept. 1983]
The authors have studied the luminescence spectrum of sodium uranyl acetate at 8K under conditions of selective optical excitation, carried out close to resonance frequencies. (12 refs.)

109008 Photothermal creation of $Cu^0v_a^+$ centres and mobility of anion vacancies in X-irradiated KCl:Cu crystals. S.Zazubovich, A.Usarov, ZH.Egemberdiev (Inst. of Phys., Acad. of Sci., Tartu, Estonian SSR).
Phys. Status Solidi b (Germany), vol.118, no.2, p.789-98 (1 Aug. 1983).
Associates of Cu^0 atoms with anion vacancies v_a^+($Cu^0v_a^+$ centres) are used as luminescent detectors for the study of anion vacancy mobility in KCl crystals. It is found that near 220K, $Cu^0v_a^+$ centres may be thermally formed because of the migration of v_a^+ only to its neighbouring Cu^0 atom (i.e. the process occurs in Cu^0-v_a^+ pairs). An analogous process in $\{Cu^+$-$v_a^+\}$ pairs results in the creation of $Cu^+v_a^+$ centres. After $Cu^+v_a^+$ have trapped electrons released at the thermal destruction of Cu^0, $Cu^0v_a^+$ centres are formed. $\{Cu^0$-$v_a^+\}$ and $\{Cu^+$-$v_a^+\}$ pairs are produced at low temperatures by the transfer of an F electron onto an impurity ion in irradiation-generated $\{Cu^+$-F$\}$ and $\{Cu^{2+}$-F$\}$ pairs. If the crystal contains $Cu^-{}_a$ centres, $Cu^0v_a^+$ centres may be formed at $T > 370$K by the interaction of mobile V_F centres, produced at a thermal dissociation of Cl_3 molecular ions, with $Cu^-{}_a$ centres. It is proposed that at T<300K it is not the isolated but the 'associated' anion vacancy that can migrate. This process occurs in the field of some defects and needs a comparatively lower activation energy than the motion of isolated v_a^+. The isolated or 'free' v_a^+ which are believed to be mobile at higher temperatures, are practically absent in X-irradiated crystals at T>250K due to the interaction of v_a^+ with mobile cation vacancies or interstitial halide ions as well as due to the thermal association of v_a^+ with neighbouring lattice defects. (40 refs.)

109009 Tail-tail luminescence in amorphous silicon. B.Rauscher, H.Pfleiderer (Forschungslab., Siemens AG, Munchen, Germany), B.Bullemer.
Phys. Status Solidi a (Germany), vol.78, no.2, p.623-32 (16 Aug. 1983).
Experiments and a model calculation of the stationary photoluminescence (PL) in hydrogenated amorphous silicon are presented. The model is based on the concept of geminate recombination and considers the tunneling of the photogenerated carriers from shallow to deep localized states as a process competitive with the radiative recombination. The active energy of the temperature-dependent PL quantum efficiency is the sum of the electron-hole binding energy and of the trapping energy of one of both the charge carriers. This model allows a complete interpretation of the decrease of PL quantum efficiency, the shift of the PL spectrum towards lower photon energies, and of the increase in the FWHM with rising temperature. The long-wavelength PL (0.8 eV$\leq \hbar\omega_{PL} \leq 1.0$ eV) is found to be characteristic of the density of localized midgap states. (26 refs.)

109010 The nature of photoluminescence from plastically deformed silicon. M.Suezawa, K.Sumino (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
Phys. Status Solidi a (Germany), vol.78, no.2, p.639-45 (16 Aug. 1983).
The nature of photoluminescence from plastically deformed silicon crystals is investigated from the dependences of the spectrum and intensity of the luminescence on various parameters. Besides the well established characteristic lines D1 through D4, a broad background component is found to exist in the photon energy range of 0.75 to 1.1 eV. Neither impurities nor clusters of point defects are shown to be responsible for the deformation-induced photoluminescence. Thus, dislocations are concluded to be active as radiative recombination centres. It is shown, however, that dangling bonds are not responsible for the recombination processes. Thus, the reconstructed bonds or severe distortion of the lattice at the dislocation core is thought to contribute to the radiative recombination processes occurring in a plastically deformed silicon crystal. The D1 and D2 lines seem to be related to geometrical kinks on dislocations. (13 refs.)

109011 Photoluminescence of rare-earth centers in ZnO phosphors. Vu Xuan Quang, Nguyen Quang Liem, Nguyen Cong Thanh, Truong Van Chuong, Le Thi Le Thanh (Inst. of Phys., Hanoi, Vietnam).
Phys. Status Solidi a (Germany), vol.78, no.2, p.K161-5 (16 Aug. 1983).
Trivalent rare-earth ions (RE) in II-VI phosphors show luminescence spectra which are characterized by a broad-band emission and a narrow line emission as well. It is shown that group V ions, for example N ions, can act simultaneously as charge compensations and as energy transfer agent. Obviously in the ZnO:N, RE system, the occupying of a trivalent RE ion in a bivalent substitutional Zn site is more easier than that in, for instance the ZnO:Na, Cu, RE system. Samples used were ZnO:N, Eu^{3+} powder phosphors. (15 refs.)

109012 Pressure dependence of the alexandrite emission spectrum. T.Kottke, F.Williams (Phys. Dept., Univ. of Delaware, Newark, DE, USA).
Phys. Rev. B (USA), vol.28, no.4, p.1923-7 (15 Aug. 1983).
The dependence on hydrostatic pressure of the photoluminescent spectrum of alexandrite has been measured to 40 kbar, at 300 and 167K. The R_1 and R_2 lines red shift linearly 0.27 ± 0.01 and 0.33 ± 0.1 Å/kbar, the same for both temperatures. Narrowing of the R lines with pressure is observed. The phonon sidebands are blue shifted with pressure. By analysis of these spectral shifts the authors calculate the anharmonicities of the $^4A_2$ and ^2E states and explain the line narrowing. Thus from these analyses they propose that the linear dependency of the R-line transition energies on hydrostatic pressure results from anharmonic effects on the zero-point levels of the $^4A_2$ and ^2E states, for Cr^{3+}-doped materials in general. (13 refs.)

109013 The nature of luminescent transitions of the main U^{6+} center in NaF. A.Lupei, V.Lupei (Central Inst. of Phys., Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.4, p.367-70 (1983).
The lowest electronic transitions in the excitation spectra of the main luminescent U^{6+} center in NaF are discussed in terms of a charge transfer transition, within a tetragonal C_{4v}, UO_5F^{5-} complex. The lines 5380 Å, 5528 Å, 5636 Å, the last ones observed in luminescence spectra too, are assigned to a $\gamma_7 \rightarrow \gamma_7$ charge transfer transition. The excited states associated to this charge transfer transition have A_1, A_2 and E symmetry, as determined experimentally for the lowest excited levels. (13 refs.)

109014 Polariton luminescence and additional boundary conditions: comparison between theory and experiment. F.Askary, P.Y.Yu (Dept. of Phys., Univ. of California, Berkeley, CA, USA).
Solid State Commun. (USA), vol.47, no.4, p.241-6 (July 1983).
Polariton luminescence spectra in semiconductors have been calculated as a function of temperature and impurity trapping rates using a two branch polariton model. Typically, the theoretical spectra show two structures: a peak near the transverse exciton energy and a shoulder near the longitudinal exciton energy. While the lower energy peak is relatively insensitive to the choice of additional boundary conditions (ABC), the higher energy shoulder strongly depends on (ABC). The theoretical curves obtained with Pekar's ABC are in quantitative agreement with experimental spectra reported in CdS, CdSe and CuCl. However, significant discrepancies between theory and experiment are found in GaAs and ZnTe. (23 refs.)

109015 Tunnelling contribution in non-radiative processes. R.Englman (Soreq Nuclear Res. Centre, Yavne, Israel), A.Ranfagni, D.Mugnai, A.Agresti.
Solid State Commun. (USA), vol.47, no.9, p.723-6 (Sept. 1983).
A semiclassical formalism, already introduced to treat non-radiative processes in multidimensional spaces, has been extended to compute total non-radiative transition rates. A simple approximate analysis results in simple formulae which discriminate between quantum-tunnelling contributions and classical ones. Applications to diffusion processes of vacancies in solids are considered. (20 refs.)

109016 GaAs surface oxidation-related photoluminescence transients. H.Booyens, J.H.Basson, A.W.R.Leitch, M.E.Lee, C.M.Stander (Nat. Inst. for Materials Res., Council for Sci. & Industrial Res., Pretoria, S Africa).
Surf. Sci. (Netherlands), vol.130, no.2, p.259-68 (Aug. 1983).
Evidence is presented for the involvement of surface oxidation phenomena in the photoluminescence response obtained on GaAs (110) surfaces. By using high intensity HeNe laser illumination on freshly cleaved (110) n-type GaAs surfaces, room temperature photoluminescence transients are observed having magnitudes determined by excitation intensity. The observed transients are in excess of the steady state photoluminescence signal on surfaces exposed to normal ambient air conditions. A model based on photodesorption and photoadsorption processes, is proposed to explain this phenomenon. (20 refs.)

Time-resolved nonlinear luminescence spectroscopy by picosecond excitation correlation .... See Entry 105388

Low temperature photoluminescence of detector-grade HgI_2 .. See Entry 106225

The T_1 state of *p*-nitroaniline and related molecules: a CNDO/S study .... See Entry 106330

Internal heavy-atom effect on the T_1 states on monochloroquinolines and monochloronaphthalenes .... See Entry 106487

Laser glass .... See Entry 106768

Sn ion doping during GaAs MBE with field ion gun .... See Entry 107723

Distribution of Cu between solid CdS and liquid $CdCl_2$+CdS .... See Entry 107733

Impurity composition and surface-layer state of diphenyl crystals .... See Entry 107735

Interface properties of *n*-ZnSe-*p*-Ge heterojunctions grown by organometallic chemical vapor deposition .... See Entry 108199

Low compensation vapor phase epitaxial gallium arsenide ..... See Entry 108208

Instabilities of (110) III-V compounds grown by molecular beam epitaxy .... See Entry 108219

The influence of the variation of the chemical composition and of the nitrogen doping level on the energy spectra of the bound excitons in $GaAs_{1-x}P_x$:N .... See Entry 108300

An optical characterization of defect levels induced by MBE growth of GaAs .... See Entry 108335

Defects in Zn fired ZnTe: detection of a double acceptor (Si_{Te}?) .... See Entry 108345

Electrical resistivity of undoped GaAs single crystals grown by magnetic field applied LEC technique .... See Entry 108410

Optical investigation of MQW system InP-InGaAs-InP .... See Entry 108534

Structure of active centers in manganese-doped single crystals of yttrium titanate $Y_2Ti_2O_7$ .... See Entry 108773

Optical and optically detected magnetic resonance studies of AgBr:I^- .... See Entry 108838

ODMR study of the nature of iron-red photoluminescence in ZnS crystals .... See Entry 108839

Excitonic reflectance of GaAs crystals cleaved in liquid helium .... See Entry 108975

New inorganic material with a high concentration of Nd^{3+} ions for obtaining stimulated emission at the $^4F_{3/2} \rightarrow {}^4I_{11/2}$ and $^4F_{3/2} \rightarrow {}^4I_{13/2}$ transitions .... See Entry 108978

Growth and stimulated emission spectroscopy of $Ca_3Ga_2Ge_3O_{12}$-Nd^{3+} garnet crystals .... See Entry 108979

Influence of elementary structure defects on the optical properties of glasses .... See Entry 108986

A study of the luminescent and electrical characteristics of films of ZnS doped with Mn .... See Entry 109018

High-quality ZnSe thin films grown by molecular beam epitaxy .... See Entry 109153

Intramolecular donor-acceptor systems. VII. Solvent dielectric relaxation effects on the photophysics of 6-(phenylamino)-*N*,*N*-dimethyl-2-naphthalenesulfonamides .... See Entry 109769

The effect of ammonia ions on the absorption and fluorescence of an oxazine dye .... See Entry 109778

On the determination of emission quantum yields in turbid solid and liquid solutions .... See Entry 109779

Formation of surface states on strontium oxide powders. [Photoluminescence observations] .... See Entry 109804

78.60 OTHER LUMINESCENCE SPECTRA AND RADIATIVE RECOMBINATION

(for photoconduction and photovoltaic effects, see 72.40; for photoluminescence, see 78.55)

A single crystal of $YAlO_3$:Ce^{3+} as a fast scintillator in SEM .... See Entry 105431

78.60F Electroluminescence

109017 Measurement of electroluminescence spectra of Ga phosphide p-n junctions with time resolution. A.M.Demchenko.
Optoelektron. & Poluprovodn. Tekh. (USSR), no.1, p.36-9 (1982). In Russian.
A unit for measuring the title spectra is described, and the spectra are measured over a nitrogen concentration range of 8.10^{17} to 7.10^{18} cm^{-3} and over the temperature range of 100-400K. It is established that with increase in nitrogen concentration the maximum radiation at room temperature is displaced into the long wave region by an amount equal to the energy of the LO phonon. With increase in current density from 5 to 100 $A.cm^{-2}$ the quantum radiation yield in the green region of the spectrum is increased from 0.05 to 0.3%. (9 refs.) *N.F.S.*

109018 A study of the luminescent and electrical characteristics of films of ZnS doped with Mn. A.J.Warren, C.B.Thomas, H.S.Reehal, P.R.C.Stevens (School of Appl. Phys. & Phys. Electronics, Univ. of Bradford, Bradford, England).
J. Lumin. (Netherlands), vol.28, no.2, p.147-62 (May-July 1983).
The preparation of films of ZnS by radio-frequency sputtering and also the doping with manganese by either co-sputtering or ion-beam implantation has been described. The brightness of ZnS:Mn films doped by both techniques have been compared. Also concentration quenching has been examined. In addition the conditions for preparing ZnS films on ITO substrates which are free of pin-holes have been given. Space-charge limited currents, defined by thickness dependence, have been observed prior to the onset of electroluminescence. A brief description is presented also of the behaviour of DC pulsed devices of ITO/ZnS:Mn/Al devices during electroluminescent operation. (14 refs.)

109019 Electroluminescence in In-ZnSe:Cu-ZnSe(s)-Au structures. W.Bala, F.Firszt, H.J.Lozykowski (Inst. of Phys., Nicolas Copernicus, Torun, Poland).
J. Lumin. (Netherlands), vol.28, no.2, p.203-15 (May-July 1983).
The electroluminescent properties of In-ZnSe:Cu-ZnSe(s)-Au structures have been studied in the temperature range from 27 to 300K. The spectrum of the forward-biased diodes at 27K consists of emission lines due to the recombination of bound excitons, an associated donor-acceptor pair band with LO-phonon replicas and a deep level emission (green and red bands). At room temperature only the red band was observed. The time-resolved spectra (TRS) of the deep levels emission have also been investigated. (27 refs.)

109020 The effect of self radiation on the aging of zinc-sulfide phosphors. B.A.Kovalev.
Svetotekhnika (USSR), no.7, p.15-16 (1983). In Russian.
The process of the aging of zinc-sulfide phosphors exposed to self radiation is studied. The reabsorption of the self radiation is shown to affect this process. A decrease in the electroluminescence brightness drop rate is explained by a model accounting for copper ion electrodiffusion and increased voltage within the phosphor grains. A mechanism of photoinhibited impurity diffusion is assumed to take place. (6 refs.)

Exciton-enhanced double injection currents in tetracene crystals .... See Entry 108301

78.60H Cathodoluminescence, ionoluminescence

109021 Cathodoluminescent efficiency of $Y_3Al_5O_{12}$ and $YAlO_3$ single crystals in dependence on Ce^{3+} and other dopants concentration. R.Autrata, P.Schauer, J.Kvapil, J.Kvapil (Inst. of Sci. Instruments, Czechoslovak Acad. of Sci., Brno, Czechoslovakia).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.907-13 (1983).
The content of Ce^{3+} ions in the investigated single crystals grown under reducing conditions is limited by a low value of the distribution coefficient. This distribution coefficient decreases sharply with increasing concentration of Ce^{3+} ions in a melt. Cathodoluminescent efficiency rises with increasing Ce^{3+} concentration up to a certain state of saturation. At higher concentrations of Ce^{3+} ions emission from activator centres is dominant, while at lower concentrations defect centres play an important part. Iron acts as a strong quenching centre, especially in the $YAlO_3$ lattice. Nd, Ir, Fe, Ti, Cr centres exhibit a high quenching effect too. A trace amount of Mo enhances cathodoluminescent efficiency. (5 refs.)

109022 Emission and transmission cathodoluminescence analysis of InGaAsP/InP double heterostructures emitting at 1.3 and 1.6 micron. M.Cocito (CSELT, Torino, Italy), C.Papuzza, F.Taiariol.
CSELT Rapp. Tec. (Italy), vol.11, no.4, p.293-7 (Aug. 1983).
An investigation on the crystallographic defects and the surface morphology of InGaAsP/InP liquid phase epitaxy (LPE) doubleheterostructure (DH) is reported. A combination of emission cathodoluminescence (ECL), transmission cathodoluminescence (TCL), Si and Ge detectors at various beam energies allowed the identification of crystallographic defects on different layers in complete DHs with a simple and nondestructive technique. A preliminary work on InP substrates and on single layer structures enabled us to understand the main cathodoluminescence (CL) contrast mechanisms and to emphasize some basic rules for the interpretation of the complete DH images. (4 refs.)

109023 Thermally induced changes in the cathodoluminescence image of deformed MgO. J.Llopis, C.Ballesteros (Dept. de Fisica del Estado Solido, Univ. Complutense, Madrid, Spain), J.Piqueras, A.Remon, R.Gonzalez.
Phys. Status Solidi a (Germany), vol.78, no.2, p.679-84 (16 Aug. 1983).
The effect of annealing of the cathodoluminescence (CL) from deformed MgO single crystals has been investigated. Annealing at 1200°C for a short time changes the bright slip bands into dark bands and also produces CL rosettes in indented crystals. The behaviour is attributed to annihilation and diffusion of point defects responsible for the CL emission. (16 refs.)

Extremely rapid out diffusion of sulfur in InP .... See Entry 108048

The influence of the variation of the chemical composition and of the nitrogen doping level on the energy spectra of the bound excitons in $GaAs_{1-x}P_x$:N .... See Entry 108300

Observation of wear damage of a hot isostatically pressed alumina cutting tool by cathodoluminescence .... See Entry 109534

78.60K Thermoluminescence

109024 Thermoluminescence studies in KBr_xI_{1-x} mixed crystals. P.Veeresham, U.V.Subba Rao, V.Hari Babu (Dept. of Phys., Osmania Univ., Hyderabad, India).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.939-49 (1983).
Thermoluminescence (TL) studies have been carried out in KBr, KI, and in different compositions of KBr_xI_{1-x} mixed crystals as a function of X-irradiation time. The TL glow peaks have been analysed and the trap depths and frequency factors have been calculated for different compositions. The complex TL peaks observed in these crystals were isolated by using thermal cleaning technique. The various glow peaks observed in these crystals were attributed to native impurities, first stage and second stage colour centres and the results have been discussed. (11 refs.)

109025 Trap distribution analysis for thermoluminescence of $CaSO_4$:Dy. J.K.Srivastava, S.J.Supe (Div. of Radiological Protection, Bhabha Atomic Res. Centre, Trombay, Bombay, India).
J. Phys. D (GB), vol.16, no.9, p.1813-18 (14 Sept. 1983).
The trap distribution analysis of $CaSO_4$:Dy has been carried out using a fractional-glow technique. It shows that the TL process in $CaSO_4$:Dy involves quasi-continuous distribution of traps with activation energies ranging from 1.15 to 2.39 eV in the 340-370K glow-temperature range. The trap spectrum of $CaSO_4$:Dy reveals that the activation energies are distributed in a number of groups, with a prominent group, linked with the 495K dosimetric peak, peaking at around 1.40 eV. (11 refs.)

109026 Build-up of CaF_2 thermoluminescence excited by high energy X-rays. S.Costa (Istituto di Fisica Superiore Univ. Torino, Torino, Italy), A.Delunas, V.Maxia, G.Spano.
J. Lumin. (Netherlands), vol.28, no.2, p.217-20 (May-July 1983).
Experiments have been performed on the buildup of CaF_2 thermoluminescence excited by penetrating X-rays, thus avoiding effects caused by the sample absorption. The initial part of the buildup curve shows superlinear behaviour which can be explained by the presence of two kinds of recombination levels. (6 refs.)

109027 Optical absorption and thermoluminescence of KCl single crystals coloured under DC fields. A.Subrahmanyam (Dept. of Phys., Indian Inst. of Technol., Madras, India).
Phys. Status Solidi a (Germany), vol.78, no.2, p.665-70 (16 Aug. 1983).
The optical absorption and thermoluminescence of KCl single crystals X-irradiated at 300 and 373K are studied in presence of large DC fields (0 to 22 kV/cm). With DC field the F band peak shifts to the higher frequency side and the overall colour centre concentration is observed to increase. The shift in F band is attributed to a shrinkage in the lattice parameter (at the dislocation region) due to the mobile anion impurity experiencing the applied field. The preferential movements of charges may decrease the rate of recombination of the generated carriers resulting in an increase in colour centre concentration. An attempt is made to analyse these data. (11 refs.)

109028 Thermoluminescence of Z_3 centres in X-irradiated Ca-doped KCl crystals. J.Manam (Dept. of Phys., Indian Inst. of Technol., Kharagpur, India), R.K.Gartia, V.V.Ratnam.
Phys. Status Solidi a (Germany), vol.78, no.2, p.685-8 (16 Aug. 1983).
The formation of Z_3 centres in Ca-doped crystals is studied using thermoluminescence as the tool. By an expeditious choice of the temperature of X-irradiation and the time of post-irradiation F-bleaching the centers responsible for the occurrence of the glow peak at 326K are identified to be Z_3 centres. 196K appears to be very a favourable suitable temperature for the formation of Z_3 centers. (10 refs.)

78.65 OPTICAL PROPERTIES OF THIN FILMS

109029 Infrared transmission spectra of $CuInSe_2$ thin films. H.Neumann, H.Sobotta, V.Riede, B.Schumann, G.Kuhn (Sektion Phys. und Sektion Chem., Karl-Marx-Univ., Leipzig, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.K90-2 (1983).
The optical transmission spectra were recorded at room temperature with unpolarised radiation at normal incidence in the wavenumber range $\bar{\nu}=50-300$ cm^{-1} where the fundamental lattice modes of $CuInSe_2$ are expected. There are two strongly pronounced minima at $\bar{\nu}=213$ cm^{-1} and $\bar{\nu}_2=206$ cm^{-1} and a broad weaker minimum at $\bar{\nu}_3=168$ cm^{-1}. Within the error limits of $\Delta\bar{\nu}_1=\Delta\bar{\nu}_2=\pm 2$ cm^{-1} and $\Delta\bar{\nu}_3=\pm 5$ cm^{-1} in the frequency determination the position of these minima was independent on the thickness of the substrate and the film. Therefore, the authors can be sure that they are caused by the lattice vibrations of $CuInSe_2$ and can be identified with transverse optical mode frequencies. (18 refs.)

109030 Electrooptic effect in anodic Nb_2O_5 films. Shen Wenjiang (Shanghai Inst. of Railway Technol., Shanghai, China).
Acta Opt. Sin. (China), vol.3, no.4, p.344-50 (1983). In Chinese.
The measurement and experimental result of the electrooptic effect in anodic Nb_2O_5 films are presented. It has been found that dependences of the change in indices on the field are different from those reported in previous papers. The power is 2 at higher field and 1.63 at lower field. Some hysteresis, but no permanent change in indices was observed. (13 refs.)

109031 Maximum statistical increase of optical absorption in textured semiconductor films. H.W.Deckman, C.B.Roxlo, E.Yablonovitch (Exxon Res. & Engng. Co., Linden, NJ, USA).
Opt. Lett. (USA), vol.8, no.9, p.491-3 (Sept. 1983).
Complete statistical randomization of the direction of propagation of light trapped in semiconductor films can result in a large absorption enhancement. The authors have employed a calorimetric technique, photothermal deflection spectroscopy, to monitor the absorption of *a*-SiH_x films textured by the natural lithography process. The observed enhancement factors as high as 11.5, are consistent with full internal phase-space randomization of the incoming light. (8 refs.)

109032 Irradiation-induced photodarkening in As-Se-Cu amorphous films. M.M.Hafiz (Phys. Dept., Assiut Univ., Assiut, Egypt), H.M.Shafey, A.M.Hafez, M.Dongol.
Phys. Status Solidi a (Germany), vol.78, no.2, p.449-55 (16 Aug. 1983).
Irradiation-induced photodarkening in evaporated $As_{30}Se_{60}Cu_{10}$ films is studied. The transmission spectra are shifted towards longer wavelengths after irradiation. Increasing the irradiation flux seems to have negligible effect on the total decrease in the spectral transmission of these films. The change in transmission is found to increase with increasing chalcogenide film thickness. A quantitative description of the photodarkening effect is given. The calculations show that the photodarkening effect depends only on the value of the absorption coefficient regardless of its spectral distribution. The study of the photodarkening kinetics indicates that the latent darkening centres are directly proportional to the chalcogenide film thickness. The optical behaviour of the heat treated films after irradiation is also studied. The results are discussed on the basis of rearrangement of the constituent atoms which takes place within a short-range order of the network. (20 refs.)

109033 Optical and electrical properties of laser-synthesized CdTe. L.Baufay, A.Pigeolet, R.Andrew, L.D.Laude (Univ. de l'Etat, Mons, Belgium).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.665-70
Optical and electrical characterization of CdTe synthesized by laser irradiation of a multilayer film of alternate Cd and Te is achieved. Optical absorption measurements evidence the good quality of these films and show that they have behaviour comparable to the single crystal. The influence of the irradiation conditions on the electrical properties of such CdTe films is discussed; they are compared to the single crystal from the point of view of resistivity. It is shown that it is possible to prepare by this means samples devoid of impurity states in the middle of the forbidden gap. Finally, the ohmicity of Au, Al, Cr, ITO nonirradiated Cd/Te sandwich contacts is tested. (22 refs.)

How to specify and select transparent EC coatings .... See Entry 106833

Light propagation along periodic metal-dielectric layers .... See Entry 106857

Interface analysis by spectroscopic ellipsometry of $Ga_{1-x}Al_xAs$-GaAs heterojunctions grown by metal organic vapor phase epitaxy .... See Entry 108193

Low compensation vapor phase epitaxial gallium arsenide ..... See Entry 108208

Instabilities of (110) III-V compounds grown by molecular beam epitaxy .... See Entry 108219

Structural organisation of amorphocrystalline films of lead tin telluride during annealing in vacuo and in oxygen .... See Entry 108224

Structure and bonding of hydrocarbon plasma generated carbon films: an electron energy loss study .... See Entry 108232

Interpreting light scattering patterns by means of optical diffraction .... See Entry 108238

An optical characterization of defect levels induced by MBE growth of GaAs . ... See Entry 108335

Internal photoemission from quantum well heterojunction superlattices by phononless free-carrier absorption .... See Entry 108528

Properties and ion implantation of $Al_xGa_{1-x}N$ epitaxial single crystal films prepared by low pressure metalorganic chemical vapor deposition .... See Entry 108579

Determination of the dispersion and the measurement of the thickness of epitaxial garnet films .... See Entry 108902

Optical properties of a-Si: (Cl, H) films .... See Entry 108903

Optical constants of transition-metal silicides .... See Entry 108904

Dispersion of optical constants of amorphous $Si_{1-x}Ge_x$(H) films beyond their absorption edges .... See Entry 108908

Magneto-optical investigations of a novel superlattice: HgTe-CdTe .... See Entry 108930

Light scattering from vibrational modes in GaAs-$Ga_{1-x}Al_xAs$ superlattices and related alloys .... See Entry 108954

Raman studies on local structural disorder in silicon-based amorphous semiconductor films .... See Entry 108958

Effect of growth temperature on the photoluminescent spectra of undoped AlGaAs grown by metalorganic-chemical vapour deposition .. See Entry 108989

Temperature-independent photoluminescence in amorphous $Si_{1-x}C_x$:(F,H) films with low defect density .... See Entry 108993

A study of the luminescent and electrical characteristics of films of ZnS doped with Mn .... See Entry 109018

Ion beam sputter deposition of optical coatings .... See Entry 109150

High-quality ZnSe thin films grown by molecular beam epitaxy .... See Entry 109153

High conductive carbon films obtained by plasma CVD .... See Entry 109164

Heteroepitaxial growth of CdTe on GaAs by laser assisted deposition .... See Entry 109166

A structural study of the tensile drawing behavior of poly(ethylene terephthalate) .... See Entry 109413

Transparent conducting tin oxide films for application in heterojunction solar cells .... See Entry 109900

78.70 OTHER INTERACTIONS OF MATTER WITH PARTICLES AND RADIATION

109034 Directional Compton profiles and the electron density distribution in iron. A.J.Rollason, R.S.Holt, M.J.Cooper (Dept. of Phys., Univ. of Warwick, Coventry, England).
J. Phys. F (GB), vol.13, no.9, p.1807-19 (Sept. 1983).
The [100], [110] and [111] directional Compton profiles and their reciprocal form factors (*B* functions) have been deduced from Compton scattering measurements on single crystal slices of iron with ^{198}Au 412 keV gamma radiation. The accuracy of the individual profiles is sufficient not only to detect the small asphericity in the electron momentum density but also to discriminate between APW and LCAO band-structure models. In general terms the LCAO calculations with a Gaussian basis describe the momentum density better, although, in common with studies of other transition metals, the asphericity is still overestimated. Inspection of the reciprocal form factor reveals aspects of the density distribution not adequately by either model. (28 refs.)

109035 Density-functional theory of the Compton profiles of beryllium metal. G.E.W.Bauer, J.R.Schneider (Hahn-Meitner-Inst. fur Kernforschung, Berlin, Germany).
Solid State Commun. (USA), vol.47, no.9, p.673-6 (Sept. 1983).
A first-principles momentum density correlation correction functional in the local density approximation is shown to improve the agreement between experimental Compton profiles of beryllium and recent band structure calculations. (39 refs.)

78.70B Positron annihilation

(see also 71.65 Positron states)

109036 A study of positron annihilation in the bulk and on the surface of Pd-Si and Pd-Si-Cu amorphous alloys. Ch.Abrayev, I.Ya.Dekhtyar, E.G.Madatova, M.M.Nishchenko (Inst. of Phys. of Metals, Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.525-30 (1982). [received: Aug. 1983]
Positron annihilation in the bulk and on the surface of Pd-Si and Pd-Si-Cu alloys has been used to study the alloy structure in the crystalline and amorphous phases. The changes in bulk annihilation observed on transition to the amorphous phase are interpreted as being due to a different mechanism of the charge transfer from one alloy constituent atom to another. The surface changes following the transition are attributed to the charge transfer from one species of surface atoms to another, and to the effect of adsorption on the composition of the alloy surface layer. (3 refs.)

109037 Positron study of Nb-Mo alloys. N.Shiotani, T.Okada, H.Sekizawa (Inst. of Phys. & Chem. Res., Saitama, Japan), T.Nakamichi.
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2858-61 (Aug. 1983).
Angular correlations of positron annihilation radiation on $Nb_{80}Mo_{20}$ and $Nb_{50}Mo_{50}$ are measured. The electron-positron pair momentum distributions are calculated using the rigid band model based on the band structure of pure Nb. Most of the experimental features are reproduced and explained by a simple physical picture that the extra valence electrons from Mo fill the hole region in the momentum space. It is found that there exist well defined Fermi surfaces even in the most concentrated alloy of this system. (9 refs.)

109038 Precise positron lifetime measurements in indium. W.Puff, P.Mascher, P.Kindl, H.Sormann (Inst. fur Kernphys., Tech. Univ. Graz, Graz, Austria).
Phys. Status Solidi b (Germany), vol.118, no.2, p.799-803 (1 Aug. 1983).
The positron lifetime is measured in polycrystalline indium in the temperature range between 80 and 420K. The data show a pronounced prevacancy effect which is fairly well approximated by a straight line. The results suggest transient dilatation trapping rather than metastable self-trapping. The occurrence of this effect has some influence on the values deduced for the monovacancy formation enthalpy. In the temperature range below 180K detrapping of positrons cannot be ruled out. (23 refs.)

109039 Positron angular correlation in uncoloured and neutron irradiated LiF and LiF:OH. D.N.Popov, N.M.Nancheva, B.N.Zlatov, G.P.Georgiev (Dept. of Phys., Tech. Univ. 'Angel Kunchev', Russe, Bulgaria).
Phys. Status Solidi b (Germany), vol.118, no.2, p.K129-32 (1 Aug. 1983).
Reports positron angular correlation in uncoloured and neutron irradiated LiF and LiF:OH. Pure and OH^- doped single crystals have been used in the experiments. The concentration of the OH^- centers in LiF:OH was about 10^{19} cm^{-3}. The coloration has been made by neutron irradiation in a reactor channel. In all cases the irradiation dose was 10^{16} neutrons/cm^2. The angular distribution of the annihilating photons (ADAP) was measured using a conventional slit arrangement. (6 refs.)

109040 Microstructure and imperfections of glassy and glass-ceramic telluride semiconductors on the basis of positron annihilation. B.V.Kobrin, R.M.Kupriyanova, V.S.Minaev, E.P.Prokopiev, V.P.Shantarovich (Inst. of Chem. Phys., Moscow, USSR).
Phys. Status Solidi a (Germany), vol.78, no.2, p.385-9 (16 Aug. 1983).
The microstructures of glassy and glass-ceramic telluride semiconductors are studied by the positron annihilation technique. The validity of some structural models for such materials is analysed. An identification technique of defects (positron trapping centers) in these semiconductors is proposed. Quantitative estimations of defect concentrations are made. Additional evidence for the co-existence of two phases in the Si-Te system over certain ranges of Te concentrations is presented. The characteristic sizes of microcrystalline inclusions in Ge-Te and Si-Te glass-ceramics are estimated. (14 refs.)

109041 Achievements and perspectives in positron physics. R.I.Campeanu (Univ. Babes-Bolyai, Cluj-Napoca, Rumania).
Stud. & Cercet. Fiz. (Rumania), vol.35, no.7, p.601-22 (1983). In Rumanian.
After 50 years of existence, positronics develops today as a rapidly expanding field. This report provides an introductory survey for readers unfamiliar with positron physics, which stresses the wide applicability of positron annihilation techniques. New experimental tools and powerful computers now give physicists good insights into the behaviour of positrons in gases, liquids and solids. On the other hand, the use of positron annihilation techniques in related sciences, like chemistry, astrophysics, biology and medicine, has already passed the pioneering stage. (170 refs.)

109042 Positron studies of Ti-based alloys irradiated by neutrons. I.Ya.Dekhtyar, Sh.Sh.Ibragimov, M.I.Bitembaev, A.I.Kupchishin, K.M.Mukashev, R.G.Fedchenko.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1214-18 (Aug. 1983). In Russian.
Neutron irradiation of Ti-Al alloys leads to a change in positron annihilation parameters. Low-temperature stage due to disappearance of vacancies and a

stage caused by disappearance of dislocation-type defects are observed in isochronal annealing curves of the irradiated alloys. (8 refs.)

109043 Defect structures close to the surface in metals investigated by slow positrons. W.Triftshauser, G.Kogel (Hochschule der Bundeswehr Munchen, Neubiberg, Germany).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.15-18
A new system has been developed to produce monoenergetic positrons of variable energy. The energy range available at present is between 100 eV and 28 keV. This positron beam can be used to investigate defects and defect structures close to the surface in metals and alloys. The Doppler broadening technique of the annihilation radiation is applied for these investigations. (8 refs.)

109044 Positron annihilation in thermal equilibrium on pure and carbon doped α-iron. L.De Schepper (Materials Phys. Group, Limburgs Univ. Centrum, Diepenbeek, Belgium), D.Segers, G.Knuyt, J.Van Oppen, L.Dorikens-Vanpraet, M.Dorikens, L.Stals, P.Moser.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.508-11
Positron annihilation measurements in thermal equilibrium on extremely pure α-iron (total interstitial impurity content $\sim$5 at.ppm) and on 50 at.ppm carbon doped α-iron are presented. In pure iron, no positron trapping is observed in the ferromagnetic state. Consequently, the vacancy formation enthalpy in this state cannot be determined from the analysis of equilibrium data. However, in carbon-doped iron trapping is already observed at 700°C. This is interpreted in terms of localization of the positron at other sites than single vacancies, presumably carbon-vacancy pairs. (7 refs.)

Studies of point defects by positrons and positive muons .... See Entry 107676

Vacancies in carbon-doped iron .... See Entry 107692

The interactions between gas impurities and defects in Mo studied by the positron annihilation technique .... See Entry 107749

The migration, precipitation and dissolution of solute atoms in quenched Al-Ge, Al-Sn, and Cu-Ge alloys .... See Entry 107962

A method for investigating migration of point defects .... See Entry 108020

78.70C X-ray scattering

109045 Measurement of the integrated reflection coefficients of gypsum, quartz, and mica crystals for soft X-rays. A.L.Zapysov, I.M.Izrailev, V.A.Podgornov, N.A.Kharvonin.
Instrum. & Exp. Tech. (USA), vol.25, no.6, pt.2, p.1504-7 (Nov.-Dec. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.6, p.170-2 (Nov.-Dec. 1982).
Presents the results of measurements of the integrated reflection coefficients of flat crystals of gypsum [(020) plane], quartz [(10$\bar{1}$0) plane], and mica [(002) plane] for X-rays with a quantum energy of 1.25-2.31 keV. The measurements were made in a divergent X-ray beam of K_α-radiation of the elements Mg, Al, Si, and S and a fixed crystal. The experimental results are compared with calculated values. (10 refs.)

109046 Study of the behaviour of Al-Zn alloys by SAXS in the temperature range of the instable solid solution. G.Wendrock (Sektion Math./Phys., Padagogischen Hochschule Halle (Saale),,Germany). Halle.
Phys. Status Solidi a (Germany), vol.78, no.2, p.497-506 (16 Aug. 1983).
During cooling from the homogeneous region the structural changes of Al-Zn alloys in the range from 10 at.% up to 60 at.% Zn are observed by means of SAXS. Using a special method of investigation, typical courses of the matrix scattering (background scattering) with respect to the temperature are obtained with characteristic points and ranges. The behaviour of the matrix scattering intensity shows that already about 30K above the maximal temperature of the miscibility gap at about 39 at.% Zn an 'anomalous' concentration fluctuation is formed. The fluctuations increase with decreasing temperature and obviously represent a gradual transition into the inhomogeneous state. The characteristics of the matrix scattering allow one to define a line in the Al-Zn phase diagram which is due to the starting temperature of homogeneous nucleation. They also indicate points of the metastable as well as stable phase boundaries. Calculations based on well known models prove the concept that the behavior of the matrix scattering is influenced by the concentration fluctuations depending on temperature. (27 refs.)

Local atomic distribution in solid solutions of iron in α and β modifications of manganese .... See Entry 107606

X-ray total external reflectance-diffraction as a probe of the structure of the liquid-vapor interface .... See Entry 107893

The role of impurity atoms in the formation of defect structure on quartz surfaces under the action of an electrostatic field .... See Entry 108135

78.70D X-ray absorption and absorption edges

109047 Conductivity measurement of an X-ray absorption spectrum: Re L_{III} near-edge structure of $Re_2(CO)_{10}$ in 2,2,4-trimethylpentane. T.K.Sham (Dept. of Chem., Brookhaven Nat. Lab., Upton, NY, USA), S.M.Heald.
J. Am. Chem. Soc. (USA), vol.105, no.15, p.5142-3 (27 July 1983).
The authors report the measurements of an X-ray absorption spectrum by means of X-ray photoconductivity in a hydrocarbon solution. $Re_2(CO)_{10}$ in 2,2,4-trimethylpentane has been used for these measurements. The main objective of the report is to demonstrate the feasibility of this technique and its potential applications. (14 refs.)

109048 EXAFS study of Ni-Cl bonding in Ni(11) aqueous solutions at increasing Cl^-/Ni^{2+} ratios. G.Licheri, G.Paschina, G.Piccaluga, G.Pinna (Istituto di Chimica Fisica e Industriale, Univ. di Cagliari, Cagliari, Italy).
J. Chem. Phys. (USA), vol.79, no.5, p.2168-71 (1 Sept. 1983).
Three aqueous solutions of $NiCl_2$ with a constant concentration in Ni^{2+} and increasing Cl^-/Ni^{2+} ratios were examined by EXAFS spectroscopy. Fourier transforms of the experimental data give evidence of the increasing complex formation betwen Ni^{2+} and Cl^- ions. A quantitative analysis of this phenomenon is also attempted, based on the interpretation of Fourier filtered EXAFS spectra. (27 refs.)

109049 Application of synchrotron radiation to EXAFS and SEXAFS. H.Oyanagi (Electrotech. Lab., Ibaraki, Japan), T.Ota.
J. Vac. Soc. Jpn. (Japan), vol.26, no.3, p.219-45 (1983). In Japanese.
The most fundamental and important theme in the study of substances is examination of their microstructure. In the X-ray absorption of a substance, a fine oscillatory structure appears over a wide absorption spectrum range. This phenomenon is referred to as the extended X-ray absorption fine structure (EXSFS). It has been known for a long time that this phenomenon is related to the structure of the substance. In this review paper, new information is presented around analysis methods and experimental techniques of EXAFS. The description includes: (1) the basic formula for EXAFS; (2) problems in EXAFS theory; (3) surface EXAFS; (4) EXAFS experimental methods; (5) soft X-ray optical systems; (6) analysis methods of EXAFS; and (7) the application of EXFAS to chemistry, living things and solid surfaces. (79 refs.) *K.B.*

109050 On the chemical shifts of the K-absorption discontinuity of copper in some of its systems. B.Jagannatha Rao, A.R.Chetal (Dept. of Phys. & Maths., Indian School of Mines, Dhanbad, India).
Phys. Status Solidi b (Germany), vol.118, no.2, p.551-5 (1 Aug. 1983).
The K-absorption edge of copper in different copper systems is studied using a 40 cm Cauchois-type bent crystal spectrograph. It is observed that the K-edge shifts towards the high-energy side in all the copper systems under study (except in Cu_2O). This indicates that the copper ion behaves as a cation (except in Cu_2O). The shift is correlated with the partial charge on an absorbing ion in the system and the correlation is found to be linear. The partial charge on the copper ion in the systems chalcopyrite, copper perchlorate, and copper fluoborate is determined from the plot of the chemical shift versus the partial charge. (21 refs.)

109051 Anisotropic absorption of unpolarized X-radiation in copper-intercalated niobium disulfide. W.Thulke, R.Haensel, P.Rabe (Inst. fur Experimentalphys., Univ. Kiel, Kiel, Germany).
Phys. Status Solidi a (Germany), vol.78, no.2, p.539-45 (16 Aug. 1983).
Unpolarized X-rays from a conventional rotating anode X-ray generator are used to investigate the local environment of Cu in single crystals of the intercalation compound $Cu_{0.5}NbS_2$ by analysis of the extended X-ray absorption fine structure (EXAFS) above the Cu K-absorption edge. The anisotropy of the EXAFS allows the separation of two slightly different bond lengths between Cu and the surrounding S atoms. Measurements at low temperature indicate a substantial decrease of the van der Waals gap height and small displacements of the atoms parallel to the sandwich layers of the host crystal. (12 refs.)

109052 *L*-edge X-ray absorption spectra of γ- and α-cerium. B.Lengeler (Inst. fur Festkorperforschung, Julich, Julich, Germany), G.Materlik, J.E.Muller.
Phys. Rev. B (USA), vol.28, no.4, p.2276-8 (15 Aug. 1983).
The L absorption spectra of γ- and α-Ce have been measured. The L_2 and L_3 spectra of both systems show white lines, but α-Ce exhibits an additional peak 9 eV above the white line. In a mixed-valence model α-Ce has a ratio $[Ce^{3+}]$ to $[Ce^{4+}]$ of about 0.8 to 0.2. However, this interpretation is in conflict with Compton scattering. The measured extended X-ray-absorption fine-structure (EXAFS) spectra of α-Ce allow only for one value E_0 (zero of photoelectron energy). It is an open question why only one value E_0 is observed in the EXAFS of mixed-valent systems. (15 refs.)

109053 Extended X-ray absorption fine structure of electron-irradiated dilute aluminium alloys. W.Weber, H.Peisl (Sektion Phys., Ludwig-Maximilians Univ., Munchen, Germany).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.368-71
The EXAFS technique has been applied for the first time to study electron irradiation produced self-interstitials trapped at impurities in dilute Al alloys. During an isochronal annealing procedure the recovery of two defect structures has been observed. Possible models for the defect impurity structure are discussed. (8 refs.)

EXAFS evidence for local order in the ionic aggregates of halato-telechelic polymers .... See Entry 107563

Direct structural study of Cl on Si{111} and Ge{111} surfaces: new conclusions .... See Entry 108182

Measurement of compositional inhomogeneity of liquid phase epitaxial InGaPAs .... See Entry 108209

Structure and bonding of hydrocarbon plasma generated carbon films: an electron energy loss study .... See Entry 108232

Hydrogen absorption in Mg-Ni-Fe alloys .... See Entry 109922

78.70E X-ray emission threshold and fluorescence

109054 X-ray spectra and binding energies of atoms in a solid. V.V.Nemoshkalenkio, V.P.Krivitskii, A.V.Melezhik (Inst. of Phys. of Metals, Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.442-60 (1982). [received: Aug. 1983]
Semiempirical formulas are suggested for calculating the energies of formation for the alloys and compounds of 3d and 4d metals and the local binding energies of constituent atoms in the crystal lattices of these compounds. Since the bonds in a crystal are created by the valence electrons of atoms constituting the crystals and since direct X-ray emission and X-ray photoelectron spectroscopy methods are most suitable for studying the energy distribution of valence states, it is useful to establish a relationship between the parameters of X-ray emission of X-ray photoelectron spectra and the energy of formation of the crystal. The calculation results agree within ±25% with the energies of formation determined experimentally. (44 refs.)

109055 X-ray emission spectra and electron structure of Ni and Fe impurity atoms in dilute copper-base solid solutions. V.R.Galakhov, E.Z.Kurmaev, A.V.Postnikov, V.I.Anisimov, V.A.Gubanov (Inst. of Chem., Ural Sci. Centre, Acad. of Sci., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.104-9 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
X-ray emission spectroscopy was used to study Cu-Fe and Cu-Ni alloys with the minimum impurity concentrations of 0.65 at.% Ni and 1.4 at.% Fe. An increase in the impurity concentration increased the width of the L_α spectrum of nickel and iron. A calculation relating to $NiCu_{12}$ and Ni_2Cu_{18} clusters, carried out by the X_α scattered-wave method with k-dependent boundary conditions, was used to interpret this broadening effect as the result of interaction between impurities. (16 refs.) *A.T.*

109056 Polarized ZnK- and OK-emission bands of ZnO. G.Drager (Sektion Phys., Martin-Luther-Univ., Halle-Wittenberg, Germany), R.Wippermann, O.Brummer, A.Simunek.
Phys. Status Solidi b (Germany), vol.118, no.2, p.K113-16 (1 Aug. 1983).
Presents calculations and measurements of the polarized ZnK-and OK-emission bands of ZnO. Only the polarized spectra contain necessary information to distinguish the various details in the electronic structure of this compound. (6 refs.)

109057 Proton-induced L-shell X-ray emission cross-sections of elements with $24 \leq Z_2 \leq 50$ for projectile energies between 30 and 350 keV. G.Kreysch, H.Kerkow (Sektion Phys., Humboldt-Univ. zu Berlin, Berlin, Germany), R.I.Bogdanov, V.P.Petukhov, E.A.Romanovskii.
Phys. Status Solidi a (Germany), vol.78, no.2, p.507-25 (16 Aug. 1983).
Total L-X-ray emission cross sections are measured for proton bombardment of thin and thick targets in a wide range of elements. The results are compared with the PWBA theory. The introduction of corrections with respect to the Coulomb deflection of the particles and to the change of the binding energy of the target electrons improves the agreement between the calculated and measured results. It is established within the experimental error that the parametrized cross section for constant reduced projectile velocities does not depend on the target atomic number. (13 refs.)

Structure-factor phase information from two-beam electron diffraction ....See Entry 107493

On the formation of electroless amorphous layers. I. Phenomenological description of NiP deposited on Cu and Fe substrates ....See Entry 108227

Filling of the 3d band of the manganese in $GdAl_{2-x}Mn_x$ for $x<0.2$ ....See Entry 108276

79.00 ELECTRON AND ION EMISSION BY LIQUIDS AND SOLIDS; IMPACT PHENOMENA

3rd Tri-Service Cathode Workshop ....See Entry 105010

79.20 IMPACT PHENOMENA

(inc. electron spectra and sputtering)

79.20D Laser-light impact phenomena

109058 Electron correlation and hole localization in photon-stimulated ion desorption from solid N_2, CO, and C_2H_2. R.A.Rosenberg, V.Rehn, A.K.Green, P.R.LaRoe (Michelson Lab., Naval Weapons Center, China Lake, CA, USA), C.C.Parks.
Phys. Rev. Lett. (USA), vol.51, no.10, p.915-18 (5 Sept. 1983).
Results of photon-stimulated ion-desorption measurements from solid N_2, CO, and C_2H_2 are presented in the photon energy range $17<h\nu<35$ eV. The photon energy dependence of the ion yields illustrates the importance of electron correlation in desorption. On the surface of solid N_2, charge localization on the nitrogen atom nearest the surface causes the N^+ spectral yield to differ from the N^+ yield from gaseous N_2 and to resemble the O^+ yield from CO. The effect of hole migration on desorption from physisorbed systems is discussed. (21 refs.)

Plastics for high-power laser applications: a review .... See Entry 106792

Calculations on the laser-induced diffusion of surface-deposited dopants on silicon ....See Entry 107734

Femtosecond-time-resolved surface structural dynamics of optically excited silicon ....See Entry 108138

Resonant heating in photodesorption via laser-adsorbate coupling ....See Entry 108181

Electron- and photon-stimulated desorption benefits and pitfalls ....See Entry 108192

Distribution of laser erosion products on a substrate and its use for spectral analysis .... See Entry 109827

79.20F Electron impact: Auger emission

109059 Auger spectroscopy investigations of various types of impregnated cathodes. D.Brion, J.C.Tonnerre, A.M.Shroff (Thomson-CSF Electron Tube Div., Boulogne-Billancourt, France).
Appl. Surf. Sci. (Netherlands), vol.16, no.1-2, p.55-72 (May-June 1983). (3rd Tri-Service Cathode Workshop, Fort Monmouth, NJ, USA, 23-26 March 1982).
The formation of a complete oxygen and barium monolayer on a tungsten surface has been followed by Auger spectroscopy. At 1300K, the coverage for an S-type cathode is approximately half of a monolayer. The surface composition and the state of oxidation of barium are studied and their variations are also observed as a function of the temperature on new cathodes and on cathodes after long operation time. The decrease of surface barium concentration and the important increase in the oxidation of barium lead to an increse of the work function. Between 1100 and 1500K, the activation energy for the rate of coverage variation of barium is relatively low (0.15 eV). It has been found that when aluminum is present at the surface of impregnated cathodes, it modifies the chemical environment of the barium atoms and leads frequently to the increase of barium coverage. During activation of M-type cathodes, tungsten diffuses towards the surface. For osmium films having a thickness between 3000 and 15000 Å, the surface composition after activation is near to 35% tungsten. The barium concentration is 20% higher compared to an S-type cathode while the oxygen concentration is slightly lower. The oxidation state of barium is about the same for both cathode types. (23 refs.)

109060 Interatomic Auger analysis of the oxidation of thin Ba films. I. Characterization of the low energy Auger spectrum. G.A.Haas, C.R.K.Marrian, A.Shih (Naval Res. Lab., Washington, DC, USA).
Appl. Surf. Sci. (Netherlands), vol.16, no.1-2, p.125-38 (May-June 1983). (3rd Tri-Service Cathode Workshop, Fort Monmouth, NJ, USA, 23-26 March 1982).
The oxidation states of thin Ba films on Ir have been studied using an analysis of interatomic Auger lines. From published XPS data, some of the low energy AES were described in terms of various possible core, core, valence transitions where the core states were Ba states but the valence state could be either due to Ba or O. The magnitude of all AES lines, whose energy indicated an O valence state, was observed to increase with oxidation while those ascribed to Ba valence states decreased. The Ba 4d, 5p, valence transitions in the 65-75 V range appeared relatively free from clutter of other Ba and substrate lines and were the ones primarily used in determining the Ba-O bonding. The increase with oxidation of the interatomic Ba 4d, 5p, O 2p line at ~68V was found to be correlated with the increase in the O 2p loss peak. Furthermore, shifts in energy of this peak for various film thicknesses varied in accordance with corresponding shifts in O 2p binding energy with respect to the Fermi level. Also, the decrease with oxidation of the Ba 4d, 5p, 6s line at ~73 V was found to be correlated with the decrease in conduction electrons contributing to the surface plasmon peak. The manner in which these lines can be used to determine the extent of electron transfer in the formation of compounds other than BaO (such as BaC_2) is also given. (11 refs.)

109061 Interatomic Auger analysis of the oxidation of thin Ba films. II. Applications to impregnated cathodes. G.A.Haas, A.Shih, C.R.K.Marrian (Naval Res. Lab., Washington, DC, USA).
Appl. Surf. Sci. (Netherlands), vol.16, no.1-2, p.139-62 (May-June 1983). (3rd Tri-Service Cathode Workshop, Fort Monmouth, NJ, USA, 23-26 March 1982).
For pt.I see ibid., vol.16, p.125 (1983). The oxidation and thermal desorption of evaporated Ba films on different substrates have been characterized using low energy interatomic AES techniques. The films, which were deposited on W⟨100⟩ varied from a fractional layer to ~10 layers. Oxidation states, i.e. $Ba:O_x$, ranged from $x=0$ to $x\approx2$. Comparison of these data to those from actual impregnated cathodes allows one to infer the thickness and state of oxidation of the cathodes. The results indicate that the active state for 'B-type' impregnated cathodes can be reproduced by a near monolayer of the stoichiometric BaO on the W surface. The density of Ba atoms in this 'monolayer' should be ~one half that of the W atoms based on size consideration of the Ba compared to the W. This was confirmed by LEED. Measurements of the effusion of Ba compounds from the pores, the substrate interaction and the thermal evaporation indicate that on the W substrate, the monolayer BaO stoichiometric ratio is not only a stable configuration, but also is the one that has the lowest work function. The substrate work function is lowered because of the dipole formed from the adsorbed BaO. Studies of the electron interactions between the Ba and O indicate that a more complete electron transfer exists between the Ba and O for the BaO layer on the Ir substrate than on the W substrate. These results are based on the observation that O 2p states on the W substrate appear to be filled not only by Ba 6s but also by W valence electrons. (15 refs.)

109062 Auger characterization of new and aged dispenser cathode surfaces. G.Eng, H.K.A.Kan, K.T.Luey (The Aerospace Corp., Los Angeles, CA, USA).
Appl. Surf. Sci. (Netherlands), vol.16, no.1-2, p.181-8 (May-June 1983). (3rd Tri-Service Cathode Workshop, Fort Monmouth, NJ, USA, 23-26 March 1982).
The major changes in dispenser cathode surface signatures caused by aging were studied on B-type dispenser cathodes by operating them at high temperatures. By means of a computerized scanning Auger microprobe (SAM), the surface characterizations of three aged cathodes were measured and compared with those of a new cathode. Several hundred points were monitored on each sample to develop a good statistical description of each cathode surface, including both the impregnated core ends and the tungsten regions between the pores. A method of discrimination between impregnant regions has been developed, based on differences in the oxygen Auger peak shape and position. The results show that a surprisingly large fraction (>70%) of the new cathode surface could be similar to the impregnant. This fraction decreases to near 20% with age. The elemental composition of these different regions was examined by correlating the presence of each element to others. The elemental correlation showed that the dominant fraction of the cathode surface in early life is similar to a barium oxide on tungsten, and the cathode changes to an increasing fraction of surface tungsten oxide with aging. (14 refs.)

109063 Quantitative Auger-electron analysis of nonstoichiometric lead telluride. T.A.Smorodina, A.P.Tsuranov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1559-62 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1816-19 (Nov. 1982).
The authors have carried out a quantitative Auger-electron analysis of nonstoichiometric p-type lead telluride, which enables the degree of deviation of the material from stoichiometry to be determined. They have found a considerable enrichment of the surface with excess tellurium. The observed phenomenon of surface segregation is described by Guttman's equations (1975) for multi-component solid solutions. (3 refs.)

109064 Characterisation of computer differentiation of spectra in AES and its relation to differentiation by the modulation technique. M.P.Seah, M.T.Anthony, W.A.Dench (Div. of Materials Applications, NPL, Teddington, England).
J. Phys. E (GB), vol.16, no.9, p.848-57 (Sept. 1983).
Several computer methods of differentiating Auger electron spectra are analysed in terms of their relative signal-to-noise ratios, their distortion of the peak shape and their output intensity as a function of the differentiation amplitude, in order to maximise the measurement precision and detectability in surface analysis. These methods, a direct difference of two channels, the quadratic and cubic smoothing methods of Savitzky and Golay (1964), a variant of the latter and multiple smoothings are each compared in detail with the traditional analogue sinusoidal modulation method. The relative distortions of the techniques are established using the parameters of the Ag $M_{45}NN$ Auger electron doublet proposed by Seah and Anthony (1983). The overall comparisons show that the more complex methods are not necessarily of significantly greater benefit. (25 refs.)

109065 Low energy Auger spectrum of tungsten. I.Chorkendorff, J.Onsgaard (Fysisk Inst., Odense Univ., Odense, Denmark).
Phys. Scr. (Sweden), vol.T4, p.165-8 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).
The low energy Auger spectra of tungsten ($N_{45}N_{67}X$ and $N_{23}N_{45}N_{67}$ where $X=N_{67}$, O_{23}) have been investigated both experimentally and theoretically. The spectra have been measured by using electron impact excitation under UHV conditions. Due to the strong lifetime broadening of the 4*p* and 4*d* levels the spectra are characterized by broad structures. The energy loss spectra have also been measured in order to approximate the background. Energies and intensities have been calculated in mixed coupling scheme applying *jj*-coupling in the initial state and intermediate coupling in the final state. The calculated and experimental results have been found in reasonable agreement. The observed line widths can be explained by lifetime broadening of the levels participating in the Auger process. (15 refs.)

109066 Tm studied by electron energy-loss spectroscopy and Auger electron spectroscopy. J.Onsgaard, I.Chorkendorff, O.Sorensen (Fysisk Inst., Odense Univ., Odense, Denmark).
Phys. Scr. (Sweden), vol.T4, p.169-72 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).
The reflection electron energy-loss spectrum (ELS) of polycrystalline thulium has been studied with primary energies in the energy range (100-1000) eV. Surface and bulk excitations in the energy-loss region (0-200) eV have been identified. The line width of the giant resonance at 40 eV can be explained by a convolution of the initial and the final state density of states. A low energy transition is assigned as a valence band to conduction band excitation.

Oxygen adsorption shifts the plasmon energy significantly. The rough structure of the (100-180) eV Auger electron spectrum of Tm can be assigned as $N_{45}N_{67}N_{67}$, $N_{23}N_{45}N_{67}$ and $N_{45}N_{67}O_{23}$ transitions, and autoionization processes. (22 refs.)

109067 Surface preparation for quantitative Auger electron spectroscopy: mechanical polishing and inert gas ion sputtering. M.A.Burke, J.J.Schreurs (Westinghouse R&D Center, Pittsburgh, PA, USA).
Surf. & Interface Anal. (GB), vol.5, no.4, p.155-60 (Aug. 1983). (International Conference on Quantitative Surface Analysis, Teddington, England, 24-25 Nov. 1981).
Discusses the effect of surface preparation on surface composition as measured by Auger electron spectroscopy (AES). The problems of producing atomistically clean surfaces for calibration standards in quantitative AES analysis are illustrated by comparing the analyses of a series of copper-nickel binary alloys prepared by mechanical polishing and sputter cleaning with the compositions measured immediately after in situ fracture. Mechanical polishing results in surface enrichment by nickel for alloys of less than about 0.6 atomic fraction nickel, while alloys of greater than about 0.7 atomic fraction nickel exhibit surface enrichment by copper after mechanical polishing. Sputter cleaning results in a surface enrichment by nickel for all the alloy compositions considered ($X_{cu}<0.5$). Additionally, sputtering of the mechanically polished surfaces produces maxima in the surface nickel concentration, after short time sputtering, which coincide with the removal of the oxygen signals from the spectra. The results are discussed using a preferential sputtering model. (20 refs.)

109068 Auger spectra of lithium metal and 'oxidised lithium'. I.F.Ferguson, D.R.Masters, M.Turek.
Report ND-R-463(S), UKAEA, Risley, Lancs., England (May 1983), 26 pp.
Available from HMSO, London, England.
As part of a programme aimed at locating lithium in irradiated boron carbide, the Auger spectra of lithium metal and 'oxidised lithium' have been determined using a JAMP-3 Auger microprobe. It was found that the KVV Auger spectrum of elemental lithium was essentially identical in structure with the KVV Auger spectra of elemental Be, B and C, and with the LVV Auger spectra of Na, Mg, Al and Si. No adequate explanation could be offered for the occurrence of a lithium Auger signal at 46 eV, adjacent to the principal KVV lithium Auger transition at 51 eV. (27 refs.)

Auger depth profiling studies of interdiffusion and chemical trapping at metal-InP interfaces .... See Entry 108072

The surface composition of Pt-Cu alloys: experimental observations and theory of surface segregation .... See Entry 108131

Study of surface composition of iron-based metallic glasses by means of UV photoemission, angle resolved Auger electron and ion scattering spectroscopy .... See Entry 108140

XPS and AES quantitative surface analysis: comparison on oxide powder systems .... See Entry 108144

Partial phase diagram of the two-dimensional Ni(111)-S system from LEED and Auger electron spectroscopy .... See Entry 108157

Oxygen and hydrogen adsorption on GaAs (110) .... See Entry 108161

Enhanced oxygen adsorption on palladium silicide at room temperature .... See Entry 108163

Adsorption of NO on a Rh-10% Pt (111) surface: non-uniform spatial distribution .... See Entry 108190

Interfacial transition region between silicon and ultrathin plasma Si oxide .... See Entry 108195

Formation and properties of the copper silicon (111) interface .... See Entry 108215

Epitaxial growth of Ag films on Ge(001) .... See Entry 108216

Structure of the Al-GaP(110) and Al-InP(110) interfaces .... See Entry 108218

Superlattices formed by electrodeposition of silver on iodine-pretreated Pt(111); studies by LEED, Auger spectroscopy and electrochemistry .. See Entry 108235

Electronic characteristics of Ge-GaAs interface having chemisorbed oxygen at the GaAs surface .... See Entry 108538

Application of low damage SIMS/AES/XPS of the Ba-O-W system to cathode characterization .... See Entry 109076

Photo-electron emission microscopy of work function changes .... See Entry 109114

X-ray photoemission spectroscopy of potassium promoted Fe and Pt surfaces after H_2 reduction and CO/H_2 reaction .... See Entry 109796

79.20H Electron impact: secondary emission

109069 Secondary emission properties of impregnated tungsten cathodes. R.E.Thomas (Naval Res. Lab., Washington, DC, USA), C.D.Morrill.
Appl. Surf. Sci. (Netherlands), vol.16, no.1-2, p.292-311 (May-June 1983). (3rd Tri-Service Cathode Workshop, Fort Monmouth, NJ, USA, 23-26 March 1982).
The secondary emission properties of impregnated tungsten cathodes have been studied using high resolution Auger spectroscopy to correlate the local variations in secondary emission (δ) with composition of the surface. It is found that for a tungsten surface activated with approximately a monolayer of Ba and oxygen (such as is found over most of the surface of a normally activated dispenser cathode) $\delta_{max}\sim2.2$ with a first crossover energy ~70 eV. Any improvement in δ on practical dispenser cathodes is due to either the high value of δ from impregnant in the exposed pores, or due to excess impregnant left on the surface by the surface preparation methods. The value of δ_{max} from excess impregnants is ~5.3 consistent with previous measurements on thick BaO films. From cathode to cathode the fraction of the surface area covered with excess impregnant varied considerably. Thus, the average δ from the cathodes was not very reproducible. Little or no difference in δ could be attributed to changes in impregnant composition. It was found that charging effects can limit the value of δ that can be obtained from the pore area exposed on the surface, unless the pore size is limited. Various types of surface treatments were tried to determine their effect on δ and the highest average δ over the cathode surface was obtained from surfaces that were gritblasted with Al_2O_3 as a final treatment after impregnation. (9 refs.)

79.20K Other electron impact phenomena

109070 Energy loss spectroscopy of oxygen chemisorption on tin. C.M.Stander (Nat. Phys. Res. Lab., CSIR, Pretoria, S Africa).
Appl. Surf. Sci. (Netherlands), vol.16, no.3-4, p.463-8 (July-Aug. 1983).
Electron energy loss spectroscopy (EELS) has been used to study the room temperature chemisorption of oxygen on tin. EELS are presented that show a continuous shift in surface plasmon energy loss from 10 to 6.5 eV during oxidation. The energy loss peak at 6.5 eV is attributed to the formation of SnO_2 while the higher losses are associated with the formation of non-stoichiometric SnO_2 containing Sn interstitials during the initial stages of oxidation. (16 refs.)

109071 Electron energy loss spectra and X-ray photoelectron spectra of $Ca_2V_2O_7$. I.M.Curelaru (Dept. of Materials Sci. & Engng., Univ. of Utah, Salt Lake City, UT, USA), E.Suonien, E.Minni, K.-G.Strid, T.Ronnhult.
J. Lumin. (Netherlands), vol.28, no.2, p.123-33 (May-July 1983).
The authors measured the electron energy loss spectra of $Ca_2V_2O_7$ in the reflexion mode at incident energies between 200 and 2400 eV, and the X-ray photoelectron spectra excited by Al Kα radiation. The abundant loss structure observed can be correlated with the possible interband transitions, collective oscillations, and excitation of O2s and V3p electrons within the $V_2O_7^{4-}$ ion. The gap width and molecular orbital (MO) spread (or splitting) is about 1 eV larger in the $V_2O_7^{4-}$ ion than in its component VO_4^{3-} ion. Excitation of O2s states, which may occur together with some MO over-gap transitions, displaces the collective oscillations about 7 eV towards lower energies. Deeper V3p electrons are excited with a maximum energy loss some 7 eV above their binding energy. Cross transitions from Ca3p levels into some empty states of the $V_2O_7^{4-}$ ion, or direct transitions to available states of the Ca^{2+} ion could not be unambiguously identified. The energy dependence of the excitation cross section and of the electron penetration depth results in a significant variation of the relative intensity of various losses over the investigated energy range. (41 refs.)

109072 Absorbed energy distribution in heterogeneous semiconductor structures. A.F.Akkerman, A.L.Gibrekhterman, A.V.Dvurechenskii (Inst. for High Energy Phys., Acad. of Sci., Alma-Ata, Kazakh SSR).
Phys. Status Solidi a (Germany), vol.78, no.2, p.K131-5 (16 Aug. 1983).
Investigates the transmission of electrons with energy of 5 to 20 keV through germanium and silicon semiconductor structures. In calculations the program ETRIN of simulating low energy electron transmission through heterogeneous media by the Monte-Carlo method is used. (7 refs.)

109073 Determination of valence-electron concentration in $AgTe_3$ by electron energy loss spectroscopy. C.M.Stander (Nat. Inst. for Materials Res., CSIR, Pretoria, South Africa), K.-J.Range.
Solid State Commun. (USA), vol.47, no.10, p.843-4 (Sept. 1983).
Electron energy loss studies have shown that the valence-electrons in $AgTe_3$ give rise to an electron plasma oscillation with a frequency that can be related to the density of these electrons. The density of valence-electrons in $AgTe_3$ is similar to that in Te but larger than that in Ag. The EELS spectra of $AgTe_3$ and Te are similar with the exception of an interband transition at 5 eV which occurs in Te but not in $AgTe_3$. These similarities support the view that $AgTe_3$ is a silver-stabilized cubic Te. (11 refs.)

109074 Elementary surface excitations and electron energy loss spectroscopy. H.Ibach (Inst. fur Grenzflaschenforschung und Vakuumphys., Kernforschungsanlage Julich, Julich, Germany).
Ultramicroscopy (Netherlands), vol.11, no.2-3, p.179-85 (1983). (Surface Imaging and Analysis with High Spatial Resolution, Wickenburg Inn, AZ, USA, 12-15 Jan. 1983).
Energy loss spectroscopy of electrons reflected from solid surfaces has become a major source of information about a variety of elementary excitations of the surface. These excitations comprise plasmons of free carriers in metals and semiconductors, interband transitions, electronic excitations of adsorbed molecules and, with high resolution spectroscopy, vibrations of adsorbates and the substrate. Understanding of surface chemistry is greatly improved by the spectroscopy of adsorbate vibrations since decomposition reactions of adsorbed molecules on surfaces are easily analysed by the characteristic eigenmodes of the products. In many cases new and unexpected surface species have been identified. One of the advantages of electron energy loss spectroscopy as opposed to other techniques is that different scattering mechanisms may be employed which have different selection rules with respect to the symmetry elements of adsorbate complexes. Recently even surface phonon spectroscopy has become possible, and the dispersion of Rayleigh waves has been measured throughout the Brillouin zone. (20 refs.)

109075 Electron energy loss spectroscopy in glancing reflection from bulk crystals. O.L.Krivanek (Dept. of Phys., Arizona State Univ., Tempe, AZ, USA), Y.Tanishiro, K.Takayanagi, K.Yagi.
Ultramicroscopy (Netherlands), vol.11, no.2-3, p.215-21 (1983). (Surface Imaging and Analysis with High Spatial Resolution, Wickenburg Inn, AZ, USA, 12-15 Jan. 1983).
Electron energy loss spectral (EELS) from clean and oxidized Si surfaces have been collected in glancing reflection. The results confirm the importance of multiple surface plasmon excitation in glancing reflection EM, and indicate only a limited usefulness of glancing reflection EELS as a microanalytical technique. (25 refs.)

Ion microscopy using electron-desorbed ions .... See Entry 105421

Apparatus for probing electric fields in dielectric films by the albedo method .... See Entry 105422

Investigation of localized annealing by electron beams .... See Entry 107765

Oxygen and hydrogen adsorption on GaAs (110) .... See Entry 108161

End-on and side-on bonding of ketones to surfaces: acetone on the Ru(001) and Pt(111) surfaces .... See Entry 108172

Monohydride and dihydride formation at Si(100) 2×1: a high resolution electron energy loss spectroscopy study .... See Entry 108186

Electron- and photon-stimulated desorption benefits and pitfalls .... See Entry 108192

Interfacial transition region between silicon and ultrathin plasma Si oxide .... See Entry 108195

Structure and bonding of hydrocarbon plasma generated carbon films: an electron energy loss study .... See Entry 108232

Electronic structure of anisotropic semiconductors: optical properties and behaviour under hydrostatic pressure .... See Entry 108280

Work function measurements and their relation to modern surface analysis techniques .... See Entry 108521

Low energy Auger spectrum of tungsten .... See Entry 109065

Tm studied by electron energy-loss spectroscopy and Auger electron spectroscopy .... See Entry 109066

79.20N Atom, molecule, and ion impact

109076 Application of low damage SIMS/AES/XPS of the Ba-O-W system to cathode characterization. B.C.Lamartine, J.V.Czarnecki, T.W.Haas (Air Force Wright Aeronautical Lab., MLBM, Wright-Patterson AFB, OH, USA).
Appl. Surf. Sci. (Netherlands), vol.16, no.1-2, p.207-19 (May-June 1983). (3rd Tri-Service Cathode Workshop, Fort Monmouth, NJ, USA, 23-26 March 1982).
The activation of an impregnated dispenser cathode was characterized by SIMS, AES and XPS on the basis of analogous results from prepared thin film model standards of the Ba-O-W system. Proper SIMS characterization required low damage conditions (500 eV Ar^+, 5 nA/cm^2) and ultrahigh vacuum (beter than 2×10^{-10} Torr during analysis). Individual low damage SIMS yields from different model structures varied by several orders of magnitude; and consequently, the identification of the activated cathode structure from model compound yields was straightforward. While X-ray induced AES of cathodes requires curve synthesis to identify the activation transition with temperature, the low damage SIMS yields showed obvious but continuous transitions through the activation temperatures. (30 refs.)

109077 Sputtering of CoSi(100) and $CoSi_2$(100) single crystal surfaces. G.R.Castro, J.Kuppers (Inst. fur Phys. Chem., Univ. Munchen, Munchen, Germany), Y.Ivashchenko.
Appl. Surf. Sci. (Netherlands), vol.16, no.3-4, p.453-62 (July-Aug. 1983).
The composition of CoSi(100) and $CoSi_2$(100) surfaces is shown to change considerably upon sputtering with Ar^+ ions in the energy range 300-3000 eV. Generally, preferential sputtering of Si is observed, more pronounced approaching low ion energies. The density corrected sputter yield ratio, k_{Si}/k_{Co}, is found to be different at the compounds investigated, suggesting an influence of the chemical bonding of the atoms to be sputtered at the respective surfaces. The results fit very well into recent sputter data of low/high atomic mass compounds. (18 refs.)

109078 Absolute measurements of thermal reemission of incident helium ions. T.Nishijima.
Bull. Electrotech. Lab. (Japan), vol.47, no.6, p.455-68 (1983). In Japanese.
Single crystals of refractory metals (V, Nb, Mo and W) have been irradiated with 50, 100 and 200 keV He^+ with fluences of 2×10^{13} to 3×10^{17} $ions/cm^2$ at room temperature. Thermal release spectra and the absolute reemitted fraction of incident helium ions have been measured in the course of subsequent near linear (stepwise) annealing with a ramp rate of 50K/min from 323K to 2000K with a calibrated quadrupole mass spectrometer. Approximately 100% release of the incident helium is observed up to 2000K. The reemitted fraction of incident helium at a given temperature decreases with increasing fluences, which indicates increases in concentration of stable helium traps due to higher irradiation damage formation. In the case of irradiation with higher fluences than about 1×10^{17} $ions/cm^2$, the helium release abruptly rises to higher values (gas-burst phenomena). SEM observations indicate the surface erosion (blister formation) during the steep rise of helium release at 1×10^{17} $ions/cm^2$ irradiation. (17 refs.)

109079 Secondary ion emission from transition metals bombarded by hydrogen ions. M.A.Vasil'ev, A.A.Kosyachkov, I.N.Makeyeva, V.T.Cherepin (Inst. of Phys. of Metals, Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.515-24 (1982). [received: Aug. 1983]
The results are presented of the first systematic study on the mechanisms of the secondary ion emission (SIE) from transition metals bombarded by 6 keV hydrogen ions with 10^{-4} $A.cm^{-2}$ current density. To obtain comparative data, the surface of the targets was bombarded by argon ions. It is shown that bombardment with hydrogen ions can be used in secondary ion mass spectroscopy (SIMS) for analytical purposes. A series of comparable experiments has been carried out to measure the basic characteristics of SIE. The sputtering yield has been related to the degree of ionization. The energy distribution of secondary ions has been obtained and the mass distribution of secondary ions from the metals of the first long period has been studied. The kinetics has been investigated of the variation of the SIE characteristics with reactive gas pressure. The observed relationships are attributed to a mechanism which takes into account both the nature of the material and the enhancing effect of the change in the physical properties and chemical constitution of the surface saturated with hydrogen. (11 refs.)

109080 Ionization of an atom leaving a metal surface. V.Z.Khrinovskii (Inst. of Phys. of Metals, Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.606-9 (1982). [received: Aug. 1983]
In recent years much interest has been shown in research on surfaces of solids. One of the most widely used methods is that of secondary ion-ion emission (SIIE) which is very sensitive to the structure of the surface state. A great number of models have been proposed for the SIIE mechanism; however, they fail to describe adequately the procedures determining the charge state of secondary ions. Using the electron-exchange mechanism previously developed, the author introduces a model hamiltonian to describe the metal-outgoing atom system. (6 refs.)

109081 Effect of primary ion energy on secondary ion emission from polycrystalline surfaces. P.Chakraborty, S.D.Dey (Saha Inst. of Nuclear Phys., Calcutta, India).
Indian J. Phys. Part B, vol.57B, no.2, p.125-32 (April 1983). [received: Sept. 1983]
The intensity of secondary Al^+, Ta^+ and Zr^+ ions from polycrystalline aluminium, tantalum and zirconium surfaces respectively as a function of bombarding Zn^+ and Cd^+ ion energies in the region of 3-10 keV has been investigated. In the case of zirconium, ion emission increases steadily with bombarding ion energy, followed by an almost saturation. For Al and Ta surfaces, ion emission increases almost linearly with bombarding ion energy and then attains a broad maximum, followed by a subsequent steady decline. As far as the decreasing behaviour of secondary ion emission is concerned, rate of fall is greater in the case of Ta (BCC crystal) than that of Al (FCC crystal). Results on cluster ion emission from aluminium under Cd^+ ion bombardment are also discussed. (9 refs.)

109082 Dependence of multiple-scattering distributions on the charge states of fast ions exiting from solid targets. E.P.Kanter (Phys. Div., Argonne Nat. Lab., Argonne, IL, USA).
Phys. Rev. A (USA), vol.28, no.3, p.1401-4 (Sept. 1983).
Measurements are reported on the multiple-scattering widths for 1-4-MeV N^+ projectiles in thin carbon targets as a function of the charge state of the outgoing ion. Evidence is found for a significant enhancement of the angular widths for *K*-vacancy-bearing emergent ions. A quantitative model is proposed demonstrating how the 'memory' of *K*-vacancy-producing collisions can give rise to such an enhancement despite apparent charge-state equilibration. (20 refs.)

109083 Molecular and chemical effects in Auger processes induced by molecular ions. Y.Yamazaki, A.Yasaka, N.Oda (Res. Lab. for Nuclear Reactors, Tokyo Inst. of Technol., Tokyo, Japan).
Phys. Rev. A (USA), vol.28, no.3, p.1873-5 (Sept. 1983).
The $AlL_{2,3}VV$ Auger electrons ejected under H^+ and $H_2{}^+$ ion bombardments were measured at the backward directions. The observed ratio of the Auger-electron yield per proton for $H_2{}^+$ to that for H^+ ejected from oxidized aluminum foils increases from 1.0 ± 0.1 to 1.6 ± 0.1 with an increase of the projectile energy from 0.25 to 1.2 MeV/amu, whereas the ratio for oxide-free aluminum foils remains approximately constant (1.1 ± 0.1). First-order perturbation theory fails to reproduce the observed results for both targets. (13 refs.)

109084 The diffraction of molecular hydrogen from copper surfaces. J.Lapujoulade, J.Perreau (Service de Phys. des Atomes et des Surfaces, CENS, Gif-sur-Yvette, France).
Phys. Scr. (Sweden), vol.T4, p.138-40 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).
The diffraction of a molecular hydrogen nozzle beam (incident energy 77 meV) by various copper surfaces: Cu(100), Cu(110), Cu(115) has been experimentally studied. In every case a sharp diffraction pattern is obtained. For Cu(110) and Cu(115) the selective adsorption has been observed from which the bound state levels of the H_2-Cu potential are measured. A 9-3 potential well fits this result with a well depth $D=22.0\pm0.5$ meV and a range parameter $\sigma=2.8\pm0.1$ Å. From the diffraction pattern the corrugation of the potential is estimated. This corrugation is about five times greater than in the case of He-Cu. The reason of this high corrugation is not presently well understood. The authors did not find any evidence for dissociative chemisorption of hydrogen on copper even at the highest incident energy. (7 refs.)

109085 On the relative strength of He and H_2 diffraction from Ag(111). A.Liebsch, J.Harris (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
Surf. Sci. (Netherlands), vol.130, no.2, p.L349-57 (Aug. 1983).
Under equivalent incident conditions, H_2 diffraction beams on Ag (111) have recently been observed tobe about one order of magnitude stronger than He beams. The authors show that this effect can be attributed to details of the interaction, in particular, the exponential increase of the corrugation amplitude towards the surface. By extending a previously developed theory for the interaction between He and a metal surface, they show that the H_2-Ag (111) repulsion is roughly 1.5 times larger than for He. However, the Van der Waals attraction is about three times stronger for H_2, so that the classical turning points of low-energy H_2 particles lie closer to the surface. Because of the stronger corrugation at short distances, H_2 diffraction intensities can be up to an order of magnitude larger than for He. (17 refs.)

109086 Inelastic scattering of He atoms from a Cu(110) surface. B.F.Mason, K.McGreer, B.R.Williams (Nat. Res. Council Canada, Ottawa, Canada).
Surf. Sci. (Netherlands), vol.130, no.2, p.282-94 (Aug. 1983).
A He beam has been used to measure inelastic scattering from a Cu(110) surface. The scattering was a result of predominantly single phonon events and both energy gain and loss processes were observed. This was in contrast to Cu(001) where only energy loss was observed. For Cu(110), aligned in the [001] azimuth, partial dispersion relations have been measured which meant that phonons with ΔQ values up to the zone boundary value have not been detected under the present experimental conditions. The elastic incoherent component varied with azimuthal angle for Cu(110). (19 refs.)

109087 Inelastic atom scattering from layers of atoms and molecules on Cu(110). B.F.Mason, B.R.Williams (Nat. Res. Council, Ottawa, Canada).
Surf. Sci. (Netherlands), vol.130, no.2, p.295-312 (Aug. 1983).
The vibrational properties of adsorbed layers have been studied using inelastic He atom scattering. The substrate was Cu(110) viewed along the [001] and [$\bar{1}$10] azimuth. The adsorbates included, Kr, Xe, CH_4, CD_4, C_2H_6, CO, CO_2 and O_2 and covered the region of both physisorption and chemisorption. Despite a range of binding energies and mass ratios the vibrational frequencies showed no dependence on the momentum change, i.e. scattering was dispersionless, although intensity changes occurred in the inelastic peaks. There seemed to be no dependence of the adsorbate spectra on coverage below a monolayer. The peaks of CH_4 and C_2H_6 appeared broader than those of Kr and Xe suggesting molecular motions. Further, CH_4 and C_2H_6 gave very similar spectra. Both energy gain and loss events were observed in the inelastic spectrum. For those adsorbates which gave multilayer adsorption (Xe, C_2H_6) changes in the spectra were observed as the second layer developed. In the latter category also, mixed layers (Xe on C_2H_6, Xe on CO and C_2H_6 on Xe) were studied. (16 refs.)

109088 Direct-inelastic and trapping-desorption scattering of N_2 and CH_4 from Pt(111). K.C.Janda (Noyes Lab. of Chemical Phys., California Inst. of Technol., Pasadena, CA, USA), J.E.Hurst, J.Cowin, L.Wharton, D.J.Auerbach.
Surf. Sci. (Netherlands), vol.130, no.2, p.395-409 (Aug. 1983).
Angle and velocity distributions for supersonic chopped beams of N_2 and CH_4 scattered from clean close-packed Pt (111) surfaces are reported. For specular direct-inelastic scattering N_2 and CH_4 velocity distributions can be characterised by empirical relationships used for Ar scattering. For instance, for specular scattering the following relation is found for Ar, N_2 and CH_4: $\langle KE_f\rangle = A(KE_i)+B(2kT_s)$, where $\langle KE_f\rangle$ is the average final kinetic energy, KE_i is the incident kinetic energy and T_s is the surface temperature. The beam and surface temperature independent coefficients *A* and *B* are, respectively: Ar 0.87, 0.17; N_2 0.79, 0.19 and CH_4 0.84, 0.25. Unlike Ar, N_2 desorbs from Pt with a Maxwell-Boltzmann velocity distribution near the surface temperature. Qualitatively the trapping probabilities for these molecules on Pt (111) are ordered: $Xe>N_2>CH_4>Ar$. (12 refs.)

Ion microscopy using electron-desorbed ions ....See Entry 105421

Application of ion implantation and backscattering techniques to the analysis of nuclear waste glass corrosion ....See Entry 105959

High resolution measurement of ^{3}He depth profile ....See Entry 106157

RBS measurements of the nitrogen concentration in diamonds ....
....See Entry 107730

Surface damage of Cu/Ni alloys by low energy noble gas ion bombardment ....
....See Entry 107784

The development of surface morphological features on crystalline materials by 30 keV Ar^+ ion bombardment ....See Entry 107785

Effect of argon ion sputtering of surface on hydrogen permeation through vanadium ....See Entry 108053

Auger depth profiling studies of interdiffusion and chemical trapping at metal-InP interfaces ....See Entry 108072

The effect of the grain structure of Al_2O_3 substrate on the solid state reaction with a layer of NiO: a comparative backscattering spectrometry study. I ....
....See Entry 108075

Structure analysis of the Si(111)7×7 surface by low-energy ion scattering .... See Entry 108137

Study of surface composition of iron-based metallic glasses by means of UV photoemission, angle resolved Auger electron and ion scattering spectroscopy .... See Entry 108140

Measurement of the Rayleigh surface-phonon dispersion curve for NaCl(001) from high-resolution He time-of-flight spectroscopy and from kinematical focusing angles .... See Entry 108152

Inelastic changes during the formation of multilayers of C_2H_6 on Ag(110) .... See Entry 108187

Interfacial transition region between silicon and ultrathin plasma Si oxide .... See Entry 108195

Whisker growth and cone formation on metal surfaces under ion bombardment .... See Entry 108249

Surface preparation for quantitative Auger electron spectroscopy: mechanical polishing and inert gas ion sputtering .... See Entry 109067

Atomic beam scattering from single crystal surfaces .... See Entry 109089

Quantitative analysis of titanium nitride thin film by means of X-ray photoelectron spectroscopy .... See Entry 109101

Low energy ($\leq$100 eV) sputtering of thin molybdenum nitride films .... See Entry 109151

Elevated temperature low energy ion cleaning of GaAs .... See Entry 109543

Rutherford backscattering with heavy ions. I. Mass and depth resolution .... See Entry 109833

Rutherford backscattering with heavy ions. II. Sensitivities and applications .... See Entry 109834

79.20R Atomic and molecular beam interactions

109089 Atomic beam scattering from single crystal surfaces. D.R.Frankl (Dept. of Phys., Pennsylvania State Univ., University Park, PA, USA).
Prog. Surf. Sci. (GB), vol.13, no.4, p.285-356 (1983).
Application of atom-scattering to a variety of surface problems is expanding rapidly, owing in large part to the extreme surface-sensitivity of this probe. Helium is particularly useful because of its low mass and chemical inertness. Beams with velocity spreads of less than one percent and wavelength of the order of one Angstrom can be formed by nozzle expansion. The scattered flux from a clean, well-ordered crystal surface contains elastic and inelastic, coherent and incoherent, components. The coherent elastic component (i.e. the specular and diffracted beams) contains information about the crystallographic structure of the outermost atomic layer of the crystal and about the interaction potential between the crystal and the scattered particle. The latter manifests itself in the form of resonances between the incoming free-particle state, and the two-dimensional Bloch states bound in the potential well at the surface. Elastic scattering theory has reached the point where the resonance signatures in the various diffracted beams can be predicted accurately. Crystallographic information resides in the diffracted beam intensities. Theoretical interpretation is less well advanced, though some progress has been made with 'hard-wall' models. Experimental studies of reconstructed surfaces and chemisorbed overlayers appear very promising. In inelastic scattering, energy resolution has been achieved by both time-of-flight and diffraction methods. High-resolution studies on alkali halide surfaces have led to experimental determination of Rayleigh-wave dispersion relations over the full Brillouin zone. Preliminary results have also been obtained on some metals. (245 refs.)

The diffraction of molecular hydrogen from copper surfaces .... See Entry 109084

On the relative strength of He and H_2 diffraction from Ag(111) .... See Entry 109085

Direct-inelastic and trapping-desorption scattering of N_2 and CH_4 from Pt(111) .... See Entry 109088

79.40 THERMIONIC EMISSION

The characterization of the surfaces of tungsten-based dispenser cathodes .... See Entry 108129

Work function measurements and their relation to modern surface analysis techniques .... See Entry 108521

A study of tunnel-thermoemission currents through metal-semiconductor structures with a gap .... See Entry 108552

Determination of barium and calcium evaporation rates from impregnated tungsten dispenser cathodes .... See Entry 109115

79.60 PHOTOEMISSION AND PHOTOELECTRON SPECTRA

109090 Angle resolved photoelectron spectroscopy study of M-type cathode activation. K.D.Rachocki, B.C.Lamartine, T.W.Haas (Materials Lab., Air Force Wright Aeronautical Lab., Wright-Patterson Air Force Base, OH, USA).
Appl. Surf. Sci. (Netherlands), vol.16, no.1-2, p.40-54 (May-June 1983). (3rd Tri-Service Cathode Workshop, Fort Monmouth, NJ, USA, 23-26 March 1982).
Angle resolved photoelectron spectroscopy has been employed to investigate the chemistry occurring on osmium-ruthenium coated impregnated dispenser cathodes. This analytical technique allows the selection of acceptance angle of electrons analyzed in an X-ray photoelectron spectrometer, thus providing surface or depth enhancement of the signal. Spectra of the barium MNN Auger peaks and 3d and 4d photoelectron peaks were followed throughout activation. Surface enhancement, particularly of the barium MNN peak, showed a marked increase in the metallic component, confirming the increased concentration of metallic-like barium in the topmost layer. Auger-photoelectron energy separations were also plotted for comparison to previous data on impregnated dispenser cathodes and barium model compounds. By using higher resolution conditions, the authors have resolved the barium metal feature in the $M_4N_{4,5}N_{4,5}$ Auger transition at cathode operating temperatures. Using a digital subtraction technique, they are able to clearly distinguish elements which are predominant in the near-surface region as opposed to those which lie deeper in the cathode. (8 refs.)

109091 XPS studies on xanthate adsorption on galena surfaces. K.C.Pillai, V.Y.Young, J.O'M.Bockris (Dept. of Chem., Texas A&M Univ., College Station, TX, USA).
Appl. Surf. Sci. (Netherlands), vol.16, no.3-4, p.322-44 (July-Aug. 1983).
XPS measurement of the effect of xanthate adsorption of galena samples treated with de-oxygenated and oxygenated xanthate solutions have been made. Spectra of the Pb 4f, S 2P, C 1s and O 1s levels were recorded. Reference spectra of potassium ethyl xanthate and untreated galena samples were also obtained; these spectra were compared with previous results reported in the literature. In oxygenated solutions, the surface selvedge O 1s peak of galena has been altered by xanthate. Binding energies are such that there is evidence for a new surface compound on the galena surface. This is discussed in terms of interactions between the adsorbed intermediates of the O_2 reduction reaction and of the xanthate oxidation process. Implications for in situ flotation are discussed. (55 refs.)

109092 Dependence of surface composition of Zr-Ni intermetallic compounds on bulk composition and treatment. V.I.Nefedov, V.V.Lunin, N.G.Chulkov (Inst. of General & Inorganic Chem., Acad. of Sci., Moscow, USSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.503-14 (1982). [received: Aug. 1983]
Deals with an X-ray photoelectron study of the dependence of the surface composition of the intermetallic compounds Zr_2Ni, ArNi and $ZrNi_5$ on the holding time in air at 200°C. An investigation was conducted of the changes in the relative intensities of the lines Zr3d, Ni3p and Ni2p during ionic sputtering and for different photoelectron angles of escape. After oxidation the surface layer of the intermetallic compounds has the following structure: the uppermost layer is enriched with Ni (NiO), its content increasing with holding time, and next is a layer enriched with ZrO_2. Minimum Ni/Zr is observed 10 to 40 Å from the surface, depending on the composition and treatment time of the intermetallic compound. Next is a layer enriched with Ni, and, at a depth of 1000-1600 Å, the stoichiometric composition is reached. The formation of a Ni film on the surface of ZrO_2 is due to the diffusion of Ni through the film of oxides. (10 refs.)

109093 Modification of bulk band photoemission features by Ge overlayers. P.Zurcher (Xerox Res. Center, Palo Alto, CA, USA), J.Anderson, D.Frankel, G.J.Lapeyre.
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.682-3 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Summary form only given. Electronic structure effects due to overlayers of Ge on GaAs (110) were studied with polarization-dependent angle resolved photoemission spectroscopy (PARPES) utilizing synchrotron radiation. Ge was deposited (about 1/2 monolayer) on cleaved *p*-type crystals at room temperature and annealed to obtain a (1×1) LEED pattern and PARPES anisotropy. In the normal emission spectra the clean-surface interband emission peaks were observed to change their binding energy after the addition of Ge. The magnitude of the adsorption induced shifts is different for different interband transitions. (3 refs.)

109094 Angle-resolved photoemission study of GaAs(100) surfaces grown by molecular beam epitaxy. L.G.Salmon, T.N.Rhodin (School of Appl. & Engng. Phys., Cornell Univ., Ithaca, NY, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.736-40 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
Angle-resolved ultraviolet photoemission spectroscopy (ARUPS) using synchrotron radiation has been used to advance understanding of the surface electronic structure of reconstructed GaAs(100) surfaces. ARUPS spectra were taken using a variable energy polarized photon source ($\hbar\omega$=15-100 eV). GaAs(100) surfaces with (1×2), *c*(8×2), and (4×6) reconstructed structures were grown in situ by molecular beam epitaxy (MBE) and characterized by in situ Auger electron spectroscopy (AES) and low energy electron diffraction (LEED). Surface state peak positions were measured across the surface Brillouin zone and the peak positions and dispersion characteristics were determined. The results were consistent with occurrence of the backbonded surface states for ideal GaAs(100) surfaces described by Pollman and Pantelides (1978). Some surface state structures not predicted by them were also observed. The (1×2) As-stabilized surface showed surface states with bonding energies of −6.0 and −9.0 eV corresponding to the two backbonded surface states predicted theoretically for the ideal As-terminated GaAs(100) surface. Three other surface state bands were observed at −1.0, −3.0, and −12.0 eV which were not predicted. All five surface states continued to be observed on the *c*(8×2) and (4×6) Ga-rich surfaces. Two additional surface states were also observed at binding energies of −10.0 and −14.0 eV for the Ga-rich (4×6) surface. The surface state at −9.0 eV was not observed for the less Ga-rich *c*(8×2) surface and neither deep surface state was present for the (1×2) As-rich surface. In addition, 1-9 monolayer Ge single-crystal epitaxial overlayers were grown on the three clean reconstructed GaAs surfaces. Photoelectron emission from the GaAs-derived surfaces states was strongly attenuated. The surface reconstruction of the GaAs was removed by Ge overlayers three monolayers or greater in thickness after which the Ge overlayer subsequently developed into a stable (1×2) two-domain structure. The number of Ge overlayers required to overcome the reconstruction features and to initiate stable overlayer growth depended on the nature of the initial GaAs surface reconstruction. (23 refs.)

109095 Recent developments in the field of bremsstrahlung isochromatic spectroscopy. H.Scheidt (Phys. Inst., Univ. Wurzburg, Wurzburg, Germany).
Fortschr. Phys. (Germany), vol.31, no.7, p.357-401 (1983). In German.
Starts with a comparison of the characteristics of 5 methods for the wide band spectroscopy of vacant positions: photoelectron, secondary electron, quanta absorption and reflection, appearance potential, and Bremsstrahlung-isochromatic spectroscopy (BIS). Despite the advantages of BIS, which are listed, it has never been as widely used as photoemission techniques. This is because of the bulkiness of the X-ray monochromator equipment and the low overall sensitivity. Hence its application is limited to systems which are thermally very stable, and it is virtually excluded from surface physics. Traditional BIS, in the soft X-ray region, is reviewed next, followed by a variant which enables the crystal monochromator to be dispensed with. BIS in the UV quantum energy range is then described, together with new developments in the low energy region which make it possible to use BIS in surface physics. (109 refs.) *D.J.B.*

109096 Hydrogen diffusion and hydride formation at the metal-hydride interface. R.A.Butera (Dept. of Chem., Univ. of Pittsburgh, Pittsburgh, PA, USA), J.H.Weaver, D.J.Peterman, A.Franciosi, D.T.Peterson.
J. Chem. Phys. (USA), vol.79, no.5, p.2395-9 (1 Sept. 1983).
Synchrotron radiation photoemission has been used to examine interface reaction of overlayers of V and Ca deposited onto clean surfaces of the bulk hydride YH_2 and the deuteride $NbD_{0.75}$. Changes in the hydrogen-induced bonding bands and the d bands near E_F and variations in the intensities of

the substrate core level emission as a function of metal coverage indicate that hydrogen diffuses from the substrate into the overlayer. The results are discussed in terms of the mechanism for hydride formation. (17 refs.)

109097 Semiconductor electrodes. LII. Photoelectron spectroscopic determination of the structure of thin platinum silicide layers formed on Si (100) and Si (111) for use as electrodes. G.A.Hope, F.-R.F.Fan, A.J.Bard (Dept. of Chem., Univ. of Texas, Austin, TX, USA).

J. Electrochem. Soc. (USA), vol.130, no.7, p.1488-91 (July 1983).

Platinum silicide was grown on (100) and (111) silicon by vacuum annealing an evaporated layer (0-15 nm thick) at 400°C, immediately following deposition. The element distribution in the product layer was measured using electron spectroscopy (XPS and AES) in conjunction with argon ion sputtering of the sample. The silicide thus produced was covered by a thin surface layer of SiO_2. The decrease in platinum concentration with increasing penetration into the sample was characteristic of a reaction mechanism in which a platinum species diffuses into the Si. (10 refs.)

109098 A theory of resonant photoemission in Ni. T.Jo (Dept. of Maths., Imperial Coll., London, England), A.Kotani, J.-C.Parlebas, J.Kanamori.

J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2581-91 (July 1983).

A theory is presented for the resonant 3*d*-band photoemission spectra in Ni on the basis of a hybridized *s* and *d*-band model. The interference effect is taken into account between the 3*p*-core electron excitation followed by a super Coster-Kronig decay and the direct 3*d*-electron excitation. The photoemission intensities and their spin polarizations both for the 6 eV satellite and Auger peaks are calculated as a function of the incident photon energy ν, and the results are in good agreement with experiments. It is shown that the interference effect is important in explaining the observed ν-dependence of the spin polarization of satellite. (20 refs.)

109099 X-ray photoelectron spectroscopy study of the ionic configuration of the spinel $CuMnCoO_4$. V.A.M.Brabers, F.van Setten (Dept. of Phys., Eindhoven Univ. of Technol, Eindhoven, Netherlands).

J. Phys. D (GB), vol.16, no.9, p.L169-72 (14 Sept. 1983).

X-ray photoelectron spectra are reported for the spinels $CuMnCoO_4$, $CoMn_2O_4$, Co_2MnO_4 and $CoZnMnO_4$, from which the following ionic configurations can be induced: ${Cu_{0.65}}^{+}{Mn_{0.35}}^{3+}[{Cu_{0.35}}^{2+}Co^{3+}Mn_{0.65}]O_4$, $Co^{2+}[{Mn_2}^{3+}]O_4$, $Co^{2+}[Co^{3+}Mn^{3+}]O_4$ and $Zn[Co^{3+}Mn^{3+}]O_4$. (7 refs.)

109100 X-ray photoelectron spectroscopy study of the cation valencies in nickel manganite. V.A.M.Brabers, F.M.Van Setten, P.S.A.Knapen (Dept. of Phys., Eindhoven Univ. of Technol., Eindhoven, Netherlands).

J. Solid State Chem. (USA), vol.49, no.1, p.93-8 (Aug. 1983).

The X-ray photoelectron spectra of $NiMn_2O_4$, $NiMnZnO_4$, Mn_2TiO_4, $MnFe_2O_4$, and Mn_3O_4 are reported. The shift and broadening of the Mn-2*p*, Mn-3*s*, and Mn-3*p* lines in $NiMn_2O_4$, compared with those of the other compounds, are indicative of the charge distribution ${Ni_{1-\nu}}^{2+}{Mn_\nu}^{2+}[{Ni_\nu}^{2+}{Mn_{2(1-\nu)}}^{3+}{Mn_\nu}^{4+}]O_4$ ($\nu \simeq 0.9$). The values of multiplet splitting of the Mn3*s* level also support this distribution. (16 refs.)

109101 Quantitative analysis of titanium nitride thin film by means of X-ray photoelectron spectroscopy. K.Yabe, M.Suzuki (Government Industrial Dev. Lab., Hokkaido, Sapporo, Japan), Y.Igasaki, T.Yamashina.

J. Vac. Soc. Jpn. (Japan), vol.26, no.6, p.556-62 (1983). In Japanese.

To establish quantitative analysis of titanium nitride thin film, several experiments were carried out using X-ray photoelectron spectroscopy (XPS). It was demonstrated that two kinds of relative sensitivity ratio of nitrogen to titanium could be determined using standard materials. The one is the relative sensitivity in the primary meaning and it was determined using secondary standard materials of chemical reagents. The other is the one adoptable for a quantitative analysis accompanying Ar^+ ion sputter etching such as depth profiling and it was obtained from measurements on the standard titanium nitride films which were prepared by thermal nitriding and reactive RF sputtering. Change in atomic composition of the surface by an Ar^+ ion bombardment was investigated. It was found that the ratio of the sputtering yield of nitrogen to that of titanium was constant for the samples having nitrogen composition above 0.5 (atm.%). It is confirmed that the accurate quantitative depth analysis is possible for a sampling having composition within that range. (9 refs.)

109102 Transition from adiabatic to sudden core-electron excitation: N_2 on Ni(100). J.Stohr, R.Jaeger (Corp. Res.-Sci. Labs., Exxon Res. & Engng. Co., Linden, NJ, USA), J.J.Rehr.

Phys. Rev. Lett. (USA), vol.51, no.9, p.821-4 (29 Aug. 1983).

The first systematic study of the energy dependence of a core-level shake-up feature is presented. In contrast to expectations the shake-up peak remains nearly unchanged in intensity down to ~15 eV above threshold. The early and abrupt turn-on of the multi-electron satellite found experimentally is well explained by a theory which describes the transition from adiabatic to sudden core-level excitation by a simple exchange-interaction picture. (17 refs.)

109103 Temperature dependence of the exchange splitting in Ni studied by spin-polarized photoemission. H.Hopster, R.Raue, G.Guntherodt (Phys. Inst., Univ. Koln, Koln, Germany), E.Kisker, R.Clauberg, M.Campagna.

Phys. Rev. Lett. (USA), vol.51, no.9, p.829-32 (29 Aug. 1983).

Angle- and spin-resolved photoemission spectra from Ni(110) have been measured in the temperature range $0.5 \leq T/T_c \leq 0.94$. The data cannot be reconciled either with the predictions of local band theory assuming a temperature-independent exchange splitting or with a pure Stoner model. It is concluded that the exchange splitting decreases with increasing temperature and that spin fluctuations strongly influence the photoemission line shapes. (17 refs.)

109104 Photoemission studies of $Pd_{80-x}Si_{20}Co_x$ amorphous alloys. K.Hricovini (Inst. of Phys., Electrotech. Faculty, Slovak Tech. Univ., Bratislava, Czechoslovakia), P.Mikusik, J.Krempasky.

Phys. Status Solidi b (Germany), vol.118, no.2, p.823-7 (1 Aug. 1983).

X-ray and UV photoemission measurements of the core levels and valence bands of $Pd_{80-x}Si_{20}Co_x$ amorphous alloys are reported. XPS spectra show a broadening of the cobalt 2p-levels in the alloys while the binding energies are the same as in the polycrystalline Co. The behaviour of Co atoms during the alloying process is discussed. UPS spectra of the valence bands show a shift of Pd 4d-band to higher binding energies and a cobalt contribution to the density of states above the Fermi level of Pd-Si alloy. (17 refs.)

109105 Angular resolved photoemission from Cu(110). A.Baalmann, H.Przybylski, M.Neumann, G.Borstel (Fachbereich Phys., Univ. Osnabruck, Osnabruck, Germany).

Phys. Scr. (Sweden), vol.T4, p.148-51 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).

Angular resolved normal emission photoelectron spectra of Cu(110) using linearly polarized light ($\hbar\omega = 21.22$ eV) are presented. Within the frame of the three-step-model of photoemission corresponding spectra have been calculated and good agreement with experiment is achieved. Spin-orbit coupling is important and gives rise to a relaxation of single-group dipole selection rules even for low *Z* materials. Photoelectron spectra are critically dependent on external experimental parameters. All features in the experimental spectra may be interpreted by direct transitions. (16 refs.)

109106 Calculation of photoemission spectra using an energy dependent potential. C.G.Larsson, P.O.Nilsson (Dept. of Phys., Chalmers Univ. of Technol., Goteborg, Sweden).

Phys. Scr. (Sweden), vol.T4, p.155-7 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).

The effect of exchange and correlation in an excited system is studied by means of photoemission calculations. This is realized via an energy dependent muffin tin potential calculated from the Hedin-Lundqvist dynamic potential (1971). Results are presented for the Cu(111) and (100) surfaces. (10 refs.)

109107 UPS studies of α-phase alloys CuX and AgX (X=Zn, Ga, Ge and As). M.Lahdeniemi, E.Ojala (Dept. of Phys. Sci., Univ. of Turku, Turku, Finland).

Phys. Scr. (Sweden), vol.T4, p.158-61 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).

Photoelectron spectra of polycrystalline α-phase CuX and AgX (X=Zn, Ga, Ge, and As) have been measured using the photon energy of 21.2 eV. The alloy-host difference spectra are compared with theoretical calculations. The origin of the structures in difference spectra and the observed weak impurity dependence of the antiresonance structure are discussed. (19 refs.)

109108 On the role of spin-orbit coupling and crystal symmetry on the spin-polarization of photoelectrons in nonmagnetic crystals. M.Wohlecke, G.Borstel (Fachbereich Phys., Univ. of Osnabruck, Osnabruck, Germany).

Phys. Scr. (Sweden), vol.T4, p.162-4 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).

The light-induced electron-spin polarization (ESP) for electrons emitted normally from (111)-faces of Cu, Ag and Au is calculated within a spin-dependent three-step-model. Both the energetic positions and the strengths of the spectral features in the ESP may be interpreted as a function of the increasing spin-orbit coupling on the basis of the corresponding bandstructure along Λ. The general applicability of group-theoretical selection rules to the ESP is demonstrated and general symmetry considerations for the occurrence of a nonzero ESP in crystals are given. (14 refs.)

109109 XPS investigation of Ni/Si(111) interfaces. T.T.A.Nguyen, R.Cinti (Groupe des Transitions de Phases, CNRS, Grenoble, France).

Phys. Scr. (Sweden), vol.T4, p.176-8 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).

The early stages of the formation of thin layers (~15 monolayers) of Ni evaporated onto Si(111) clean surfaces and their transformation upon heat treatment have been investigated by XPS. For surface coverage θ sequentially increased from 6×10^{-2} to 1 equivalent monolayer, the $Ni2p_{3/2}$ peak moves from −853.9 eV, 0.9 eV lower than its bulk value, to −853.6 eV, the valence band spectra show a rapid prevalence of the derived Ni *d*-band, while the Si 2*p* remains constant in energy. Angular analysis of the core level spectra of the as-deposited and annealed layers shows composition inhomogeneity for annealing temperatures $T_a \lesssim 600$°C. At higher T_a a uniform $NiSi_2$ is formed. Experimental results are discussed in relation to existing measurements and calculations on the electronic structures of nickel silicides. (8 refs.)

109110 Semiconductor core-level to valence-band maximum binding-energy differences: precise determination by X-ray photoelectron spectroscopy. E.A.Kraut, R.W.Grant, J.R.Waldrop, S.P.Kowalczyk (Microelectronics Res. & Dev. Center, Rockwell Internat., Thousand Oaks, CA, USA).

Phys. Rev. B (USA), vol.28, no.4, p.1965-77 (15 Aug. 1983).

Angle-resolved core-level and valence-band X-ray photoelectron spectroscopy (XPS) data for GaAs(110), Ge(110), and Ge(111) surfaces are analyzed to determine core-level to valence-band maximum binding-energy differences to a precision of the order of the room-temperature thermal energy. A method for markedly improving the precision with which the position of the valence-band maximum in XPS data can be located is presented. This method is based on modeling the XPS valence-band spectrum in the vicinity of the valence-band maximum by an instrumentally broadened theoretical valence-band density of states and fitting this model to the experimental data by using the least-squares method. The factors which influence the attainable precision for determining core-level to valence-band maximum binding-energy differences are quantitatively discussed. These factors include the presence of occupied surface states, band bending, surface chemical shifts, background effects associated with inelastic processes, instrumental line shape, and spectrometer calibration accuracy. The spin-orbit-split components of the Ga, As, and Ge 3*d* core lines are resolved and binding energies of these components, measured relative to the valence-band maxima in GaAs and Ge, are reported. (55 refs.)

109111 Surface effects in Du intermetallics: a resonant photoemission study. W.D.Schneider, C.Laubschat, G.Kalkowski (Inst. fur Atom- und Festkorperphys., Freie Univ. Berlin, Berlin, Germany), J.Haase, A.Puschmann.

Phys. Rev. B (USA), vol.28, no.4, p.2017-22 (15 Aug. 1983).

The Eu-transition-metal compounds $EuAg_5$, $EuRh_2$, $EuPt_5$, and $EuPd_5$ were studied by resonant $4d \rightarrow 4f$ photoemission techniques. In divalent $EuAg_5$, a surface core-level shift of the final-state $4f^6$ multiplet components of 0.75 eV is found. For the trivalent Eu compounds $EuPt_5$ and $EuPd_5$ as well as for the mixed-valence compound $EuRh_2$, a surface valence change to the lower-valence state is observed. For $EuPt_5$, an inhomogeneously mixed-valence surface is noticed, pointing to a strong coordination dependence of the surface valence transition. The energy position of the final-state 4*f* screening orbital is discussed on the basis of 4*d* photoemission and photoabsorption threshold energies. (37 refs.)

109112 X-ray photoelectron spectroscopy study of the surface composition of CoO-MgO solid solutions. A.Cimino, B.A.De Angelis, G.Minelli (Centro di Studio SACSO, Univ. di Roma, Roma, Italy).

Surf. & Interface Anal. (GB), vol.5, no.4, p.150-4 (Aug. 1983). (International Conference on Quantitative Surface Analysis, Teddington, England, 24-25 Nov. 1981).

The surface composition of CoO-MgO solid solutions has been investigated by XPS. The samples (prepared at 1200°C in air) were checked to be homogeneous by X-ray diffraction analysis and by lattice parameter measurements. The study utilized peaks at different kinetic energies: Co 2p, O 1s, Co 3s, Mg 2s, Co 3p, Mg 2p and the Auger transition Mg KLL. It was shown that the specimens have a surface composition slightly different from the bulk, because of the formation of surface magnesium hydroxide. No segregation of cobalt was found. The results have a bearing on the catalytic activity of oxide solid solutions. (15 refs.)

109113 Surface quantitative analysis of Cr-O systems by XPS. C.Battistoni, G.Cossu, G.Mattogno, E.Paparazzo (Istituto di Teoria, Struttura Elettronica e Comportamento Spettrochimico dei Composti di Coordinazione, Roma, Italy).
Surf. & Interface Anal. (GB), vol.5, no.4, p.173-6 (Aug. 1983). (International Conference on Quantitative Surface Analysis, Teddington, England, 24-25 Nov. 1981).
A comparison among O/Cr atomic ratios obtained from XPS Cr $2p_{3/2}$ and O 1s spectra in pure inorganic compounds, employing the Elemental Sensitivity Factors approach and the so-called 'First-Principles Model' is reported. (23 refs.)

109114 Photo-electron emission microscopy of work function changes. H.Bethge, M.Klaua (Inst. fur Festkorperphys. und Elektronenmikroskopie, Akad. der Wissenschaften, Halle/Saale, Germany).
Ultramicroscopy (Netherlands), vol.11, no.2-3, p.207-13 (1983). (Surface Imaging and Analysis with High Spatial Resolution, Wickenburg Inn, AZ, USA, 12-15 Jan. 1983).
Photo-electron emission microscopy (PEEM) under ultra-high vacuum (UHV) conditions is one of the various surface imaging techniques least developed but nevertheless most promising. Excited by ultra-violet radiation, the low energy photo-electrons are only surface sensitive via the effect of the work function. Work function changes due to different materials, orientations, adsorption or reaction layers, and step densities can be visualized microscopically with a lateral resolution of some 10 nm. PEEM and Auger electron spectroscopy (AES) have been combined in a true UHV apparatus to complement surface imaging by the surface-sensitive element analysis. First investigations were focused on the orientation dependence of the photoemission in polycrystalline Ni and on contrast changes by work function changes due to the adsorption of oxygen on differently oriented Ni grains. By recrystallization large Ni(111) and Ni(110) grains were obtained, the orientations of which were determined by LEED. Relative measurements of the photoemission current by a spot photometer, and the Auger signals of O and Ni depending on oxygen exposure clearly show the different stages of chemisorption and oxidation. Measured differences due to different orientations and the sensitivity to low oxygen coverages are much higher for PEEM than for AES. Present instrumental limitations and future improvements are discussed. (14 refs.)

Modulation of atomic interdiffusion at the Si(111)-Au interface .... See Entry 108070

Room temperature exchange reaction at the Al-InP (110) interface: soft X-ray photoemission studies .... See Entry 108073

Surface study of a Ag electrode on a solid electrolyte used as oxygen sensor .... See Entry 108130

Study of surface composition of iron-based metallic glasses by means of UV photoemission, angle resolved Auger electron and ion scattering spectroscopy .... See Entry 108140

XPS and AES quantitative surface analysis: comparison on oxide powder systems .... See Entry 108144

UV photoemission study of low temperature oxygen adsorption on GaAs(110) .... See Entry 108162

Experimental evidence of a roughening transition in adsorbed xenon multilayers .... See Entry 108174

Investigation of the initial stages of oxidation of microcrystalline silicon by means of X-ray photoelectron spectroscopy .... See Entry 108185

Si-SiO_2 interface structures on Si (100), (111), and (110) surfaces .... See Entry 108194

Some observations on Ge:GaAs(001) and GaAs:Ge(001) interfaces and films .... See Entry 108200

Formation and properties of the copper silicon (111) interface .... See Entry 108215

Palladium on GaAs: a reactive interface .... See Entry 108217

Experimental evidence for a structure-induced mininum of the density of states at the Fermi energy in amorphous alloys .... See Entry 108265

Angle-resolved photoemission and band structure of copper .... See Entry 108278

Method for band structure determination from angle-dispersed photoemission data: application to Ni .... See Entry 108279

Mixed-valent ground state of CeO_2 .... See Entry 108361

Interface formation at PbTe(100) surfaces: Ge, Al, and In overlayers .... See Entry 108492

The effect of surface oxygen on the intermixing and Schottky barrier at GaAs(110)-Au interfaces .... See Entry 108493

Schottky barrier formation and the initial metal-atom bonding state: InP(110)-Al vs GaAs(110)-Al .... See Entry 108495

Observation of a new surface state on Cu(001) .... See Entry 108504

Electronic structure of a cobalt monolayer on Cu(100) .... See Entry 108506

Schottky barrier formation of Ag on GaAs(110) .... See Entry 108512

Schottky barrier formation and intermixing of noble metals on GaAs(110) .... See Entry 108513

Band discontinuities and interface Fermi-level positions in Ge-GaAs (110) heterojunctions .... See Entry 108533

Microscopic study of semiconductor heterojunctions: photoemission measurement of the valence-band discontinuity and of the potential barriers .... See Entry 108541

Fermi-level pinning energy and chemistry at InP (100) interfaces .... See Entry 108550

Three body problem in transition metals—application to nickel .... See Entry 108633

X-ray spectra and binding energies of atoms in a solid .... See Entry 109054

Electron energy loss spectra and X-ray photoelectron spectra of $Ca_2V_2O_7$ .... See Entry 109071

Application of low damage SIMS/AES/XPS of the Ba-O-W system to cathode characterization .... See Entry 109076

XPS and XAES studies of transient enhancement of Cu^I at CuO surfaces during vacuum outgassing .... See Entry 109538

Elevated temperature low energy ion cleaning of GaAs .... See Entry 109543

Cleaning chemistry of GaAs(100) and InSb(100) substrates for molecular beam epitaxy .... See Entry 109544

Photoelectrochemical passivation of GaAs surfaces .... See Entry 109545

Correlation between the photoelectron emission and photooxidation threshold energies of a solute in the condensed phase .... See Entry 109764

The adsorption of methanol on Ag(111) and its reaction with preadsorbed oxygen .... See Entry 109795

X-ray photoemission spectroscopy of potassium promoted Fe and Pt surfaces after H_2 reduction and CO/H_2 reaction .... See Entry 109796

Chemisorption of oxygen at Ag(110) surfaces and its role in adsorbate activation. [Photoelectron spectra observations] .... See Entry 109801

Comment on graphite intercalated with H_2SO_4 .... See Entry 109805

79.70 FIELD EMISSION AND FIELD IONIZATION

109115 Determination of barium and calcium evaporation rates from impregnated tungsten dispenser cathodes. G.L.Jones, J.T.Grant (Res. Inst., Univ. of Dayton, Dayton, OH, USA).
Appl. Surf. Sci. (Netherlands), vol.16, no.1-2, p.25-39 (May-June 1983). (3rd Tri-Service Cathode Workshop, Fort Monmouth, NJ, USA, 23-26 March 1982).
The evaporation rates of barium and calcium from impregnated tungsten dispenser cathodes have been determined by both a vapor-collect method and line-of-sight mass spectrometry. Cathodes having molar ratios of BaO, CaO, and Al_2O_3 of 4:1:1, 5:3:2, and 1:1:1 have been studied. All measurements were conducted in ultrahigh vacuum. For the vapor-collect method, a W(110) collector was found to be suitable for monolayer growth. The procedure involved plotting the ratio of the adsorbate Auger peak-to-peak height to that from the collector as a function of collection time. Break-points in these plots characterized the collection of one monolayer of adsorbate. A geometrical correction then allowed the evaporation rates to be determined. Evaporation rates were determined at cathode temperatures of 1050, 1100, and 1150°C. For the line-of-sight mass spectrometry an extranuclear quadrupole was used. The quadrupole was capable of measuring species up to 300 amu. Measurements with the quadrupole were made on a 5:3:2 and a 4:1:1 cathode. Results obtained using these two methods are compared. (13 refs.)

109116 Field evaporation of silicon and field desorption of hydrogen from silicon surfaces. G.L.Kellogg (Sandia Nat. Labs., Albuquerque, NM, USA).
Phys. Rev. B (USA), vol.28, no.4, p.1957-64 (15 Aug. 1983).
The field evaporation of silicon in ultrahigh vacuum and in hydrogen has been studied with the use of the pulsed-laser atom probe. Measurements of the ion yields of various field-evaporated and field-desorbed species were made as a function of applied voltage, laser power, hydrogen background pressure, and laser pulse rate. The results indicate that, in ultrahigh vacuum and above cryogenic temperatures, field evaporation of silicon is qualitatively the same as for metals. In hydrogen, however, the field-evaporation process is quite different from that of metals, with the rate-limiting step being the field-enhanced formation of surface hydrides. Field-desorbed H^+ and H_2^+ ions are shown to arise from a field-adsorbed binding state, and the voltage range where H_2^+ dissociates to H^+ is used to calibrate the electric field strength. The low-temperature evaporation field of silicon is estimated from this calibration to be 3.3-3.6 V/Å, which is considerably higher than the currently accepted value of 2.0 V/Å. Field-desorbed H_3^+ ions are detected only when oxide contamination is present on the silicon surface. If it is assumed that the mechanism of H_3^+ formation is the same as that proposed for metals, this observation suggests that weakly bound, chemisorbed hydrogen atoms exist on silicon only in the presence of surface contamination. (38 refs.)

109117 Field evaporation of silicon surfaces. T.Sakata (Dept. of Integrated Arts & Sci., Univ. of Osaka Prefecture, Osaka, Japan), J.H.Block.
Surf. Sci. (Netherlands), vol.130, no.2, p.313-25 (Aug. 1983).
Quantitative measurements on field evaporation of Si (111) surfaces in hydrogen imaging gas have been carried out by field ion microscopy. The field evaporation rate is found to increase exponentially with increase of the reciprocal of tip temperature in the range 80-103K. The evaporation field strength increases with increase of tip temperature in the investigated range, 80-300K. Within the applied pressure range, 5×10^{-6} to 2×10^{-4} Torr of hydrogen gas, the evaporation rate linearly increases with the gas pressure. Similar effects of temperature and gas pressure on field evaporation of Si(111) surfaces have been observed also in silane imaging gas. A model, based on a field-induced formation of surface hydrides as a rate-determining step, is proposed, which accounts for all the experimental results of the field evaporation process. (36 refs.)

79.75 EXOELECTRON EMISSION

109118 Intense exoelectron emission from fine particles of Al_2O_3 and its dependence on the conductivity of the substrate material. K.Kawabata (Radiation Center of Osaka Prefecture, Osaka, Japan).
Phys. Status Solidi a (Germany), vol.78, no.2, p.K127-30 (16 Aug. 1983).
The author found an intense 'thermally stimulated electron emission' (TSEE) in fine particles of Al_2O_3 irradiated with γ-rays, and the yield depends strongly on the conductivity of the substrate, becoming maximum when the substrate is a metal. (3 refs.)

79.90 OTHER TOPICS IN EMISSION AND IMPACT PHENOMENA IN CONDENSED MATTER

Evaluation of the work function distribution of impregnated cathodes .... See Entry 108507

80.00 CROSS-DISCIPLINARY PHYSICS AND RELATED AREAS OF SCIENCE AND TECHNOLOGY

81.00 MATERIALS SCIENCE

109119 ASTM D 4000: a new classification system devoted to plastics. F.O.Swanson (Engine Engng. Div., Ford Motor Co., Dearborn, MI, USA).
Plast. Eng. (USA), vol.39, no.1, p.31-3 (Jan. 1983).
By using this recently published classification standard as a guide, one can benefit in three important ways: confusion can be reduced when specifying plastics; costs can be controlled; and one's basic understanding of plastics can be increased. (no refs.)

81.10 METHODS OF CRYSTAL GROWTH AND PURIFICATION

(for physics of crystal growth, see 61.50C; for epitaxial growth methods, see 81.15)

109120 Purification of mercuric iodide. V.M.Zaletin, I.N.Nozhkina (Lenin Komsomol Novosibirsk State Univ., Novosibirsk, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1087-90 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1288-91 (Aug. 1982).
The purification of HgI_2 was performed by three methods: recrystallisation from HCl, chemical-thermal, and repeated vacuum sublimation. The results obtained on the purification of HgI_2 by all three methods are comparable with the most effective method used abroad. The best results were achieved using repeated vacuum sublimation with preliminary melting of the original HgI_2 material. The content of impurities in mercuric iodide by this method is less than $1\times10^{-4}\%$ by weight. (7 refs.)

109121 Purification of zirconium by electrotransport. R.H.Zee, J.F.Watters.
Report AECL-8051, Atomic Energy Canada Ltd., Chalk River, Ont. (April 1983), 10 pp.
An electrotransport apparatus for purifying reactive metals is described. A large d.c. current ($\sim 10\ \mathrm{A/mm^2}$) is applied to the specimen inside an ultra high vacuum chamber. This chamber is evacuated using an ion pump and a titanium sublimation pump. It is bakeable to 650K and is capable of maintaining a vacuum of 7×10^{-8} Pa. Resistivity ratio results from several preliminary runs in zirconium indicate a reduction in overall impurity level by 60% after a typical run at 1750K for ~120h. (293 refs.)

Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors .... See Entry 105014

Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191) .... See Entry 105032

81.10B Growth from vapour

109122 Growth conditions of $CuBTe_2$ (B=Ga, In) single crystals by the closed tube chemical vapour transport technique. F.Leccabue, C.Pelosi (Maspec-CNR Inst., Parma, Italy).
Mater. Lett. (Netherlands), vol.2, no.1, p.42-4 (July 1983).
Ternary chalcopyrite $CuInTe_2$ and $CuGaTe_2$ single crystals were grown by the closed tube chemical vapour transport technique for the first time. The growth conditions were selected so that the starting compounds were not dissociated by the peritectoid reaction. All samples were electrically characterised by means of the van der Pauw technique and were found to have a p-type conductivity in all cases. (12 refs.)

109123 Growing mixed crystals of $CdS_{1-x}Se_x$ from the vapor phase. B.A.Kazennov, V.F.Chernysheva (State Univ., Leningrad, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.242-3 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.409-11 (March-April 1983). [received: Sept. 1983]
The properties of CdS and CdSe crystals and their solid solutions depend on the purity of the starting material and the growth conditions. To obtain reproducibility of the physical properties it is therefore necessary to ensure detailed reproduction of the method of growing the crystals. The growth process was effected in a horizontal two-section tubular furnace. The second section creates a retaining temperature barrier in the path of the vapor in the capsule, improves the temperature distribution in the crystallization zone in the first section, and increases the yield of large, well-formed crystals. During the growth process the temperature fluctuations did not exceed ±5°C. (9 refs.)

Thermal chamber for physicochemical experiments in the electron microscope .... See Entry 105423

Mass transport, nucleation and monocrystal growth of HgI_2 with the forced flux method .... See Entry 106219

Influence of temperature upon dislocation mobility and elastic limit of single crystal HgI_2 .... See Entry 106226

81.10D Growth from solutions

109124 Preparation of III-V compounds by reduction of precursors. P.K.Gallagher, M.Robbins, F.Schrey, V.G.Lambrecht,Jr., G.Y.Chin (Bell Labs., Murray Hill, NJ, USA).
Mater. Lett. (Netherlands), vol.2, no.1, p.27-30 (July 1983).
Stoichiometric polycrystalline InP, GaAs and (InGa)As were prepared by hydrogen reduction of phosphate and arsenate precursors precipitated from aqueous solution. These ill-defined phosphate and arsenate precipitates were dried and heated at elevated temperatures in a stream of pure hydrogen to produce the phosphides and arsenides. It was found necessary to introduce elemental phosphorus or arsenic in a heated region upstream of the reaction to establish the necessary pressure of P or As in the H_2 stream to inhibit the dissociation of the newly formed InP or GaAs. (2 refs.)

109125 Kinetics of the crystallisation of barium sulphate. Effect of additives, stirring rate and barium:sulphate ratio on the rate of precipitation. E.N.Rizkalla (Faculty of Sci., Ain Shams Univ., Cairo, Egypt).
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.8, p.1857-67 (Aug. 1983).
The kinetics of the crystallisation of barium sulphate has been studied by following the changes in ionic conductivity in supersaturated solutions containing both stoichiometric and non-stoichiometric concentrations of the lattice ions at 298K. The rate of growth showed a quadratic dependence upon the relative supersaturation which suggests a surface-controlled growth mechanism. The effect of sodium tripolyphosphate and several organic phosphonates on the growth kinetics have been studied at several additive concentrations. The retardation effect of these additives has been attributed to the simultaneous chelation of an active-site metal ion and adsorption on the surface through a phosphonate/sulphate exchange. In contrast, low concentration levels of additives such as chromate and ferrocyanide anions enhanced the rate of growth markedly. The latter effect was interpreted in terms of a dynamic adsorption/desorption mechanism. (48 refs.)

109126 Hydrothermal growth of single crystals of TeO_2 and $Te_6O_{11}Cl_2$ in the TeO_2-HCl-H_2O system. V.I.Popolitov, A.Ya.Shapiro (Inst. of Crystallography, Acad. of Sci., USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.2, p.220-3 (March-April 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.2, p.377-82 (March-April 1983). [received: Sept. 1983]
In hydrothermal conditions in the TeO_2-HCl-H_2O system with hydrochloric acid concentrations between 1 and 6 mass %, crystals of TeO_2 and $Te_6O_{11}Cl_2$ with various compositions and structures grow simultaneously from seed. A mechanism of transport of solute to the growing crystals is suggested on the basis of a study of the solubility of TeO_2 and $Te_6O_{11}Cl_2$ in aqueous solutions of HCl. (3 refs.)

109127 LDEF experiments—crystal growth by a solute diffusion process. M.D.Lind (Microelectronics R&D Center, Rockwell Internat., Thousand Oaks, CA, USA), K.F.Nielsen.
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.167-74
Experiments in crystal growth by a solute diffusion process will be performed on the first flight of the NASA Long Duration Exposure Facility (LDEF) in 1984. The process to be investigated is the diffusion of two reactant solutions toward each other through a region of pure solvent in which they react chemically to form single crystals. The experiments are an extension of those performed during the Apollo-Soyuz Test Project (ASTP) and others now being developed for the first Spacelab flight. The LDEF flight will be the first space flight to satisfy completely the processing time requirements of these processes. The LDEF experiments will also incorporate precise control of the temperature, which was not possible in the ASTP experiments. The materials to be investigated are calcium carbonate, lead sulfide, and tetrathiofulvalene-tetracyanoquinodimethane (TlF-TCNQ). (5 refs.)

Reconstruction by multidirectional holographic interferometry of the concentration field in a supersaturated solution near a growing $NaClO_3$ crystal .... See Entry 106735

Structure of synthetic alkali yttrium silicates .... See Entry 107646

Crystallisation and topochemical processes occurring on the surfaces of crystals of phosphates .... See Entry 109799

81.10F Growth from melts

109128 Growth and properties of large $LiNbO_3$ crystals. Liu Jin-long, Li Hui-zhang, Shi Zhong-jian, Yang Yin-lan, Weng Wen-sheng (Inst. of Acoustica, Acad. Sinica, Peking, China).
Acta Phys. Sin. (China), vol.32, no.4, p.473-80 (April 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)* [received: Sept. 1983]
With the pulling direction along [0001] axis and normal of $(10\bar{1}4)$ plane, respectively, growth of large $LiNbO_3$ single crystals was achieved by using Czochralski technique. The dimensions of the crystals were 100 mm in diameter and 50 mm long. Measurements of various properties were made. The quality of these crystals was found to be uniform. Their piezoelastic-dielectric properties were the same as ordinary $LiNbO_3$ single crystals. (8 refs.)

109129 Czochralski growth of $Ba_6Ti_2Nb_8O_{30}$. H.Kuwamoto (Rockwell Internat. Sci. Centre, Thousand Oaks, CA, USA).
Mater. Lett. (Netherlands), vol.2, no.1, p.39-41 (July 1983).
$Ba_6Ti_2Nb_8O_{30}$ (BTN) single crystals have been grown by the Czochralski method under a reducing atmosphere. Crystals grown in an oxidising atmosphere were opaque polycrystals. It was found that BTN decomposes into several phases at temperatures above 1330°C. No congruent melt composition was found around stoichiometric composition in an oxygen or air atmosphere. (4 refs.)

109130 Stochastic model of the crystal growth. I. Theory and basic properties. Z.Chvoj (Inst. of Phys., Czechoslovak Acad. of Sci., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.9, p.961-71 (1983).
The author presents a new method of the description of crystal growth from the melt in the framework of the theory of stochastic processes. This new theory is demonstrated by a very simple linear model to obtain simple and clear results and dependences of the characteristics of crystal growth on external parameters and properties of the material. (3 refs.)

109131 Versatile magnet assembly for Czochralski silicon crystal growth. K.M.Kim, G.H.Schwuttke, P.Smetana (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.2, p.601-3 (July 1983).
A versatile modular magnet assembly consisting of multiple pancake-type coils is described. (no refs.)

109132 On remeltings at the crystal growth from the melt. O.G.Nalbandyan.
Izv. Akad. Nauk Arm. SSR Fiz. (USSR), vol.17, no.1, p.21-6 (1982). In Russian.
Conditions for the appearance of remeltings are obtained for the crystal growth from the melt in the case of a conventional growth model. The characteristic times of crystallization interface inertia were determined and the interface could be taken to be noninertial, i.e. as practically instantaneously following the melting point isotherm. The macrohomogeneity of grown crystals could be achieved by stabilizing the modal picture of convective flows in the melt. (11 refs.)

109133 Preparation and properties of single crystals of some cadmium-containing indium, thallium, and cesium halides. A.V.Orinchai, V.B.Lazarev, E.Yu.Peresh, B.M.Koperl'os, V.S.D'ordyai (Uzhgorod State Univ., Uzhgorod, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1080-6 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1281-7 (Aug. 1982).
Single crystals of the compounds $TlCdI_3$, Tl_4CdI_6, In_4CdI_6, $CsCdCl_3$, $CsCdBr_3$, Cs_2CdBr_4, and Cs_2CdI_4 were grown. Their microhardness, density, and electrical conductivity were measured and transmission and Raman spectra were recorded; the covalent component of the chemical bond was calculated (expressed in terms of the heat of atomisation). The temperature dependence of the dielectric permeability of $CsCdBr_5$ and Cs_2CdBr_4 crystals was investigated. Some laws governing the change in properties of the single crystals under study on going from Cl to Br and from In to Tl were found. (15 refs.)

109134 Recent advances and future directions in CZ-silicon crystal growth technology. G.Fiegl (Siltec Corp., Mountain View, CA, USA).
Solid State Technol. (USA), vol.26, no.8, p.121-31 (Aug. 1983).
Today's advanced micro-circuits require crystalline semiconductor materials with a very high degree of perfection. In addition, price pressures have dictated crystal diameter and melt size increases, although intrinsic material properties do not improve through mere scale-ups. New technologies have to evolve to meet the demands for the most complex devices. A first step in coping with this situation is the recent introduction of a fully computer-controlled crystal growing process, resulting in a high degree of reproducibility. The application of magnetic fields, which aid in the suppression of temperature fluctuations near the crystal melt interface, has led to further improvement towards a more homogenous material. However, inhomogeneities on a macroscopic and microscopic scale, resulting from the nonsteady state nature of the present widely used CZ batch process, can best be controlled through continuous melt replenishment. (10 refs.)

109135 Precipitation process design for denuded zone formation in CZ-silicon wafers. D.Huber, J.Reffle (Wacker Chemitronic, Burghausen, Germany).
Solid State Technol. (USA), vol.26, no.8, p.137-43 (Aug. 1983).
Modern microprocessor controlled silicon growth techniques can provide silicon materials with different tightly controlled oxygen ranges. For internal gettering purposes the precipitation rate of the interstitial oxygen is a parameter as important as the oxygen concentration itself. Fast precipitation rates, either grown into the material or generated by a low temperature preanneal can cause wafer warpage or may create a denuded zone not deep enough at the end of the device process. Materials which do not precipitate at normal process temperatures will obviously not generate internal gettering, but these materials allow the decoupling of the out-diffusion of oxygen from its precipitation. Thus, denuded zones and oxygen precipitation can be formed independently. (10 refs.)

109136 Developments in Czochralski silicon crystal growth. J.W.Moody, R.A.Frederick (Monsanto Electronic Materials Co., St. Peters, MO, USA).
Solid State Technol. (USA), vol.26, no.8, p.221-5 (Aug. 1983).
If past trends can be used as a guide, then 'bigger and better' are the watchwords for future Czochralski silicon development—bigger in the sense of larger diameter crystals from larger charge sizes; better in terms of improved homogeneity and control of impurities and defects. The economics associated with large diameter wafers and the homogeneity required for dense, fast circuits set new material specifications. Recent developments in puller-design and growth processes to meet these stringent demands of the present and future are reviewed. (7 refs.)

An automatic monoellipsoidal mirror furnace facility for long-term crystal growth on EURECA .... See Entry 105327

A single crystal of $YAlO_3$:Ce^{3+} as a fast scintillator in SEM .... See Entry 105431

Review of mercuric iodide development program in Santa Barbara .... See Entry 106217

Nuclear response and phase transformation of melt grown, SbI_3-doped HgI_2 .... See Entry 106220

Investigation of convective flows in model systems of directional solidification configurations .... See Entry 107161

Order of magnitude analysis of solute macrosegregation in crystal growth from the melt .... See Entry 107582

On the effect of ambients on the formation of oxygen-related donors in Cz-Si .... See Entry 107728

Physicochemical investigation of melts and single crystals of lithium tantalate .... See Entry 107732

Density and viscosity of melts in the system Pb-Sn-Te and critical rates of growing $Pb_{1-x}Sn_xTe$ single crystals by the Czochralski method .... See Entry 107795

Convection effects at solid-liquid interfaces—influence of gravity .... See Entry 107888

Interaction between platinum and melts of compounds containing bismuth oxides .... See Entry 107958

Electrical resistivity of undoped GaAs single crystals grown by magnetic field applied LEC technique .... See Entry 108410

Deep electron traps in undoped semi-insulating GaAs grown by the liquid encapsulated Czochralski method .... See Entry 108440

The benitoites $KMgP_3O_9$, $KZnP_3O_9$ and $KCaP_3O_9$: crystal growth, electrooptical and electrostrictive properties .... See Entry 108927

Growth and stimulated emission spectroscopy of $Ca_3Ga_2Ge_3O_{12}$-Nd^{3+} garnet crystals .... See Entry 108979

81.10H Zone melting and zone refining

109137 A continuous method of zone melting. A.Bryczkowski (Inst. of Chem. Processing of Coal Zabrze, Zamkoklal, Poland).
Chem. Eng. Sci. (GB), vol.38, no.8, p.1343-6 (1983).
Methods of continuous zone melting are characterized by a minor productivity in comparison to the periodical melting process—conducted under the same conditions—with the application of a multisectional system of heaters. A continuous method of repeated zone melting has been proposed which allows one to obtain higher yield compared to the one gained in an analogical periodical installation, a yield characterized by a very good equalization of the concentration of impurity in the product in case of distribution coefficient smaller than one. (6 refs.)

109138 RF plasma zone melting apparatus. Y.Kumarishiro (Electotech. Lab., Ibaraki, Japan), N.Yazawa, S.Misawa, A.Itoh.
Plasma Chem. & Plasma Process. (USA), vol.3, no.2, p.249-57 (June 1983).
The characteristics of a RF plasma for the crystal growth of nitrides with high dissociation pressures are described. The electrical behaviour measured with a new ammeter is sensitive to both gas composition and ambient pressure. A VN rod was melted under optimum conditions of 400 torr in an Ar-N_2 mixed plasma to demonstrate that the present crystals have nearly the same composition as those obtained by RF induction heating under 10 atm. of nitrogen. This is direct evidence of chemical dissociation of nitrogen from the melt being suppressed by means of the RF plasma gas. (11 refs.)

109139 Zone-melting preparation of rare earth element orthovanadate crystals. Yu.P.Udalov, Z.S.Appen (I.V. Grebenshchikov Inst. of Silicate Chem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1143-5 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1349-51 (Aug. 1982).
Good quality RE orthovanadate crystals may be prepared by the relatively inexpensive method of zone melting with 'dynamic' immersion by means of an iridium plate heater. The growth of RE orthovanadate crystals by zone melting is a complex combination of physicochemical incongruent evaporation and crystallization from a multicomponent Y_2O_3-V_2O_3-V_2O_5 system. The process requires careful maintenance and control of a set oxygen partial pressure. (11 refs.)

109140 Free-surface vibration of a floating zone induced by surface-tension-driven oscillating flow. C.-H.Chun, W.Wuest (DFVLR-Inst. for Experimental Fluid Mech., Gottingen, Germany), J.Siekmann.
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.205-11
The interaction between the oscillating thermal Marangoni convection in a cylindrical liquid bridge heated from the upper bound and the vibration of the free surface is studied by analysing temperature oscillations due to the flow oscillation and the deflection of a laser sheet passing through the liquid bridge employing an FFT analyzer. The frequencies of the free surface vibrations are strictly the same as those of the temperature oscillations and can be clearly separated from those of the capillary waves. A physical interpretation on the shape of the free surface deformation is given. (9 refs.)

109141 Measurement of the critical Marangoni number in a floating zone under reduced gravity. D.Schwabe, A.Scharmann (I. Phys. Inst., Justus-Liebig-Univ. Giessen, Giessen, Germany).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.213-18
The oscillatory state of thermocapillary convection in floating zone is described. The results of an experiment under reduced gravity in the sounding rocket experiment TEXUS 5 are reported. The Marangoni number for the transition from laminar to oscillatory thermocapillary convection under microgravity is of the order of 9×10^3. The experiment is discussed critically. Further 1-g results are presented and discussed which will serve as the basis for analyzing forthcoming μ-g-experiments. (13 refs.)

109142 Numerical solutions of floating-zone thermocapillary flows. Being-I Fu, S.Ostrach (Dept. of Mech. & Aerospace Engng., Case Western Reserve Univ., Cleveland, OH, USA).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.239-45
A finite difference scheme is used to determine the axisymmetric flow and temperature fields in a half floating-zone configuration. The primary purpose of this study is to determine the effects of the surface-tension Reynolds number, Marangoni number, and Prandtl number on the thermocapillary flow under weightless conditions. The range of parameters considered includes those for actual growth of silicon crystals. A strongly coupled nonlinear numerical scheme and variable grid size are utilized to obtain solutions at the appropriate large ranges of parameters. The effects of buoyancy, surface heat loss, and aspect ratio are also investigated. The flows are found to form essentially a single-cell pattern with the core located nearer to the free surface. The axial velocity near the free surface is two to four times larger than near the axis. (15 refs.)

Influence of geometry on oscillatory Marangoni flows .... See Entry 107158

Evaporation of carbon from the melt during the growth of silicon single crystals .... See Entry 107577

Effect of growth conditions on formation of microdefects in dislocation-free silicon crystals .... See Entry 107698

Almost cylindrical isorotating liquid bridges for small Bond numbers .... See Entry 108124

Conservation laws for liquid bridges .... See Entry 108125

The breaking of axisymmetric non-cylindrical liquid bridges .... See Entry 108126

Stability of axisymmetric liquid bridges .... See Entry 108127

81.10J Growth from solid phases

(inc. multiphase diffusion and recrystallisation)

109143 Study of the synthesis of complex analogs of TlSe by a thermographic method. E.M.Godzhaev, M.M.Zarbaliev, K.M.Dzhafarov, V.A.Mamedov (M. Azizbekov Inst. of Petroleum & Chem., USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1178-80 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1386-8 (Aug. 1982).
The process of synthesis of chalcogen-containing compounds was studied by the method of differential thermal analysis. Thermograms of the process of synthesis were obtained on a NTR-62M brand pyrometer. At the temperature of heating of the initial mixture with composition $TlInSe_2$ (ternary analog), three exoeffects are observed—at 230, 265, and 780°C. The first two effects correspond to the temperature of formation of the compounds In_2Se and Tl_2Se; at 780°C these chalcogenides, combining with one another, form the ternary compound $TlInSe_2$. It can be suggested that the ternary compound $TlInSe_2$ is formed by bypassing the formation of a defective compound. On the thermogram of the synthesis of $TlInGaSe_3$ six exoeffects were observed at 230, 265, 620, 645, 690, and 780°C. These effects probably correspond to the temperatures of formation of the compounds In_2Se, Tl_2Se, In_2Se_2, Ga_2Se, Ga_2Se_3 and $TlInGaSe_3$. (4 refs.)

109144 A new type of regular concretion of crystals [gypsum]. G.V.Russo, T.G.Petrov (State Univ., Leningrad, USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.114-16 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.196-9 (Jan.-Feb. 1983). [received: Sept. 1983]
Investigates concretions in a study of the crystallization of gypsum. To investigate the crystallization of gypsum the authors used a method based on bulk crystallization. Gypsum was formed by the reaction $CaCl_2+Na_2SO_4+H_2O \rightarrow CaSO_4.2H_2O\downarrow$. The authors used supersaturations $\Delta c/c_0$ between 0.5 and 2.0. The temperature was 22°C. (14 refs.)

Technology of high-purity HgI_2 .... See Entry 106218

81.15 METHODS OF THIN FILM DEPOSITION

(inc. epitaxial growth methods; see also 68.55 Thin film growth, structure, and epitaxy)

109145 A new method for the fabrication of submicron thick gallium arsenide membranes. K.C.Lee, J.Silcox, C.A.Lee (Nat. Res. & Resource Facility for Submicron Structures, Cornell Univ., Ithaca, NY, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.488-9 (1 Sept. 1983).
This letter reports a new anodic etching technique for the fabrication of submicron thick, self-limited GaAs films directly from bulk GaAs wafers, without the use of epitaxial layers as etch stops. The new etch stop mechanism used is the apparent reduction, by low dosage ion implantation, of the lifetime of defect electron states (holes) in a submicron thick layer near the surface of the wafer. Since the anodic dissolution of GaAs proceeds with the consumption of six holes per GaAs molecule dissolved, the reduction in the hole lifetimes causes a corresponding reduction in the etch rate of the implanted layer, which therefore enables the fabrication of large area submicron thick GaAs films. Evidence is also presented to show that the thickness of the membranes produced using this technique is approximately twice the projected range of the implanted ions. (8 refs.)

109146 Silver coatings obtained using a wire spraying technique. M.Ghouse, P.R.Krishnamoorthy, B.S.Mann (Materials Sci. Lab., Corporate Res. & Dev. Div., Bharat Heavy Electricals Ltd., Hyderabad, India).
Surf. Technol. (Switzerland), vol.19, no.4, p.363-71 (Aug. 1983).
Silver coatings were obtained on aluminium alloy (LM6) using a wire spraying technique and their bond strength and electrical contact resistance were measured using an Elcometer adhesion tester and a microhammeter respectively. The thickness and the surface roughness of the coatings were measured with an optical microscope and a Taylor Hobson Surtronic 3 instrument respectively; the structure and oxidation of the coatings were examined by means of a scanning electron microscope and a Philips X-ray diffractometer. The results of the present investigation reveal that there is no marked change in the bond strength of the sprayed coatings when bond coatings (Ni_3Al/Cu) are applied. The electrical contact resistance of silver coatings obtained without a bond coating seems to be lower than that for silver coatings with a bond coating. Silver coatings obtained using the wire spraying technique were not oxidized. (6 refs.)

109147 Crystallization of silicon films on glass: a comparison of methods. R.A.Lemons (Los Alamos Nat. Lab., Los Alamos, NM, USA), M.A.Bosch, D.Herbst.
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.581-92
The lure of flat panel displays has stimulated much research on the crystallization of silicon films deposited on large-area transparent substrates. In most respects, fused quartz is ideal. It has high purity, thermal shock resistance, and a softening point above the silicon melting temperature. Unfortunately, fused quartz has such a small thermal expansion that the silicon film cracks as it cools. This problem has been attacked by patterning with islands or moats before and after crystallization, by capping, and by using silicate glass substrates that match the thermal expansion of silicon. The relative merits of these methods are compared. Melting of the silicon film to achieve high mobility has been accomplished by a variety of methods including lasers, electron beams, and strip heaters. For low melting temperature glasses, surface heating with a laser or electron beam is essential. Larger grains are obtained with the high bias temperature, strip heater techniques. The low-angle grain boundaries characteristic of these films may be caused by constitutional undercooling. A model is developed to predict the boundary spacing as a function of scan rate and temperature gradient. (28 refs.)

Otto-Schott-Colloquium on the State of Optical Glass Research 1982 .... See Entry 105025

Controlling deposition of a substance onto the inner surface of a cylindrical channel .... See Entry 107186

Mesure continue de l'epaisseur des revetements sur les toles (Continuous measurement of the thickness of coatings on metal sheets) ....See Entry 109603

81.15C Deposition by cathodic sputtering

109148 Deposition of films of zinc oxide by ion-beam sputtering. A.P.Semenov, M.V.Mokhosoev, V.D.Bazarov.
Elektron. Obrab. Mater. (USSR), no.3, p.83-5 (1983). In Russian. English translation in: *Electrochem. Ind. Process. & Biol. (GB)*
The results are given of a process of sputtering zinc oxide powder, previously sintered in the form of a tablet, by a beam of ions of inert gas. Piezoelectric films of zinc oxide on various substrates were obtained. The technological parameters influencing the quality of the films so obtained are determined. (6 refs.) *A.J.B.*

109149 Predicting conditions for sputtering gas-thermal coatings with given thickness and waviness. G.P.Lazarenko.
Izv. VUZ Mashinostr. (USSR), no.7, p.102-9 (1983). In Russian.
Data on the shaping of gas-thermal coatings sputtered onto plane surfaces and the surfaces of solids of revolution are correlated. The relationship between the mean thickness and waviness of the coating and the technological parameters appropriate for controlling the shape is described. A procedure and algorithms for predicting the conditions required for the process which will ensure the production of coatings with the required macrogeometry for machine production components are given. (4 refs.) *L.M.H.*

109150 Ion beam sputter deposition of optical coatings. J.R.Sites, P.Gilstrap, R.Rujkorakarn (Dept. of Phys., Colorado State Univ., Fort Collins, CO, USA).
Opt. Eng. (USA), vol.22, no.4, p.447-9 (July-Aug. 1983).
A beam of 500 to 1200 eV argon and oxygen ions, neutralized with an equal number of electrons, strikes a target, and the sputtered particles form a deposited layer of SiO_2, Ta_2O_5, or TiO_2. A second beam at lower energy is aimed at the substrate and used for stress modification and predeposition sputter cleaning. Deposited films are mechanically stable and extremely adherent; internal stress is compressive. The primary contaminant is carbon, which is less than one per cent. Refractive indices near 1 μm are 1.47 for SiO_2, 2.03 for Ta_2O_5, and 2.27 for TiO_2. Optical absorptance of half-wavelength films at 1.06 μm is near 10^{-4} for SiO_2 and Ta_2O_5 and near 4×10^{-4} for TiO_2. Damage tests with a 114 μm radius, 5 ns pulse length, 1.06 μm wavelength laser show an onset energy flux for visible damage in the 12 to 30 J/cm^2 range for single-layer films, and slightly less for a three-layer structure. (7 refs.)

109151 Low energy ($\leq$100 eV) sputtering of thin molybdenum nitride films. D.A.Baldwin, N.Shamir, P.Hochmann, J.W.Rabalais (Dept. of Chem., Univ. of Houston, Houston, TX, USA).
Surf. Sci. (Netherlands), vol.130, no.2, p.361-72 (Aug. 1983).
Molybdenum nitride films formed by 100 eV N_2^+ bombardment to saturation of polycrystalline Mo have been sputtered to high fluency by normally incident 100 eV Ar^+ and He^+ and 15 eV Ne^+ while the surface nitrogen concentration was monitored by Auger electron spectroscopy (AES). The penetration distance of nitrogen atoms during film formation and subsequent sputtering is assumed to be small enough that AES will detect, to some degree, all of the nitrogen in the film. The nitrogen AES signal decays exponentially to unsputterable levels for the 15 eV Ne^+ and 100 eV He^+ cases and decays bi-exponentially to near the bulk contamination level for the 100 eV Ar^+ case. The results are interpreted according to existing concepts, but the kinetics of nitrogen loss is modelled using a two-layer adaptation of the standard model for adsorbate monolayer sputtering kinetics. Fitting the proposed model to the data yields apparent cross-sections which are interpreted as composites of cross-sections for experimentally indistinguishable elementary processes; these elementary cross-sections for each process are geometrical averages on the polycrystalline surface. Processes considered, in addition to nitrogen sputtering, include bombardment-induced transport of nitrogen within the film and sputtering of the Mo lattice itself. (33 refs.)

Fabrication of germanium-coated nickel hollow waveguides for infrared transmission .... See Entry 106859

Preparation, crystallization, and magnetic properties of amorphous $Fe_{100-x}B_x$ ($18\leq x\leq42$) .... See Entry 107555

Fabrication of NbN films by DC bias sputtering and their application to superconducting bridges .... See Entry 108589

A study of the luminescent and electrical characteristics of films of ZnS doped with Mn .... See Entry 109018

Production and properties of low electrical resistance molybdenum silicide layers .... See Entry 109552

81.15G Vacuum deposition

109152 Laterally seeded regrowth of silicon over SiO_2 through strip electron beam irradiation. Y.Hayafuji, T.Yanada, S.Usui, S.Kawado, A.Shibata, N.Watanabe, M.Kikuchi (Sony Corp. Res. Center, Yokohama, Japan), K.E.Williams.
Appl. Phys. Lett. (USA), vol.43, no.5, p.473-5 (1 Sept. 1983).
Studies the laterally seeded regrowth of polycrystalline Si film over SiO_2 islands through the use of a very narrow strip electron beam of a high-energy density. A 0.5-μm polycrystalline Si film was deposited over the entire surface of wafers on which SiO_2 islands, 30-100 μm wide and 2 cm long, had been formed. A stationary electron beam 60 μm$\times$3 cm was focused on the wafer surface with an average energy density of 0.7 MW/cm^2 at 10 kV. The wafers were irradiated for 0.1-2 ms while moving at a speed of up to 500 cm/s past the beam. A transmission electron microscopic analysis showed that the laterally seeded regrowth of Si films over SiO_2 islands were realized successfully and that the regrowth film which covered the SiO_2 islands resulted in a quasi-single-crystal film with small-angle boundaries. The average speed of the front of the lateral regrowth over the SiO_2 was estimated to be about 200 cm/s. (22 refs.)

109153 High-quality ZnSe thin films grown by molecular beam epitaxy. T.Yao, M.Ogura, S.Matsuoka, T.Morishita (Electrotech. Lab., Ibaraki, Japan).
Appl. Phys. Lett. (USA), vol.43, no.5, p.499-501 (1 Sept. 1983).
High-quality, nominally undoped, low-resistivity ZnSe thin films are grown by molecular beam epitaxy (MBE). The MBE ZnSe shows the largest peak intensity ratio of the near-band-edge emission to the deep center luminescence even at room temperature compared with other epitaxial techniques, which indicates the smallest concentration of complex defects in the MBE ZnSe. From the temperature dependence of electron mobility for MBE ZnSe, the authors obtained the mobility value as high as 6.9×10^3 cm^2/Vs. This is the highest value ever obtained in epitaxial ZnSe films and indicates the concentration of isolated charge defects as low as 1×10^{16} cm^{-3}. (18 refs.)

109154 Hydrogen in carbon foils made by DC glow discharge in ethylene. P.Bailey, D.G.Armour (Dept. of Electrical Engng., Univ. of Salford, Salford, England), J.B.A.England, N.R.S.Tait, D.W.L.Tolfree.
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.2-3, p.517-23 (1 Aug. 1983).
Thermal deposition has been studied from thin films of carbon prepared by DC glow discharge in ethylene. The only gases released in significant quantities are hydrogen and methane. Both releases can be characterised by a continuum of activation energies but the methane release peaks at a lower temperature than that from hydrogen. The estimated total hydrogen release is compared with the hydrogen content determined by nuclear scattering experiments. Infrared studies suggest that the majority of CH_2 and CH_3 bonds can be ruptured by annealing at 300°C, a temperature well below the hydrogen and methane release rate maxima. Possible hydrogen bonding modes and desorption mechanisms are discussed. (28 refs.)

109155 Enhanced E-beam evaporation of tin. V.C.Marcotte, R.C.Martinson, K.Tautel (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.2, p.608-9 (July 1983).
The objective is to evaporate tin at a high angstrom per second rate. (no refs.)

109156 Phase composition and structure of thin praseodymium and dysprosium sulphide films. L.S.Palatnik, M.N.Naboka, A.P.Kulikov, V.Ya.Shevchenko, V.I.Sergienko, S.S.Borisova (Inst. of Chem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1531-4 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1784-7 (Nov. 1982).
The optimum conditions for the formation of thin films of the sulfides Pr_3S_4 and Dy_2S_3 and epitaxial films of praseodymium and dysprosium monosulfides have been determined. At T_s=650-870K, praseodymium sulfide of the composition Pr_3S_4 is formed on NaCl, quartz and sapphire substrates; at $T_s\approx$670K, the layer on KCl is biphasic (Pr_3S_4+PrS); under the same conditions epitaxial layers of PrS are formed on NaCl. Biphasic layers of the

composition DyS+Dy_2S_3 are formed on KCl substrates at 620-670K. A hexagonal phase of the praseodymium oxysulfide Pr_2O_2S is formed at condensation temperatures of 870K and higher through interaction of the condensate with the residual gases (O_2 and H_2O). (12 refs.)

109157 Chemical conversion of surface and film formation techniques used together with vacuum deposition and ion implantation. M.Satou (Government Industrial Res. Inst., Osaka, Japan), F.Fujimoto.
J. Vac. Soc. Jpn. (Japan), vol.26, no.4, p.287-93 (1983). In Japanese.
An attempt was made to form a new surface layer on a substrate by concurrently performing deposition and ion injection. In this case, although the energy per ion atom was 10 to 20 keV, lower than in ordinary ion injection, the adhesion between the substrate and the new layer was excellent. This paper reports experimental conditions and results on aluminum nitride films formed using nitrogen molecular ions and aluminium as depositing atom. (13 refs.) *K.B.*

Sn ion doping during GaAs MBE with field ion gun .... See Entry 107723

Direct observation of lattice arrangement in MBE grown GaAs-AlGaAs superlattices .... See Entry 108197

Internal stress in evaporated tellurium films .... See Entry 108214

Damped oscillations in reflection high energy electron diffraction during GaAs MBE .... See Entry 108220

Nature of group Ib metal films deposited on polymer surfaces photooxidised with far-ultraviolet (185 nm) radiation .... See Entry 108234

Electrophysical properties of Nb and Nb nitride deposited in a getter magnetron discharge device .... See Entry 108605

Formation of solid solutions in vacuum condensed Al_2O_3-ZrO_2 systems .... See Entry 109248

81.15H Chemical vapour deposition

109158 Hydrogenated amorphous silicon produced by laser induced chemical vapor deposition of silane. M.Meunier, T.R.Gattuso, D.Adler, J.S.Haggerty (MIT, Cambridge, MA, USA).
Appl. Phys. Lett. (USA), vol.43, no.3, p.273-5 (1 Aug. 1983).
The electronic properties of hydrogenated amorphous silicon (*a*-Si:H) produced by laser-induced chemical vapor deposition of silane are reported. Spin density and both optical gap and hydrogen content increased with decreasing substrate temperature. Electrical conductivities are reported. Film properties are superior to those produced by conventional chemical vapor deposition of silane. (22 refs.)

109159 Photodeposition of aluminum oxide and aluminum thin films. R.Solanki, W.H.Ritchie, G.J.Collins (Engng. Res. Center, Colorado State Univ., Fort Collins, CO, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.454-6 (1 Sept. 1983).
Uniform films of Al_2O_3 have been photodeposited using an excimer laser operating at 248 nm (KrF) or at 193 nm (ArF) and trimethylaluminum and N_2O as the reactants. Deposition rates were typically 2000 Å/min and the physical, chemical, and electrical properties of the photodeposited Al_2O_3 films are comparable to films deposited using conventional techniques. Properties of photodeposited aluminum films are also presented. (22 refs.)

109160 AsH_3 to $Ga(CH_3)_3$ mole ratio dependence of dominant deep levels in MOCVD GaAs. M.O.Watanabe (Toshiba Res. & Dev. Center, Kawasaki, Japan), A.Tanaka, T.Udagawa, T.Nakanisi, Y.Zohta.
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.6, p.923-9 (June 1983).
Dependence of the 0.8 eV electron trap (so-called EL2) concentration on the As/Ga mole ratio during growth in MOCVD GaAs has been investigated by varying growth temperatures. It has been found that a demarcation exists in the growth temperatures, which divides two regions with different trap concentration-As/Ga mole ratio relationships. The trap concentration increases with the As/Ga mole ratio by the one-fourth power at growth temperatures of 630°C and 660°C, while it increases with the As/Ga mole ratio by the one-half power at 720°C and 740°C. Corresponding with this difference, there is a slight difference in activation energies between the materials grown at the lower temperatures and those grown at the higher temperatures. A possible explanation based on thermodynamic considerations is presented. (19 refs.)

109161 Degradation-free P-CVD SiN deposition on GaAs FETs. Y.Yamane, Y.Ishii, T.Mizutani (Musashino Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Tokyo, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.6, p.L350-2 (June 1983).
The plasma enhanced chemical vapour deposition (P-CVD) silicon nitride (SiN) effect on normally-off GaAs FETs was examined. It was verified that positive ion bombardment effect brings about GaAs FET degradation. A simple, improved method of successfully achieving damage free SiN deposition on GaAs FETs is proposed. (3 refs.)

109162 A simple reusable susceptor design for MOCVD. J.S.Roberts (Dept. of Electronic & Electrical Engng., Univ. of Sheffield, Sheffield, England).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.850-1 (July-Sept. 1983).
A popular research size reactor is the horizontal design described by Bass (1975) consisting of a quartz envelope and RF heated silicon carbide coated graphite susceptor. During deposition of GaAs and AlGaAs the susceptor surface and reactor walls become coated with polycrystalline material leaving a pattern of the slices on the surface of the susceptor. Subsequent growth with irregular shaped substrates invariably leads to staggering of the coated and uncoated regions of the susceptor, and multiple use results in thick uneven deposits of the residual material. Under such conditions the slice receives uneven radiative heating leading to temperature variations across the wafer. Since slice temperature is an important parameter for residual doping, dopant incorporation, and luminescence efficiency, the resulting epitaxial layer can have uneven properties. The problem of cleaning the susceptor in the absence of an HCl vapor etch has been overcome by using a specially designed susceptor with molybdenum inserts which can be easily removed and cleaned after growth. (1 ref.)

109163 Self-regulation of epitaxial growth of gallium arsenide in a chloride system. I.A.Frolov, B.L.Druz', V.E.Aver'yanov.
Inorg. Mater. (USA), vol.18, no.9, p.1241-3 (Sept. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.9, p.1456-8 (Sept. 1982). [received: Sept. 1983]
The authors have studied the characteristics of gallium arsenide eitaxy with the formation of a local polycrystalline deposit zone in the system Ga-$AsCl_3$-H_2 on the reactor walls. They observed the effect of self-regulation of the epitaxial process due to the change in the size of the gallium arsenide deposit zone on the reactor walls. (4 refs.)

109164 High conductive carbon films obtained by plasma CVD. Y.Onuma, Y.Kato (Faculty of Engng., Shinshu Univ., Wakasato, Nagano, Japan), H.Matsushima.
J. Vac. Soc. Jpn. (Japan), vol.26, no.6, p.563-70 (1983). In Japanese.
Carbon films have been prepared by RF plasma decomposition of benzene vapour, intending to obtain high conductive films at low decomposition temperature. The surface morphology, structure, IR absorption and electrical properties have been investigated. By this method, carbon films can be obtained at decomposition temperature range of 400~1000°C. Electron transmission microscopy and electron diffraction analyses show that carbon films consist of microfine particles and have graphite like structure. Increasing the decomposition temperature, the intensity of absorption corresponding to the vibration of C-H bonds tends to decrease and the resistivity of carbon films rapidly decrease, owing to the crystallization and evaporation of hydrogen. Conductivity of carbon films prepared at low decomposition temperature rapidly increasing the ambient temperature as like semiconductor. On the other hand, carbon films prepared at high decomposition temperature show weak dependence of conductivity on the ambient temperature like narrow gap semiconductors and have p type conduction. (20 refs.)

109165 Procedure of growing thin CdS specimens free from surface contamination for TEM observation. H.Iwanaga, T.Yoshiie.
Solid State Phys. (Japan), vol.18, no.5, p.265-6 (May 1983). In Japanese.
The essential points in producing clean vapor-grown crystals are (1) to utilize a one-side sealed quartz tube, (2) rapid cooling of the furnace and (3) evacuation of the growth zone after the growth. (4 refs.)

Very low-loss and highly reproducible optical fibres by a pressurized MCVD method .... See Entry 106874

New light on fiber fabrication and materials .... See Entry 106905

Optical waveguide manufacturing techniques .... See Entry 106908

Optical fiber and cable manufacture .... See Entry 106909

Low compensation vapor phase epitaxial gallium arsenide ..... See Entry 108208

Mismatch and electron mobility in MBE $Ga_xIn_{1-x}As$ epitaxial layers on InP substrates .... See Entry 108213

Properties and ion implantation of $Al_xGa_{1-x}N$ epitaxial single crystal films prepared by low pressure metalorganic chemical vapor deposition .... See Entry 108579

Epitaxial layers of iron-doped gallium arsenide .... See Entry 108580

Effect of growth temperature on the photoluminescent spectra of undoped AlGaAs grown by metalorganic-chemical vapour deposition .. See Entry 108989

Plasma-enhanced CVD silicon nitride antireflection coatings for solar cells .... See Entry 109898

81.15J Ion plating and other vapour deposition

109166 Heteroepitaxial growth of CdTe on GaAs by laser assisted deposition. J.T.Cheung, M.Koshnevisan (Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA), T.Magee.
Appl. Phys. Lett. (USA), vol.43, no.5, p.462-4 (1 Sept. 1983).
The heteroepitaxial growth of (111) CdTe on (100) GaAs substrates has been obtained by laser assisted deposition at 350°C. Films 5-14 μm thick were characterized by X-ray diffraction, UV reflectance measurement, and transmission electron microscopy. Results indicate good crystallinity with 10^5 cm^{-2} dislocation densities beyond a few microns from the CdTe/GaAs interface. (7 refs.)

109167 Preparation and oxidation of a thin Ba film. A.Shih, G.A.Haas, C.R.K.Marrian (Naval Res. Lab., Washington, DC, USA).
Appl. Surf. Sci. (Netherlands), vol.16, no.1-2, p.93-105 (May-June 1983). (3rd Tri-Service Cathode Workshop, Fort Monmouth, NJ, USA, 23-26 March 1982).
A method of determining the thickness of vapor-deposited thin Ba films is described. The thickness is expressed in terms of numbers of Ba monolayers which were defined and characterized on W (100) and Ir (100) substrates using low energy electron diffraction (LEED) and Auger electron spectroscopy (AES). The changes in the electronic properties of a 10-layer Ba film on Ir (100) during oxidation were studied using low energy electron reflectivity (LEER) measurements. When the oxidation of Ba was nearly complete (as shown by AES), the LEER patterns were similar to that found for a randomly oriented BaO layer with perhaps a partial layer of Ba on the surface. Additional O_2 exposure, however, resulted in the formation of a BaO crystal whose characteristic LEER patterns were similar to that found for a randomly oriented BaO layer with perhaps a partial layer of Ba on the surface. Additional O_2 exposure, however, resulted in the formation of a BaO crystal whose characteristic LEER patterns indicated a Fermi level position which suggested a high density of oxygen-vacancy donors and whose large electron affinity indicated nonstoichiometry at the surface. Further O_2 exposure resulted in a BaO-type surface dipole and oxygen vacancy donor densities more typical of BaO lattices. At this level of oxidation, a minimum work function of 1.4 eV was attained, which was identical to that of an active thin BaO film. Furthermore, AES indicated a Ba to O ratio identical to that of a BaO film. Any change from this stoichiometry through the addition of either oxygen or barium resulted in an increase in the work function. (15 refs.)

109168 Properties of plasma-deposited films using ethylene and fluoroethylenes as starting monomers. T.F.Retajczyk,Jr., P.K.Gallagher (Bell Labs., Murray Hill, NJ, USA).
Mater. Lett. (Netherlands), vol.2, no.1, p.23-6 (July 1983).
Some properties of plasma-deposited films using each of the members of the ethylene and fluoroethylene series of the general formula $C_2H_NF_{4-N}$ (N=0-4) as starting monomers, under otherwise identical deposition conditions, were determined as a function of the fluorine/carbon ratio of the starting monomer. These included film stoichiometry, deposition rate, film stress, hydrophobicity, dielectric constant ($\epsilon \approx 2.6$-3.7), dielectric strength (>200 V/μm), and thermal stability. (6 refs.)

109169 Production of layers of $A^{IV}B^{VI}$ compounds with specific parameters by quasi-closed-volume methods. D.M.Freik (Ivano-Frankovskii State Pedagogic Inst., USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1041-52 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1237-48 (Aug. 1982).
Layers of $A^{IV}B^{VI}$ compounds and their solid solutions are obtained by quasi-closed-volume methods ('hot-wall' and gas-dynamic vapour flow deposition) using an auxiliary chalcogen source. (32 refs.)

Long-lived GaAlAs laser diodes with multiple quantum well active layers grown by organometallic vapor phase epitaxy .... See Entry 106755

Recent advances in optical fiber materials .... See Entry 106836

Metastable Fe(Pd) alloys formed by pulsed electron beam melting .... See Entry 107769

Thermal conductivity and thermal capacity of glow discharge polymers ....See Entry 107978

Phase composition and structure of thin praseodymium and dysprosium sulphide films ....See Entry 109156

81.15L Deposition from liquid phases (melts and solutions)

109170 Liquid phase growth of epitaxial Ni and Co silicides. R.T.Tung, J.M.Gibson, D.C.Jacobson, J.M.Poate (Bell Labs., Murray Hill, NJ, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.476-8 (1 Sept. 1983).
Epitaxial Ni and Co silicides have been fabricated using pulsed laser melting and ultrarapid solidification techniques. Interfacial instabilities and cell formation are suppressed during the liquid phase epitaxy by melting mono or disilicide layers. Single crystal $NiSi_2$ and $CoSi_2$ films have been grown on (100) and (111) Si. This method does not require ultrahigh vacuum deposition or reaction techniques. (10 refs.)

109171 High-efficiency GaP pure green light-emitting diodes of 555 nm fabricated by new liquid phase epitaxy method. T.Kawabata, S.Koike (Semiconductor Div., Matsushita Electronics Corp., Kyoto, Japan).
Appl. Phys. Lett. (USA), vol.43, no.5, p.490-1 (1 Sept. 1983).
A new liquid phase epitaxy (LPE) method, which can control impurity concentration by volatilization of impurities from the growth solution under reduced pressure, has been developed. Using this LPE method, high-efficiency GaP pure green light-emitting diodes, of which the peak wavelength is 555 nm, has been obtained. The average efficiency for an epoxy-encapsulated diode is 0.1% and the maximum efficiency is 0.14% at 16 A/cm^2. (5 refs.)

109172 Chemical deposition of SiO_2 on InP. P.A.Bertrand, P.D.Fleischhauer (Chem. & Phys. Lab., Aerospace Corp., El Segundo, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.832-6 (July-Sept. 1983).
Chemical deposition experiments were performed to determine how surface preparation and film deposition conditions influence the resulting insulator-semiconductor interface composition and chemical structure. Silicon dioxide layers were chemically deposited on indium phosphide by hydrolyzing silicon orthopropoxide. On unoxidized, etched surfaces, coverage was always patchy. On InP with approximately one monolayer of chemisorbed oxygen in a hydrated-phosphate like environment, a continuous, ~60-Å-thick SiO_2 film was formed at room temperature. SiO_2 attached to the substrate through about one monolayer of Si-O-P bonds. Heating to 50°C during hydrolysis resulted in a mixed Si-In-P oxide, owing to simultaneous hydrolysis and oxidation processes. (13 refs.)

109173 Growth of epitaxial $Cd_xHg_{1-x}Te$ layers from mercury solutions of Cd and Te. Ya.F.Dub, V.I.Ivanov-Omskii, V.K.Ogorodnikov (A.F. Ioffe Phys. Tech. Inst., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1072-5 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.,* vol.18, no.8, p.1271-4 (Aug. 1982).
Epitaxial $Cd_xHg_{1-x}Te$ layers on CdTe substrates can be obtained by liquid epitaxy from mercury solutions. At high degrees of supersaturation of the solution ($\Delta t > 3$°C), the constitutional supercooling on the crystallisation front can be prevented by introducing a temperature gradient $Gl > 8$ deg/cm. The gradient of the composition across the thickness of a layer increases with increasing supercooling. The variation of the composition across the thickness of a layer is caused mainly by diffusion processes. (01 refs.)

109174 Choice of solvent for liquid-phase epitaxy of $Ga_xIn_{1-x}As_yP_{1-y}$ solid solutions. A.A.Selin, V.N.Vigdorovich, V.P.Batura (Inst. of Electronic Technol., Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.9, p.1248-51 (Sept. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.,* vol.18, no.9, p.1464-7 (Sept. 1982). [received: Sept. 1983]
An examination of the heterogeneous equilibria in the Ga-In-As-P system has shown that crystallization of $Ga_xIn_{1-x}As_yP_{1-y}$ solid solutions can be brought about over practically the whole range of compositions, from melts having compositions corresponding to the In-GaAs-GaP-InAs-InP concentration pyramid. The growth of epitaxial layers of solid solutions isoperiodic with indium phosphide or gallium arsenide must be carried out from melts having compositions within the In-GaAs-InAs-InP concentration tetrahedron (with $x \geq 0.85$, in the case of isoperiodicity with gallium arsenide, the In-GaAs-GaP-InP concentration tetrahedron has to be used). (10 refs.)

109175 Production of high-strength nickel coatings by pulse electrolysis. V.A.Zabludovskiy, Yu.V.Krivusha, N.A.Kostin.
Russ. Metall. (GB), no.2, p.54-7 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.,* no.2, p.58 (1982).
The structure of galvanic nickel coatings obtained with a unipolar pulse current was studied; an increase in pulse-current amplitude density leads to formation of a defective structure. The change in structure greatly affects the physico-mechanical properties of the nickel coatings. (8 refs.)

109176 Experimental studies of laterally seeded recrystallized, polysilicon on silicon dioxide. S.Banerjee (Coordinated Sci. Lab., Univ. of Illinois, Urbana, IL, USA), B.G.Streetman.
UGIM-83 Proceedings. 1983 University/Government/Industry Microelectronics Symposium, College Station, TX, USA, 25-27 May 1983 (New York, USA: IEEE 1983), p.79-83
Zone melting recrystallization using a scanning graphite strip heater has been employed to prepare device quality single crystal silicon films on silicon dioxide covered silicon substrates. The films contain low angle grain boundaries at about 25 μm intervals. These have a negligible effect on dopant activation and carrier mobilities in ion implanted films. Planar p-n junctions fabricated in these films have slightly higher leakage than similar junctions in bulk silicon, apparently due to intersection of the low angle grain boundaries with the junction. The results indicate, however, that device quality films on insulating substrates can be conveniently grown by zone melting recrystallization. (9 refs.)

109177 Lateral epitaxial growth of thick polysilicon films on oxidized 3-inch wafers. G.K.Celler, McD.Robinson, D.J.Lischner, T.T.Sheng (Bell Labs., Murray Hill, NJ, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.575-80
In the technique of lateral epitaxial growth over oxide (LEGO), crystallization is initiated at seeding was in SiO_2 and propagates over the amorphous insulator, resulting in high structural quality of the grown film. Uniform and bow-free crystallization of complete 3-inch wafers occurs in <60 sec in a special furnace, with wafers placed between a bank of high intensity tungsten halogen lamps and a water cooled base. The authors provide further details of crystallization procedure and new structural characterization data. The mechanism of LEGO crystallization and its limitations are also discussed. (8 refs.)

A 1.59 μm wavelength GaInAsP/InP distributed feedback laser with first-order grating on anti-meltback layer ....See Entry 106781

Solubility of silicon carbide in tin and gallium ....See Entry 107943

Thermal Soret diffusion in the liquid phase epitaxial growth of binary III-V compounds ....See Entry 107995

Crystalline perfection of heteroepitaxial structures of $Al_{0.3}Ga_{0.7}P_yAs_{1-y}$-GaAs grown from the liquid phase ....See Entry 108203

Measurement of compositional inhomogeneity of liquid phase epitaxial InGaPAs ....See Entry 108209

High-resistivity ($>10^5$ Ω.cm) InP layers by liquid phase epitaxy ....See Entry 108210

A study of meniscus lines on the surface of LPE-GaAs ....See Entry 108211

Influence of supercooling on the compositional homogeneity of $InAs_{1-x}Sb_x$ solid solutions in the case of liquid-phase epitaxy ....See Entry 108226

Superlattices formed by electrodeposition of silver on iodine-pretreated Pt(111); studies by LEED, Auger spectroscopy and electrochemistry ..See Entry 108235

Characteristics of recrystallised polysilicon on SiO_2 produced by dual electron beam processing ....See Entry 108240

Linear zone-melt recrystallized Si films using incoherent light ....See Entry 108241

Knurl roll design for stable rotogravure coating ....See Entry 109540

Influence of evolution of hydrogen on the value of the slope of polarization curves during cathodic deposition of metals of the iron group ....See Entry 109751

Sprayed CdS-Cu_2S solar cells. II. Preparation of CdS by airless spray ....See Entry 109891

81.20 OTHER METHODS OF PREPARATION OF MATERIALS

109178 Electrochemical synthesis of photoactive MoS_2. L.F.Schneemeyer, U.Cohen (Bell Labs., Murray Hill, NJ, USA).
J. Electrochem. Soc. (USA), vol.130, no.7, p.1536-9 (July 1983).
The growth of polycrystalline films and single crystals of molybdenum disulfide by electrolytic reduction of a sodium tetraborate-sodium fluoride melt containing molybdenum trioxide and sodium sulfate has been examined and physical properties of those deposits studied. Polycrystalline n-type MoS_2 is readily obtained from a melt at 800°C while larger single-crystals are obtained if the melt temperature is 900°C. MoS_2 is a semiconductor with bandgap well matched to the solar spectrum and with unusual resistance to photoelectrochemical corrosion. Electrochemically-grown single crystals and polycrystalline films were employed as photoanodes in aqueous iodide-triiodide electrolytes under ~40 mW/cm^2 tungsten-halogen illumination. Open-circuit photopotentials of ~150 mV were observed for polycrystalline MoS_2. For single crystal electrolytic MoS_2 an open-circuit photopotential of 210 mV and ~2 mA/cm^2 short circuit current were reached. The use of electrochemical methods to prepare these materials offers the advantages of relatively low growth temperatures, controlled thickness, and excellent adaptability to producing large-area films inexpensively. (21 refs.)

Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191) ....See Entry 105032

Variation of the magnetic properties of $SmCo_5$ powders by water milling ....See Entry 108740

81.20E Powder techniques, compaction and sintering

109179 Investigation of the sintering process of NiO from the point of view of its electronic structure. M.M.Ristich, D.Ch.Stefanovich, L.F.Pryadko.
Bull. Acad. Serbe Sci. & Arts Cl. Sci. Tech. (Yugoslavia), no.20, p.1-13 (1982). In Russian.
Investigates the changes in density, microstructure and electronic properties of NiO during pressing and sintering processes. The experimental studies were conducted in a wide interval of pressing pressure which influence the stoichiometry of NiO powder and which was studied by measuring the electrical conductivity of pressed samples. The experimental data were used to calculate the changes in the electronic structure of NiO during sintering. (23 refs.)
V.G.P.

109180 Particle growth mechanisms in fluidised bed granulation. I. The effect of process variables. P.G.Smith, A.W.Nienow (Dept. of Chem. & Biochem. Engng., Univ. Coll. London, London, England).
Chem. Eng. Sci. (GB), vol.38, no.8, p.1223-31 (1983).
Two types of product granule have been identified in an experimental study of batch fluidised bed granulation; agglomerates which consist of two or more, and usually several, initial particles; and layered granules, which consist of single primary particles with dried feed material adhering to the surface. Increasing the excess fluidising gas velocity, in the range $U\text{-}U_{mf}$=0.15-0.525 m s^{-1}, resulted in decreased particle growth rates and, depending upon the binder material, a change in product morphology from agglomerates to layered granules. Similar changes resulted from increasing the mean size of the starting material. Thus, a mechanism of particle growth is proposed in which the strength of inter-particle bridges and the extent of fluid drag and inertial forces on particles determine the equilibrium granule form and size. (21 refs.)

109181 Particle growth mechanisms in fluidised bed granulation. II. Comparison of experimental data with growth models. P.G.Smith, A.W.Nienow (Dept. of Chem. & Biochem. Engng., Univ. Coll. London, London, England).
Chem. Eng. Sci. (GB), vol.38, no.8, p.1233-40 (1983).
For pt.I see ibid., vol.38, p.1223-31 (1983). Growth data from batch granulation experiments have been fitted to simple geometrical models. Layered granule growth approximates to concentric coating of core particles with binder, although the actual mechanism of growth is different. In the case of agglomeration, a relationship is established between mean granule size and binder content. (5 refs.)

109182 Localized particle fracture during compression of materials expected to undergo plastic deformation. G.R.B.Down (Pharmacy Res. & Dev., Merck Frosst Canada Inc., Pointe Claire-Dorval, Quebec, Canada).
Powder Technol. (Switzerland), vol.35, no.2, p.167-9 (July-Aug. 1983).
When powders are compressed in a die during tablet making, various stages of compaction occur, starting with rearrangement of the powder to its closest packing, followed by eventual plastic deformation or brittle fracture. Scanning electron microscopy has been utilized to further characterize all stages of compression. It is shown that materials, such as sodium chloride, which undergo eventual plastic deformation undergo some form of fracture during

the earlier stages of compaction due to the creation of high localized stresses acting on individual particles. (5 refs.)

109183 Application of critical state to uniaxial compaction. N.G.Stanley-Wood, A.M.Abdel Karim (Postgraduate School of Powder Technol., Univ. of Bradford, Bradford, England).
Powder Technol. (Switzerland), vol.35, no.2, p.185-93 (July-Aug. 1983).
From the radial stress σ_R and the normal stress σ_A, measured continuously during uniaxial loading and unloading on three compactable (sodium chloride, polyethylene and tartaric acid) and two non-compactable (polypropylene and polystyrene plastics) materials, characteristic compaction profiles of $(\sigma_A-\sigma_R)$ versus $(\sigma_A+\sigma_R)$ can be observed. The uniaxial loading stress pathways for both compactable and non-compactable materials validated the assumption that the Coulomb yield criterion, which is usually applicable for the shear testing of soils, can be applied to the uniaxial compression of particulate materials. In addition, the unloading stress profiles for the compactable materials produced two characteristic parameters: a normal stress value at zero shear $(\sigma_A+\sigma_R)_0$ and a minimum shear stress value $(\sigma_A\text{-}\sigma_R)_{\min}$. (15 refs.)

109184 Dislocation-activated solid-phase sintering. W.Schatt, E.Friedrich (Tech. Univ. Dresden, Dresden, Germany).
Z. Metallkd. (Germany), vol.74, no.8, p.489-93 (Aug. 1983). In German.
The integral dislocation densities measured by means of the positron annihilation spectroscopy on compacts of electrolytic copper powder in dependence on the sintering temperature and sintering time as well as the shrinkage and shrinkage velocity evaluated under the same conditions on identical samples lead to the conclusion that the dislocation multiplication in the course of sintering (self-activation) constitutes a general phenomenon of one-component sintering. In the stage of intensive shrinkage obviously, it is a necessary condition for a rapid material transport which is effected by particle sliding at simultaneous shape accommodation. (14 refs.)

Preparation of (UPu)C, (UPu)N and (UPu) (CN) powders ......See Entry 106070

Structure study of lead oxides used as precursors of lead zirconate-titanate sintering process ......See Entry 107500

Electrical conduction in nickel ferrite ......See Entry 108461

Low-temperature dielectric properties of ceramic potassium tantalate ($KTaO_3$) ......See Entry 108867

The metallurgy and applications of beryllium ......See Entry 109185

Microcrystalline iron-base alloys made using a rapid solidification technology . ...See Entry 109186

Structure and properties of rapidly solidified 7075 P/M aluminum alloy modified with nickel and zirconium ......See Entry 109187

Possibilities of deoxidation of molybdenum with manganese and metals of the iron group ......See Entry 109188

On the local grain growth in WC/Co cemented carbides ......See Entry 109189

Hot isostatic pressing in ceramics ......See Entry 109196

Preparation and strength of forsterite-zirconia ceramic composites ......See Entry 109197

Synthesis of alumina and zirconia fibers ......See Entry 109198

Densification of silicon nitride powder with various additives ......See Entry 109199

Influence of precipitation procedure on sinterability of Y_2O_3 prepared from hydroxide precursor ......See Entry 109200

The use of molten magnesium chloride in the preparation of crystalline ceramic powders ......See Entry 109201

Preparation of Mn-Zn ferrites having a low temperature coefficient of permeability ......See Entry 109203

Effect of chemical composition on the sinterability of ultrafine SiC powders ... .See Entry 109204

Mechanism and kinetics of formation of ferrite in the solid phase in the $CaO\text{-}Fe_2O_3$ system [Mossbauer observations] ......See Entry 109205

The effect of MnO_2 and La_2O_3 additions on the sintering of $Pb(Zr,Ti)O_3$ solid solutions ......See Entry 109206

Use of emanation thermal analysis in the evaluation of sinterability of ceramic powders ......See Entry 109207

Corundum ceramics with reduced sintering temperatures ......See Entry 109208

Structural and magnetic studies of pure and substituted gamma iron oxide ....See Entry 109322

Material-oriented preparation of sintered ceramic bodies ......See Entry 109649

Formation of surface states on strontium oxide powders. [Photoluminescence observations] ......See Entry 109804

Estimation of the co-ordination number in a multi-component mixture of spheres ......See Entry 109820

81.20G Specific metals and alloys (compacts, pseudoalloys)

109185 The metallurgy and applications of beryllium. C.V.Sundaram, C.M.Paul, B.P.Sharma (Metall. Div., Bhabha Atomic Res. Centre, Bombay, India).
Trans. Indian Inst. Met., vol.35, no.2, p.171-92 (April 1982). [received: Aug. 1983]
Beryllium metal by virtue of its unique combination of physical, mechanical and nuclear properties is an attractive choice for specific functions in selected areas of modern engineering. At the same time, on account of the limited ductility of cast beryllium, the effective harnessing of the metal for structural applications has posed a challenge to the metallurgists over the years. During the past decade, however, there has been considerable progress in beryllium metal technology, and new grades of beryllium having superior strength and ductility have been developed. Improvement in the purity and morphology of the metal powder through electrorefining and impact attritioning techniques, and the emergence of hot isostatic pressing technology have been the major breakthroughs. As a result powder metallurgy beryllium products close to theoretical density with reduced microporosity and good three dimensional ductility are now available for structural applications. Physical metallurgy developments have been concerned with optimising microstructural features—grain size, dislocation density and beryllium oxide particle size and volume fraction—through control of specific impurities, micro-alloy additions and thermomechanical treatments. For critical applications where toughness and ductility comparable to other light alloys are required, new beryllium-aluminium alloys have been developed. Considerable headway has also been made in the metal forming and joining techniques. (88 refs.)

109186 Microcrystalline iron-base alloys made using a rapid solidification technology. R.Ray, V.Panchanathan (Marko Materials Inc., North Billerica, MA, USA), S.Isserow.
J. Met. (USA), vol.35, no.6, p.30-6 (June 1983).
Initial results of investigation on selected iron-base alloys using a rapid solidification powder metal technology are reported. The various alloys studied include commercial precipitation hardenable (PH) stainless steels, iron-aluminide-base alloys and high-speed steels. These alloys were modified with specific amounts of boron and processed by melt spinning as rapidly solidified powders followed by hot extrusion. The consolidated alloys were subjected to various heat treatment procedures for optimum mechanical properties. A 30-35% improvement in tensile strength combined with good ductility has been achieved in boron modified PH stainless steel compared to the conventional alloys. Rapidly solidified Fe-Al-B alloys show high specific strength and modulus of elasticity in the temperature range 1000-1400°F. The other noteworthy attributes of the iron-aluminide-base alloys are outstanding oxidation resistance, good low-cycle fatigue strength and high thermal stability at elevated temperatures. Very high elongations, typically up to 280%, were achieved in these alloys at high temperatures (1600°F), indicating the possibility of superplastically hot forming these materials. A rapidly solidified boron-modified tool steel showed significant improvement in tool life in cutting (turning) tests, compared to its commercial counterpart. (6 refs.)

109187 Structure and properties of rapidly solidified 7075 P/M aluminum alloy modified with nickel and zirconium. P.K.Domalavage, N.J.Grant (Dept. of Materials Sci. & Engng., MIT, Cambridge, MA, USA), Y.Gefen.
Metall. Trans. A (USA), vol.14A, no.8, p.1599-606 (Aug. 1983).
Aluminum alloy 7075 was modified by additions of 1.1 wt.% nickel and 0.8 wt.% zirconium, rapidly solidified by ultrasonic gas atomization, canned, cold compacted, hot extruded, and evaluated in terms of structure and properties. Significant improvements in tensile strength (627 MPa YS and 680 MPa UTS) and crack growth rates were realized, along with a decrease in fracture toughness (23.7 MPa $\sqrt{m}$) while maintaining ductility (10% elong.) as compared to nominal I/M 7075 behavior. A variety of experiments was performed to evaluate effects on strength, ductility, and on structure. The variables were: power size distribution, extrusion ratio, extrusion profile, different size fractions from the same lot of powder, and different locations of test bars in the several extrusions. Tensile properties, toughness, and fatigue properties were not importantly influenced by the location of test bars in the cross section or length of rectangular extruded bars. A comparison of mechanical properties from extruded bars prepared from -53 μm powders vs. 53 to 250 μm powders showed a small loss of ductility and fatigue stress for 10^7 cycles for the fine poweder product. (13 refs.)

109188 Possibilities of deoxidation of molybdenum with manganese and metals of the iron group. A.M.Bogomolov, Yu.S.Kim, L.V.Navalikhin.
Russ. Metall. (GB), no.1, p.35-8 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.39-42 (1982).
Introducing up to 0.8 wt.% Mn into molybdenum reduces its hardness and lowers the total concentration of oxygen in specimens. On alloying molybdenum with manganese and metals of the iron group, only oxide phases of manganese with a composition close to MnO_2 can be formed in the matrix. For the deoxidation of molybdenum, alloying with manganese is preferable to alloying with metals of the iron group. (16 refs.)

109189 On the local grain growth in WC/Co cemented carbides. T.Schmitt, M.Schreiner, E.Lassner, B.Lux (Inst. fur Chem. Technol. Anorganischer Stoffe, Tech. Univ. Wien, Wien, Austria).
Z. Metallkd. (Germany), vol.74, no.8, p.496-9 (Aug. 1983). In German.
It was shown that coarse polycrystalline WC particles, present in fine-grained WC powders can induce local grain growth during sintering with cobalt. This phenomenon is illustrated by mixing fine-grained WC/Co powders with 4 wt.% coarse Mo_2C. Grain growth of the coarse particles was revealed by elemental distribution of Mo and W in the crystals and as a result of the different etching behaviours of coarse WC crystals with and without Mo. The mechanism was identified as a solution-reprecipitation process phenomenologically similar to Ostwald ripening. The actual grain growth process, preceded by particle disintegration, is succeeded by grain shape accommodation. (18 refs.)

Preparation of thorium metal sponge from thorium oxalate ..See Entry 106069

Sounding-rocket flight test of an acoustic mixer by manufacture of a lead zinc emulsion alloy in microgravity ......See Entry 106949

Metastable Fe(Pd) alloys formed by pulsed electron beam melting ......See Entry 107769

Amorphous Al(Ni) alloy formation by pulsed electron beam quenching ......See Entry 107770

A study on the modification of eutectic Al-Si alloys by Sr in permanent mold casting ......See Entry 109268

Structure and properties of alloys of the Al-Mn system quenched from the liquid state ......See Entry 109270

On the difference between 'baykovite' and finely dispersed ledeburite ......See Entry 109271

Influence of carbon vacuum deoxidation on the properties of 34KhN1M steel .. ..See Entry 109484

Influence of evolution of hydrogen on the value of the slope of polarization curves during cathodic deposition of metals of the iron group ......See Entry 109751

Peculiarities of the electroreduction of aluminum from high-temperature aluminum chloride melts ......See Entry 109762

81.20J Dispersion-,fibre-, and platelet-reinforced metal-based composites

109190 Metallic composite materials and microgravity. L.Froyen, A.Deruyttere (Dept. Metaalkunde, Katholieke Univ. Leuven, Leuven, Belgium).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.31-6
Interfacial phenomena such as wetting, formation of a compound, diffusion between the metallic matrix and the dispersed phase play a crucial role for the fabrication process and for the final product properties of metallic composite materials. Therefore the wetting behaviour of the material systems Al-SiC and Cu-SiC has been investigated. The interpretation of the TEXUS 6-samples and the concept of the forthcoming space experiments during the TEXUS 7 and SPACELAB 1 flights are based on these results. (9 refs.)

81.20L Ceramics and refractories

109191 Ceramics from polymer pyrolysis, opportunities and needs—a materials perspective. R.W.Rice (Naval Res. Lab., Washington, DC, USA).
Am. Ceram. Soc. Bull. (USA), vol.62, no.8, p.889-92 (Aug. 1983).
Past work on polymer pyrolysis is reviewed. The opportunities, as well as some of the needs, for making several important non-oxide ceramics by polymer pyrolysis are presented. Compositions already achieved, as well as others that may be feasible, are discussed, along with expected limitations due to density considerations. Possible applications and expected microstructures are also reviewed. (33 refs.)

109192 Special heat-resisting materials from organometallic polymers. S.Yajima (Tohoku Univ., Ibaraki-ken, Japan).
Am. Ceram. Soc. Bull. (USA), vol.62, no.8, p.893-8, 903, 915 (Aug. 1983).
From organometallic polymers special heat-resisting materials are obtained by heat treatment. Organometallic polymers made in the author's laboratory are two kinds of polycarbosilanes and two kinds of polyborosiloxanes. These polymers are converted into SiC ceramics by heat treatment. A polycarbosilane is formed into a fiber and it is heated up to 1300°C, so that a SiC fiber with high tensile strength is obtained. This polymer is also promising as a binder for sintered SiC powders. Various heat-resisting materials obtained using organometallic polymers and their characteristics are described. (22 refs.)

109193 Polysilastyrene: phenylmethylsilane-dimethylsilane copolymers as precursors to silicon carbide. R.West, L.D.David, P.I.Djurovich, H.Yu (Univ. of Wisconsin, Madison, WI, USA), R.Sinclair.
Am. Ceram. Soc. Bull. (USA), vol.62, no.8, p.899-903 (Aug. 1983).
Cocondensation of phenylmethyl-$SiCl_2$ and dimethyl-$SiCl_2$ with sodium metal in toluene leads to copolymers of the formula $[(Me_2Si)_x(PhMeSi)]_n$ where $x=0.6$ to 1.4 (polysilastyrene). Synthesis and some physical properties are described for the polymer, which can be molded, cast into films or drawn into fibers. Exposure of the solid polymer to ultraviolet light leads to crosslinking. The crosslinked polymer can be thermolyzed to silicon carbide by heating above 800°C in an inert atmosphere. (22 refs.)

109194 Polycarbosilane precursors for silicon carbide. C.L.Schilling,Jr., J.P.Wesson, T.C.Williams (Union Carbide Corp., Tarrytown, NY, USA).
Am. Ceram. Soc. Bull. (USA), vol.62, no.8, p.912-15 (Aug. 1983).
One-step preparations of tractable polycarbosilanes are achieved through silicon-carbon bond-forming reactions of vinylic or chloromethyl ($ClCH_2^-$) silanes. These polymers are directly convertible to silicon carbide compositions by atmospheric pressure pyrolysis. Backbone branching is recognised as essential for practical conversion of such polycarbosilanes to silicon carbide. (16 refs.)

109195 Preparation and properties of monolithic and composite ceramics produced by polymer pyrolysis. B.E.Walker,Jr., R.W.Rice, P.F.Becher, B.A.Bender, W.S.Coblenz (Naval Res. Lab., Washington, DC, USA).
Am. Ceram. Soc. Bull. (USA), vol.62, no.8, p.916-23 (Aug. 1983).
A survey of a number of available compounds showed a general trend for measurable-to-good ceramics yields from pyrolysis to more ofen be associated with cage, phenyl, unsaturated ring and unsaturated chain structures, than with precursors having saturated bonds and metal constituents contained mainly in side groups. More detailed studies were performed on selected polymers giving yields of compounds of interest, e.g. some giving ~60% yields of SiC. Retention of some structural integrity and measurable strengths especially in composites suggests that production of small pieces of bulk ceramics, and especially ceramic composites is feasible by such processing. Electron microscopy of pyrolysis products shows most porosity to be quite fine, e.g. 0.05 to 0.5 μm and grain structure to be also be very fine, e.g. 0.1 to 0.3 μm and possibly truly absent in some cases. (9 refs.)

109196 Hot isostatic pressing in ceramics. K.Hunold (Elektroschmelzwerk Kempten GmbH, Kempten, Germany).
CFI-Ceram. Forum Int. Ber. Dtsch. Keram. Ges. (Germany), vol.60, no.5-6, p.182-9 (30 July 1983). In German, English.
A survey of possible applications for hot isostatic pressing (HIP) in connection with ceramic materials is presented. Several sample applications are examined for the purpose of indicating the advantages and disadvantages of the process for the compaction of special ceramics and pointing out some economic aspects in a comparison with conventional manufacturing methods. (22 refs.)

109197 Preparation and strength of forsterite-zirconia ceramic composites. Shen Yangyun, R.J.Brook (Dept. of Ceramics, Univ. of Leeds, Leeds, England).
Ceram. Int. (Italy), vol.9, no.2, p.39-45 (1983).
Forsterite ceramics, toughened with zirconia inclusions, have been prepared by heat treating mixtures of zircon and magnesia. The ceramics have been sintered both with and without applied pressure. The extent of reaction, the fraction of tetragonal zirconia and the density of the product materials have been determined. The strength has been measured in 3 point bend tests. Owing to the fact that the rate of reaction is faster than the rate of pore removal during pressureless sintering suitable microstructures have not been prepared by this technique. However, hot pressing yields dense, fully reacted, materials with 35% of the zirconia present in the tetragonal form; these materials have strengths (>350 MPa) substantially greater than those of conventional forsterite ceramics. (10 refs.)

109198 Synthesis of alumina and zirconia fibers. P.A.Vityaz, I.L.Fyodorova, I.N.Yermolenko, T.M.Ulyanova (Powder Metall. Res. Inst., Minsk, Belorussian SSR).
Ceram. Int. (Italy), vol.9, no.2, p.46-8 (1983).
The results of investigations of conversions occurring during synthesis of aluminum oxide and zirconium dioxide porous fibres with alloying additions in the temperature range from 20 to 1300°C are presented. The analysis of the experimental results enabled features typical for pyrolitic conversion and sintering of aluminum oxide—and zirconium dioxide—base ceramic fibres to be revealed. (1 ref.)

109199 Densification of silicon nitride powder with various additives. S.K.Bhattacharya, A.C.D.Chaklader (Dept. of Metall. Engng., Univ. of British Columbia, Vancouver, Canada).
Ceram. Int. (Italy), vol.9, no.2, p.49-52 (1983).
Cold compaction behavior of a sub-micron size silicon nitride powder with additives has been studied at various loading rates up to about 450 MPa. Liquid lubricants are found to be more effective than the solid lubricants. A marked increase in relative density has been obtained with the aid of 10 weight percent polyethyleneglycol after surface treatment of the powder with a dispersant solution. The loading rate between 0.8 and 800 MPa per minute has no effect on the densification process. Results are analysed with various theoretical equations available in the literature. The Cooper and Eaton's equation (1962) and also its modified form are used to determine the mechanism of densification during cold compaction. (11 refs.)

109200 Influence of precipitation procedure on sinterability of Y_2O_3 prepared from hydroxide precursor. M.D.Rasmussen, G.W.Jordan, M.Akinc, O.Hunter,Jr., M.F.Berard (Dept. of Materials Sci. & Engng., Iowa State Univ., Ames, IA, USA).
Ceram. Int. (Italy), vol.9, no.2, p.59-60 (1983).
The sinterability of Y_2O_3 prepared from reverse strike hydroxide precursors was found to be highly dependent on final pH and precursor dewatering procedure, high pH recursors yielding poorly-sinterable oxides if oven dried, but quite sinterable oxides if dewatered either by acetone-toluene-acetone or controlled-humidity treatments. Direct strike hydroxide precursors yielded highly-sinterable Y_2O_3 regardless of final pH or dewatering procedure. (9 refs.)

109201 The use of molten magnesium chloride in the preparation of crystalline ceramic powders. E.I.Cooper, D.H.Kohn (Dept. of Chem., Technion-Israel Inst. of Technol., Haifa, Israel).
Ceram. Int. (Italy), vol.9, no.2, p.68-72 (1983).
The interaction of molten $MgCl_2$ with various oxides and oxide minerals is described. Within several hours, at temperatures of 700-1100°C, components such as oxides of Fe, K, Ca and—under proper conditions—Ti are largely converted into the corresponding chlorides, the more volatile of which evaporate, the others being extracted into the liquid phase. By proper choice of stoichiometry, crystalline cordierite, forsterite, enstatite and spinel could be prepared; they contained a total <0.2% of oxides of Na, K, Ca and Fe, and their average-diameter range was usually 1-10 μm (or larger for forsterite). The preparation of other microcrystalline powders in molten $MgCl_2$ is briefly discussed. (32 refs.)

109202 Synthesis of iron-dispersed carbons by pressure pyrolysis of divinylbenzene-vinylferrocene copolymer. S.-I.Hirano, T.Yogo, H.Suzuki, S.Naka (Synthetic Crystal Res. Lab., Nagoya Univ., Nagoya, Japan).
J. Mater. Sci. (GB), vol.18, no.9, p.2811-16 (Sept. 1983).
Versatile carbons with finely dispersed iron were synthesized by pressure pyrolysis of a copolymer prepared from divinylbenzene and vinylferrocene at temperatures below 680°C and pressures of 125 MPa. The pyrolysis conditions of the copolymer were found to influence the final morphology of carbons to give fibrils, spheres and polyhedra. The resulting carbons contained uniformly fine particles of cementite (Fe_3C) which were less than 30 nm in size, whereas the magnetite was dispersed in the carbon matrix by pressure pyrolysis in the presence of water. Highly dispersed cementite in carbon was found to decompose into metallic iron by further heat treatment above 850°C. Porous spherulitic carbons were also synthesized by heat treatment of magnetite containing carbon spherulites. (8 refs.)

109203 Preparation of Mn-Zn ferrites having a low temperature coefficient of permeability. P.K.Gallagher, E.M.Gyorgy, D.W.Johnson,Jr., M.Robbins, E.M.Vogel (Bell Labs., Murray Hill, NJ, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.7, p.C110-11 (July 1983).
Substitutions of Ge, and to a lesser extent Ga, for Zn in manganese-zinc ferrite were found to increase the initial permeability (μ) from ≈200 to ≈1000. The relative temperature coefficient of permeability is very low (<0.02%) over the range −40° to +80°C. These desired properties are achieved without controlling the atmosphere during sintering and subsequent cooling provided that the atmosphere contains ≥1 vol% O_2. (3 refs.)

109204 Effect of chemical composition on the sinterability of ultrafine SiC powders. J.Hojo, K.Miyachi, Y.Okabe, A.Kato (Dept. of Appl. Chem., Kyushu Univ., Fukuoka, Japan).
J. Am. Ceram. Soc. (USA), vol.66, no.7, p.C114-15 (July 1983).
Ultrafine β-SiC powders with an average particle size of 0.01 to 0.06 μm were produced by CVD methods. When these powders contained enough carbon to remove impurity oxygen, sintered bodies with a relative density >95% were achieved at 2050°C in the presence of 1 wt% boron. The Vickers microhardness reached 21 to 25 GPa at a density of ≈95%. (6 refs.)

109205 Mechanism and kinetics of formation of ferrite in the solid phase in the CaO-Fe_2O_3 system [Mossbauer observations]. T.Ya.Malysheva, V.Ya.Lyadova, V.V.Korovushkin, I.V.Ostrovskaya.
Russ. Metall. (GB), no.1, p.5-8 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.6-9 (1982).
The authors' study of the kinetics and mechanism of ferrite formation in the solid state in the CaO-Fe_2O_3 system indicated that in a charge of any composition, the primary phase is monocalcium ferrite. Dicalcium ferrite is formed by the reaction between monocalcium ferrite and calcium oxide. That formed in charges at low temperatures and retention times is the reaction product of the heterogeneous charge where the reaction of ferrite formation is limited only by the diffusion of the substance in the solid state and is independent of the kinetics of sintering. In the temperature range studied (up to 900°C) semicalcium ferrite is not formed in the system. In the charge of the corresponding composition monocalcium ferrite and hematite are the only reaction products. (10 refs.)

109206 The effect of MnO_2 and La_2O_3 additions on the sintering of $Pb(Zr,Ti)O_3$ solid solutions. T.Kala (Res. Inst. of Electrotech. Ceramics, Hradec Kralove, Czechoslovakia).
Silikaty (Czechoslovakia), vol.27, no.3, p.193-8 (1983).
The study revealed a substantial effect of non-compensated charged defects resulting from the presence of heterovalent admixtures of MnO_2 and La_2O_3 oxides, on the final microstructure following the sintering of solid solutions based on $Pb(Zr,Ti)O_3$. Solid solutions of $PB(Zr,Ti)O_3$ containing excess of charged point defects were found to be capable of sintering up to about 98% of theoretical density. On the other hand, solid solutions based on $Pb(Zr,Ti)O_3$ free from heterovalent admixtures, or with electrically compensated admixtures of acceptor or donor type, showed extensive grain growth at sintering and were virtually uncapable of being sintered to an apparent density exceeding 95% of theoretical density. (15 refs.)

109207 Use of emanation thermal analysis in the evaluation of sinterability of ceramic powders. V.Balek (Inst. of Nuclear Res., Rez, Czechoslovakia).
Silikaty (Czechoslovakia), vol.27, no.3, p.257-69 (1983). In Czech.
Emanation thermal analysis (ETA) was used for characterizing the initial stages of sintering of ferric oxide (α-Fe_2O_3) and thorium dioxide. ETA, which is based on measuring the rate of release of radon from radioactive-labelled samples, was shown to follow sensitively in particular the changes in surface area during the initial stages of sintering, and changes in the microstructure of samples resulting from their densification at higher temperatures. The behaviour of thorium dioxide (ex-oxalate) during non-isothermal heating up to 1100°C in air is described. On the basis of ETA curves obtained from isothermal heating of powdered ThO_2 at 705, 735, 780 and 825°C, the kinetics of the changes in surface area has been characterized. The kinetics of sintering of powdered α-Fe_2O_3 during non-isothermal heating at the respective rates 2.5, 5, 10 and 16°C/min was characterized by means of ETA curves. The sintering process is characterized by decreasing emanating power E. The apparent activation energy of the sintering process, calculated from the experimental curves, is $Q=214.2$ kJ/mole. (4 refs.)

Enhancement of gas sensitivity by controlling microstructure of α-Fe_2O_3 ceramics .... See Entry 105317

Preparation of (UPu)C, (UPu)N and (UPu) (CN) powders ...... See Entry 106070

New compounds with the structure of tetragonal potassium-tungsten bronze .... See Entry 107631

Low-temperature dielectric properties of ceramic potassium tantalate ($KTaO_3$) .... See Entry 108867

Material-oriented preparation of sintered ceramic bodies ...... See Entry 109649

Formation of tungsten carbides on reaction of tungsten trioxide with carbon in a low-temperature plasma .... See Entry 109724

Formation of surface states on strontium oxide powders. [Photoluminescence observations] .... See Entry 109804

81.20N Cermets, ceramic and refractory composites

109208 Corundum ceramics with reduced sintering temperatures. A.M.Cherepanov, T.V.Solov'eva, F.Ya.Kharitonov, I.V.Gorshkova, R.F.Tyrina (All-Union Inst. of Electrical Ceramics, USSR).
Glass & Ceram. (USA), vol.39, no.9-10, p.504-6 (Sept.-Oct. 1982). Translation of: *Steklo & Keram. (USSR)*, vol.39, no.10, p.19-20 (Oct. 1982).
Investigates a new composition for corundum ceramic with a reduced sintering temperature, possessing rather high physical and engineering properties, including corrosion resistance to molten aluminum. The main source of material consisted of technical alumina grade GK containing 90% α-Al_2O_3 (GOST 6912-74). Glass-forming additives in the form of fluorite (CaF_2) and talc from the Alguisk deposits were added. Analysis of the fired results showed that the best properties were possessed by specimens containing 7% glassy additive, fired at 1650°C. (3 refs.)

Preparation and properties of monolithic and composite ceramics produced by polymer pyrolysis .... See Entry 109195

81.20P Glasses

Anisotropy of SANS in metallic glasses .... See Entry 107551

Amorphous Al(Ni) alloy formation by pulsed electron beam quenching .... See Entry 107770

81.20S Polymers

109209 Study of comparative characteristics of adhesional strength of epoxide resins on the basis of sulfone and bis-phenol A. R.K.Benzal, K.Keshav.
Vysokomol. Soedin. Ser. A (USSR), vol.25, no.8, p.1772-4 (Aug. 1983). In Russian. English translation in: *Polym. Sci. USSR (GB)*
Epoxide resins of various MM have been synthesized from epichlorohydrin and 4,4′-sulfonyldiphenol and from epichlorohydrin and bis-phenol A. These resins were cured at high temperature by four various crosslinking agents including aliphatic and aromatic amines. For each case the adhesional strength was measured. The adhesional strength of both types of epoxide resins was shown to be higher when curing by aromatic amines. The adhesional strength of sulfone-containing resin was lower than that of the resin obtained from bis-phenol A. (2 refs.)

Profile development in continuous drawing of viscoelastic liquids .... See Entry 107088

Special heat-resisting materials from organometallic polymers .... See Entry 109192

Polysilastyrene: phenylmethylsilane-dimethylsilane copolymers as precursors to silicon carbide .... See Entry 109193

Polycarbosilane precursors for silicon carbide .... See Entry 109194

Preparation and properties of monolithic and composite ceramics produced by polymer pyrolysis .... See Entry 109195

81.20T Reinforced polymers and polymer-based composites

109210 Adhesion of graphite fibres to epoxy matrices. I. The role of fibre surface treatment. L.T.Drzal (Air Force Wright Aeronaut. Labs., Wright-Patterson Air Force Base, OH, USA), M.J.Rich, P.F.Lloyd.
J. Adhes. (GB), vol.16, no.1, p.1-30 (1983).
The authors' study has combined fibre surface chemistry, morphology, interfacial strength measurements and fracture characterisation in order to elucidate the role of surface treatments. The results of this investigation lead to the conclusion that surface treatments designed to promote adhesion to epoxy matrix materials operate through a two-part mechanism. First, the treatments remove a weak outer fibre layer initially present on the fibre. Second surface chemical groups are added which increase the interaction with the matrix. (37 refs.)

109211 Carbon-reinforced thermoplastics: what they offer, how to process them. S.R.Gerteisen, S.D.Gerbig (Wilson-Fiberfil Internat., Neshanic Station, NJ, USA).
Plast. Eng. (USA), vol.39, no.1, p.39-42 (Jan. 1983).
Carbon-fiber-reinforced thermoplastics are emerging as engineering materials superior in key properties to glass-reinforced thermoplastics and no more difficult for experienced GRTP molders to process. With little doubt, CFRTPs will be a significant part of the molding trends of the 1980s. (no refs.)

81.30 PHASE DIAGRAMS AND MICROSTRUCTURES DEVELOPED BY SOLIDIFICATION AND SOLID-SOLID PHASE TRANSFORMATIONS

(see also 61. Structure of liquids and solids 64.70 Phase equilibria, phase transitions, and critical points)

109212 Cementite decomposition in steel under plastic deformation. G.N.Gridnev, V.G.Gavrilyuk (Inst. of Phys. of Metals, Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.531-51 (1982). [received: Aug. 1983]
Investigations of the state of cementite in cold-worked pearlitic steel are reviewed and summarized. Thermomagnetic analysis, electron microscopy, and Mossbauer spectroscopy data point to a partial decomposition of cementite in steel subjected to plastic strain. The extent of decomposition may be as great as several tens of percent and depends on the interfacial area and the concentration of alloying elements. Thermodynamically, decomposition is attributed to the fact that the binding energy of carbon atoms and dislocations in ferrite exceeds the heat of solution of cementite. Possible mechanisms of decomposition are considered, and the largest contribution to the process is found to be due to the strain-promoted mass transport of carbon from the surface layers of cementite to dislocations at the interfae. The distribution of carbon among different types of defects is analyzed, and the effect of original structure on the magnetization-temperature curves is shown to be fairly well explicable on the assumption that in the process of cementite decomposition some of the carbon atoms get into microcracks and form graphite during subsequent heating. (58 refs.)

109213 Effect of repeated plastic deformation on the state of the carbide phase in steels. M.V.Belous, V.B.Novozhilov (Polytech. Inst., Kiev, Ukrainian SSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.552-6 (1982). [received: Aug. 1983]
The effect of repeated plastic deformation on the state of the carbide phase in steels was examined by thermomagnetic analysis and transmission electron microscopy. Preliminary plastic deformation and recrystallization annealing were found to prevent the carbide phase decomposition during subsequent plastic deformation. This is attributed to the formation of graphite film around retained carbide particles. (10 refs.)

109214 The high pressure disproportionation of Spinel $MgAl_2O_4$. R.A.Howald, A.Moe, B.N.Roy (Dept. of Chem., Montana State Univ., Bozeman, MT, USA).
High Temp. Sci. (USA), vol.16, no.2, p.111-21 (April 1983). [received: Sept. 1983]
The thermodynamic properties of prericlase, corundum, and spinel are known with sufficient accuracy to calculate equilibrium pressures for the reaction $MgAl_2O_4(c)=MgO(c)+2\ AlO_{1.5}$ (c, corundum) as a function of temperature. The shape of the calculated equilibrium line is quite sensitive to the details of the equations of state used for the various materials. The authors have tested a new computer program with calculations on this system, and find that it provides a good test for proposed equations of state. Murnaghan's logarithmic equation of state (1944) is satisfactory provided both the bulk modulus and its pressure derivative are functions of the temperature. Full equations of state are given in equations and tables for all three solids. The P-T phase diagram calculated with these values differs substantially from that of Liu (see High Temp. High Press., vol.12, p.217, 1980). Depending on the thermodynamic values selected for $MgAl_2O_4$, the equilibrium line is near $9000+1.11(T-1000)$ of $9700+1.50(T-1000)$. (33 refs.)

109215 A percolation model for the two-phase zone of alloys. V.A.Zhuravlev, V.V.Chetvertnykh, N.V.Fedorova, V.P.Podshivalov, S.R.Gallyamov.
Russ. Metall. (GB), no.2, p.117-20 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.131-3 (1982).
A percolation mode has been derived for the two-phase zone of alloys with random and correlated phase distributions in the zone, and a computer implementation is described. The presence of percolation thresholds in the zone was established, with a scaling dependence of the permeability. (4 refs.)

Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191) .... See Entry 105032

Heat treatment of the Cu-Ni-Sn alloys .... See Entry 109352

Fracture of phosphate-bonded high-alumina refractories .... See Entry 109435

81.30B Phase diagrams of metals and alloys

109216 Studies on copper-nickel-tellurium system. Mrityunjaya Singh, S.Bhan (Dept. of Metall. Engng., Inst. of Technol., Banaras Hindu Univ., Varanasi, India).
Trans. Indian Inst. Met., vol.35, no.6, p.548-51 (Dec. 1982). [received: Aug. 1983]
The ternary isotherm at 470°C in the copper-nickel-tellurium system has been worked out by X-ray diffraction technique. In the Ni-Te binary system only two intermetallic compounds viz. Ni_3Te_2 and $NiTe_{1+x}$, the latter with a large homogeneity range extending up to $Ni_{55}Te_{45}$, are found stable at the temperature of investigation. In the Cu-Te binary system only Cu_2Te phase is found stable at 470°C. In the ternary system the existence of two phases viz. $Cu_{55}Ni_5Te_{40}$ and another around the composition $Cu_{20}Ni_{42}Te_{38}$ has been established. The structure of $Cu_{55}Ni_5Te_{40}$ has been found related to (B8)Ni_2In type with $a=3.95_1$ Å and $c=10.72_3$ Å. The $Cu_{20}Ni_{42}Te_{38}$ phase has been indexed on the basis of a face centred cubic lattice with $a=11.54_6$ Å. Density measurements have indicated that the f.c.c. phase contains 80 atoms per unit cell. The $NiTe_2$ phase is found to have a large homogeneity range in the ternary system. (17 refs.)

109217 Kinetics of growth of phases by mutual diffusion in three-component multiphase metallic systems. V.I.Gryzunov, G.V.Shcherbedinskii, E.M.Sokolovskaya, B.K.Aitbaev, A.S.Sagyndykov (M.V. Lomonosov State Univ., Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.194-7 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The published phase diagrams of various three-component systems were considered, especially the phase diagram of Ti-Ni-Co alloys at 1000°C. A theoretical analysis of the results indicated that the dimensions of a growing phase depended on the mutual diffusion coefficients, relationships between these coefficients, and concentrations of various elements at the boundary of the new phase. (9 refs.) *A.T.*

109218 Phase equilibria in iron ternary alloys. X. Critical evaluation of constitution of cobalt-iron-vanadium system. G.V.Raynor, V.G.Rivlin (Dept. of Metall. & Materials, Univ. of Birmingham, Birmingham, England).
Int. Met. Rev. (GB), vol.28, no.4, p.211-27 (1983).
For pt.IX see ibid., vol.28, no.1, p.23 (1983). Available experimental evidence on the constitution of the Co-Fe-V system has been critically reviewed. A projection of the liquidus surfaces is recommended, involving primary separation of the γ-phase (solid solution of Fe and V in Co), the α-phase (solid solution of Co and V in the $\alpha\delta$Fe-phase of the Fe-V system), and the σ-phase. Isothermal sections, partial in some cases, are presented for temperatures ranging from 1300° to 900°C, and emphasize the importance of the σ-phase. No ternary compounds have been reported. In alloys with less than 20% V which are subject to the γ/α transformation on cooling or heating, an approach to equilibrium is only obtained after very long annealing treatments, and diagrams are therefore given for both equilibrium and non-equilibrium conditions at approximately 600°C. In view of its importance, the course of the γ/α transformation in alloys poor in V is also reviewed. (29 refs.)

109219 On the study of austenite stabilization in the Cr13%Ni4-6% steels. J.Svejcar, J.Hubackova, V.Cihal, K.Mazanec (VUT, Brno, Czechoslovakia).

Kovove Mater. (Czechoslovakia), vol.21, no.4, p.353-63 (1983). In Czech.

Deals with the study of chemical heterogeneity and structural stability of the phases, coexisting in the structure of the Cr13%Ni4-6% steels, during tempering in the intercritical temperatures region. From the evaluation of potentiokinetic polarization curves it follows that under the given conditions the microregions with a different content of basic alloying elements originate in the matrix. The electron microanalysis of the present phase proved the significant nickel enrichment of austenite with a simultaneous nickel content decrease in the martensitic matrix. No changes in the chromium content could be found. The structural stability of austenite, originating at the intercritical temperatures tempering is determined not only by its nickel enrichment, but also by its morphology and, particularly by the dimensions of the austenitic regions (their thickness should not be greater than 0.15-0.25 μm). (9 refs.)

109220 Phase equilibria and kinetics in the solid state reaction between silicon and NiCrAl. E.L.Hall, R.L.Mehan, M.R.Jackson (Corporate Res. & Dev. Center, General Electric Co., Schenectady, NY, USA).

Metall. Trans. A (USA), vol.14A, no.8, p.1549-60 (Aug. 1983).

The result of the solid state reaction of silicon with a model superalloy consisting of 70 at.% Ni, 20 at.% Cr, and 10 at.% Al at 900°C is examined using light microscopy, electron microprobe analysis, and analytical electron microscopy. Extensive reaction is observed, with the formation of seven distinct reaction zones. The crystallography and chemistry of the phases present in each zone are determined using the analytical electron microscope. The reaction paths are described with reference to binary and ternary phase equilibrium diagrams. The kinetics of the reaction are presented. The nature and extent of the reaction are compared with previous experiments in which silicon carbide and reaction-bonded Si-SiC were reacted with the model superalloy. (17 refs.)

109221 A correlation of the thermodynamic properties and phase diagram of the system lead-silver using a Gaussian plus subregular formalism. J.D.Esdaile, N.G.Siviour (Div. of Mineral Engng., CSIRO, Clayton, Victoria, Australia).

Metall. Trans. A (USA), vol.14A, no.8, p.1707-12 (Aug. 1983).

A method of correlating with precision the thermodynamic properties and phase boundaries of the lead-silver system is described. This employs a Gaussian plus subregular formalism for the liquid phase and uses Henrian behaviour for the solid phases, which have minor extents of solid solubility. The experimental liquidus data obtained by using the high shear technique of Esdaile and Siviour (see ibid., vol.10, p.382-4, 1979) are tabulated and also compared with the requirements of the phase diagram, leading to a mean temperature difference of 0.43K for the silver-rich side and 0.017K for the lead-rich side, between measured and calculated liquidus and solidus data. For the high temperature liquidus data of Heycock and Neville (1897) the mean temperature difference is 2.2K. The calculated compositions of the solid lead and silver phases below the eutectic point are also compared with the experimental measurements. (17 refs.)

109222 Nitrogen solutions in liquid iron alloys. L.A.Bol'shov.

Russ. Metall. (GB), no.1, p.22-5 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.,* no.1, p.23-5 (1982).

Interaction coefficients at constant concentration ratios, B_i^j, have been considered which correspond to concentrations expressed in mole fractions and the use of natural logarithms. A relation connecting the interaction parameters at constant concentration ratios, B_i^j and b_i^j has been obtained. Two methods for the theoretical estimation of interaction coefficients at constant concentration ratios have been proposed for nitrogen in iron alloys. Values of the B_N^j interaction coefficients at constant concentration ratios have been calculated for nitrogen with alloying transition metals (Ni, Co, Mn, Cr, Mo, W, V, Nb and Ta) in melts of Kh18N8 steel at 1600°C. (9 refs.)

109223 Activity of arsenic and tin in Fe-As-Sn melts. V.M.Chumarev, V.M.Sholokov, A.I.Okunev.

Russ. Metall. (GB), no.1, p.26-8 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.,* no.1, p.26-8 (1982).

The distribution of tin and arsenic between Fe-As-Sn melts and lead at 1623K has been studied. From the distribution data the activity coefficients of tin are calculated. The calculated vales of the activity of tin have large positive, and those of arsenic negative, deviations from Raoult's law. The interaction parameter ϵ_{Sn}^{As} was found to be 2.4. (11 refs.)

109224 Interaction of additions of vanadium and copper with admixture atoms of iron in α-Zr [Mossbauer observations]. V.V.Igrushkin, V.G.Kirichenko, I.A.Petel'guzov, V.V.Chekin.

Russ. Metall. (GB), no.1, p.74-8 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.,* no.1, p.87-91 (1982).

Analysis of the Mossbauer absorption spectra of iron containing phases of alloys based on α-Zr, containing up to 1% admixtures of Fe, Fe-V and Fe-V-Cu, state diagrams of binary Zr-Fe, Zr-V and Zr-Cu systems, coefficients of distribution of admixtures and crystal structures of intermetallides of these systems, leads to a conclusion that in the ternary Zr-Fe-V and quarternary Zr-Fe-V-Cu system, the iron containing intermediate phase forms on the basis of the intermetallide ZrV_2. (11 refs.)

109225 Examination of phase equilibrium in Ti-Al-Zr-W-Mo alloys. M.A.Volkova, T.T.Nartova, E.V.Meleshko.

Russ. Metall. (GB), no.1, p.114-16 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.,* no.1, p.130-2 (1982).

A partial polythermal section of the Ti-Al-Zr-Mo-W system with a constant content of 6% Al, 7% Zr and 3% W was constructed. The section is characterised by the presence of the α, β and δ(W) solid solutions. The alloys of the given section solidify as the β solid solution and one cooling from 1040°C and lower undergo transformation in the solid state associated with the $B \rightarrow \alpha+\beta \rightarrow \alpha+\beta+\delta(W) \rightarrow \alpha+\delta(W)$ transformation. (7 refs.)

109226 Solubility of various metals in solid sodium and potassium. B.N.Aleksandrov, N.V.Dalakova.

Russ. Metall. (GB), no.1, p.117-21 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.,* no.1, p.133-40 (1982).

A method of preparation of dilute alloys based on sodium in the range of concentrations 5×10^{-4}-1 at.% without carrying our a quantitative analysis, was developed. Using the method of the residual electrical resistance, the solubility limit C_{lim} was either determined (as for K, Rb, Cs, Cd, Hg, Inm Sn, Pb, Ti) or evaluated (as for Sr, Ca, Li) for 12 admixtures in solid sodium. It is shown that the solubility of K, Li, Tl, Rb, Hg in sodium is sufficiently high (0.75-0.05 at.%) and for the remaining metals is low (0.01-2×10^{-4} at.%); for Sn and Pb, C_{limit} increases with an increasing temperature of annealing and for Hg, Cd and Tl—it decreases. (20 refs.)

109227 Examination of quasibinary sections of the Mg-Al-Sr system. M.M.Makhmudov, A.V.Vakhobov, T.D.Dzjurayev.

Russ. Metall. (GB), no.1, p.122-4 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.,* no.1, p.141-3 (1982).

It has been shown that the Mg-Al-Sr ternary system contains five quasibinary sections. All the examined sections are eutectic with limited miscibility. (6 refs.)

109228 Construction of the T-P-N state diagram of the Co-C system at pressures up to 100 kbar. T.P.Ershova, D.S.Kamenetskaya, L.P.Il'ina.

Russ. Metall. (GB), no.1, p.130-7 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.,* no.1, p.153-61 (1982).

A thermodynamic calculation of the equilibrium lines of the T-P-N state diagram of the Co-C system, taking into consideration equilibria with diamond and carbide Co_3C, were carried out to a pressure of 100 kbar. The T-N cross-sections of the T-P-N state diagram of this system at pressures of 1 atm, 60 and 100 kbar, and projections of the temperatures and concentrations of the characteristic points of the diagram on to the T-P and N-P planes, were constructed. (15 refs.)

109229 The Zr-Fe phase diagram (0-66.6 at.% Fe). T.O.Malakhova, A.N.Kobylkin.

Russ. Metall. (GB), no.2, p.187-91 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.,* no.2, p.205-9 (1982).

Zr-Fe alloys containing from 0.2 to 66.6 at.% Fe were examined. The specimens were prepared from iodide zirconium of 99.68%. Examination of the system by X-ray phase and microstructural analysis confirms the existence of Zr_3Fe formed by the peritectoid reaction $\beta+Zr_3Fe \rightleftharpoons Zr_3Fe$; the temperature of formation of Zr_3Fe was also found, about 885°C. Zr_2Fe (tetragonal, $a=6.384$ Å, $c=5.598$ Å, $c/a=0.877$) decomposes eutectoidally: by the reaction $Zr_2Fe \rightleftharpoons Zr_3Fe+ZrFe_2$, at about 775°C. DTA was used to determine the $\alpha \rightleftharpoons \beta$ transformation temperature in alloys with 0-25 at.% Fe, the temperature of the eutectic $liq \rightleftharpoons \beta+Zr_2Fe$ and the peritectic $liq+ZrFe_2 \rightleftharpoons Zr_2Fe$ equilibria (928 and 974°C, respectively). The results from all three methods were used to plot the Zr-Fe phase diagram for 0-66.6 at.% Fe. (10 refs.)

109230 Thermodynamic properties of solid U-Sb alloys. V.A.Lebedev, V.I.Pyatkov, L.V.Khalturin.

Russ. Metall. (GB), no.2, p.192-4 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.,* no.2, p.210-12 (1982).

A new variant of the EMF method was used to determine the thermodynamic properties of solid U-Sb alloys in the range 750-900 Å. (6 refs.)

109231 The Nb-Ga-Cu phase diagram (superconducting compounds). V.M.Pan, V.I.Latysheva, O.G.Kulik, V.V.Gorskiy.

Russ. Metall. (GB), no.2, p.195-8 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.,* no.2, p.213-17 (1982).

The isothermal section of the Nb-Ga-Cu system was constructed for 800°C, and the phase equilibria were examined in cast and annealed alloys. The existence was confirmed of the ternary Laves phase NbCuGa and the ternary sigma phase Nb_2CuGa. A new ternary χ-phase was detected, composition 57 at.% Nb, 25 at.% Ga, 18 at.% Cu. (10 refs.)

109232 Structure and properties of rapidly cooled (superconductive) Pb-Bi alloys. E.M.Savitskiy, Yu.V.Efimov, G.Yenn, I.Shtapf.

Russ. Metall. (GB), no.3, p.84-7 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.,* no.3, p.93-9 (1982).

The microstructure, phase composition and certain properties of Pb-Bi alloys after their quenching from the liquid state are studied under various conditions. The amorphous state is not fixed when Pb-Bi melts are cooled at rates of 10^4-10^8 K/s from 423-1273 to 77-293K. Metastable compounds (X and Y), only formed with super-fast cooling to nitrogen temperatures, are not stable on tempering. Super-fast cooling to 293K leads to an increase in the mutual solubility of components, a shift of the ϵ-phase composition from 27-42 to 20-50 at.% Bi, a sharp refinement of the structural constituents and the change in properties associated with these manifestations (to a rise in T_k, J_k, χ and HV). (10 refs.)

109233 On the origin of increasing hydrogen pressures in the two solid phase regions of intermetallic compound-hydrogen systems. W.A.Oates (Dept. of Metall., Univ. of Newcastle, Shortland, NSW, Australia).

Scr. Metall. (USA), vol.17, no.8, p.983-6 (Aug. 1983).

A new and quite general explanation of 'sloping plateau pressures' in alloy-hydrogen systems is presented. Three possible transformation modes for the ternary Ab_x-H systems during the phase transformation from low hydrogen concentration (α-phase) to high hydrogen concentration (β-phase) are discussed. (11 refs.)

109234 Cu-Ti and Cu-Ti-Al solid state phase equilibria in the Cu-rich region. J.-Y.Brun (Inst. Nat. Polytech. de Grenoble, Grenoble, France), S.-J.Hamar-Thibault, C.-H.Allibert.

Z. Metallkd. (Germany), vol.74, no.8, p.525-9 (Aug. 1983).

Solid state phase equilibria of Cu-rich Cu-Ti and Cu-Ti-Al alloys have been determined by composition and structure analysis of the phases present in samples annealed at 850, 800, 700, and 600°C. Orthorhombic Cu_4Ti exists in equilibrium with a Cu solid solution, the Ti content of which largely increases with temperature. A low temperature Cu_4Ti structure modification is found to be tetragonal body centered. In Cu-rich ternary alloys, 4 phase domains are found: Cu solid solution, $Cu+Cu_4Ti$, $Cu+Cu_2TlAl$, and $Cu+Cu_4Ti+Cu_2TiAl$. The Ti limit content of the ternary Cu phase increases with temperature. Cu_4Ti does not extend in the ternary system. (24 refs.)

109235 Constitution of the binary Pd-Si system in the concentration range from 0 to 33.3 at.% Si. H.Langer, E.Wachtel (Max-Planck-Inst. fur Metallforschung, Stuttgart, Germany).

Z. Metallkd. (Germany), vol.74, no.8, p.535-44 (Aug. 1983). In German.

The palladium-silicon phase diagram has been newly established applying thermoanalytical (MTA, DTA), metallographic and X-ray methods. In the concentration range from 0 to 33.3 at.% Si, besides the stable and the glass system (MS-I), two further metastable systems can be characterized, the constituents of which are formed from melt as a consequence of well defined cooling rates. MS-I: $\dot{T}>10^4$ $Ks^{-1} \rightarrow$ amorphous state ($15<c_{Si}<23$ at.%). MS-II: $10^2<\dot{T}<10^4$ $Ks^{-1} \rightarrow$ the following intermetallic phases are occurring: $Pd_{5.25}Si$ (16 at.% Si) and $Pd_{4.5}Si$ (18.18 at.% Si). MS-III: $\dot{T}<10^2$ $Ks^{-1} \rightarrow$ the formation of the $Pd_{4.5}Si$ intermetallic phase is suppressed. In this concentration range, the Pd_5Si (16.67 at.% Si) and Pd_4Si (20 at.% Si) phases belong to the stable system. (49 refs.)

109236 Phase diagrams under irradiation. K.C.Russell (Dept. of Materials Sci. & Engng., MIT, Cambridge, MA, USA).

Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.365-74

The high intensity irradiation environments produced by advanced fast fission and proposed fusion reactors, high voltage electron microscopes, and heavy ion accelerators add a new dimension to materials science. Typical irradiations of alloys in these devices introduce the order of 10^8 J/mol displacement energy in the form of vacancy-interstitial (Frenkel) pairs. Although most of this energy is dissipated as heat during Frenkel pair recombination, significant amounts may be harnessed to produce microstructural change, hence changes in the phase diagram. The author discusses the various atomistic mechanisms available to convert irradiation energy to microstructural change and cites selected experimental observations where the various mechanisms are operative. (31 refs.)

109237 Effect of concentration gradient on phase stability. K.N.Tu, U.Gosele (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.375-6
Summary form only given. A feature of thin film reaction that is different from the reaction in bulk samples is the tendency to form a single intermetallic compound rather than all of them which are allowed according to the equilibrium phase diagram. For example, in thin film silicide formation, Pd_2Si has been found to form along and to grow as a layer between Pd and Si. The silicide is stable over a wide temperature range of 100 to 700°C. The phenomenon of single intermetallic compound growth is not unique to silicide formation between transition metal films and silicon, but is also commonly observed in reactions between bimetallic thin films. The phenomenon indicates phase stability. Analysis of the kinetics of layered compound growth in thin film reactions follows more or less the same analysis which has been developed for bulk diffusion couples. The basic equation of growth can be represented by $\dot{x}=k_1f(\Delta G)$ where $\dot{x}$ is the growth rate, k_1 is the rate constant (or mobility) and $f(\Delta G)$ is the driving force which in general is a function of free energy change of the system. When the driving force is a first order gradient term across the layer, a parabolic growth is obtained and frequently it is observed in the so-called 'diffusion limited' growth. When the driving force is constant, a linear growth is obtained and observed in the so-called 'interface reaction limited' growth. (8 refs.)

109238 The Au-Pb phase diagram. D.S.Evans, A.Prince (Hirst Res. Centre, GEC plc, Wembley, England).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.383-8
The Au-Pb system has been redetermined using DTA, metallography and X-ray techniques. The compounds Au_xPb, $AuPb_2$ and $AuPb_3$ are generated by peritectic reactions at 434°, 253° and 221.5°C respectively. $AuPb_3$ and Pb form a eutectic at 84.8 at.% Pb and 212°C. It is confirmed that Au_2Pb is stable down to at least 200°C. (12 refs.)

109239 The In-Sn phase diagram. D.S.Evans, A.Prince (Hirst Res. Centre, GEC plc, Wembley, England).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.389-94
The In-Sn system has been redetermined using DTA, metallography and X-ray diffraction techniques. It is confirmed that the β and γ intermediate phases are formed by peritectic reactions, at 141.0° and 222.6°C respectively. β and γ form a eutectic at 47.4 at.% Sn and 119°C. The kink in the γ-phase solidus proposed by Heumann and Alpaut (see J. Less-Common Met., vol.6, p.108-17, 1964) is not confirmed. (9 refs.)

109240 Phase equilibria in the Ni-rich region of the Ni-Al-Zr system. C.S.Jayanth, P.Nash (Dept. of Metall. & Materials Engng., Illinois Inst. of Technol., IL, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.395-8
Alloys from the Ni-rich corner of the Ni-Al-Zr system have potential for use in high temperature, high strength applications. Such applications require a detailed knowledge of the high temperature phase equilibria. In the case of the Ni-Al-Zr system no isothermal sections have been published although the existence of a monovariant eutectic valley between Ni_3Al and Ni_7Zr_2 has been established. An experimental determination of the phase equilibria in this system is being carried out using quantitative electron microprobe analysis (JEOL JSM-U3), X-ray diffraction and optical metallography. Partial isothermal sections are being determined for 1373K (1100°C) and 1273K (1000°C) and the resulting phase equilibria compared to that in the Ni-Al-Hf system determined previously. (10 refs.)

109241 Phase equilibria at 1173K in the Ni-Ti-Al system. W.W.Liang (Gas Res. Inst., Chicago, IL, USA), P.Nash.
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.399-401
In order to provide some consistent data over a substantial range of composition an experimental determination of the phase equilibria at 1173K and from 0-50 atomic % Al is being carried out. The main experimental technique being used is quantitative electron microprobe analysis (JEOL 733) by wavelength dispersive X-ray spectrometry. In addition, X-ray diffraction is being used to establish the structures of phases present and optical metallography of cast structures to determine the fields of primary crystallization. In addition to establishing the phase equilibria at the temperature the composition range for the existence of the $AlNi_2Ti$ phase is being determined. The results thus far are compared with previous experimental data and calculated isothermal sections. (5 refs.)

109242 Cu-Pb-Sn ternary system: low Cu additions to Pb-Sn- binary system. V.C.Marcotte (IBM General Technol. Div., Hopewell, Junction, USA), K.Schroder.
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.403-10
A portion of the Cu-Pb-Sn ternary diagram was determined experimentally. The investigation was concentrated on the high Pb corner and, to a lesser extent of alloys from Sn to the binary Pb-Sn eutectic. The experimental techniques used were thermal analysis, metallography, and electron microprobe analysis. A new technique for determining liquidus temperatures was used. For the high Pb region the proposed ternary eutectic at 0.06 Cu 0.02% SnPb (all compositions are in weight %) was not observed. For most alloys the primary crystallization phase was Cu_3Sn. It was shown the primary crystallization phase was Cu_3Sn. It was shown that Cu_6Sn_5 exists in the solid state; for high Sn alloys, it was observed that the addition of Pb reduced the decomposition temperature of Cu_6Sn_5. A ternary eutectic reaction near the binary Pb-Sn eutectic was confirmed, and the temperature of the ternary eutectic was 1K below that of the binary eutectic. (7 refs.)

109243 Modification of Al-Si microstructure—the Al-Si-Sr phase diagram from 0-20 wt.% Si and 0-5.0 wt.% Sr. M.D.Hanna, A.Hellawell (Dept. of Metall. Engng., Michigan Technol. Univ., Houghton, MI, USA).
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.411-16
It is well known that the morphology of primary and eutectic silicon resulting from solidification is sensitive to minor impurity additions: 'modification' by alkali and alkaline earth metals is common foundry practice and the use of strontium is of recent and current interest because its effect is retained in liquid metal for relatively long times. The mechanism for modification remains obscure and is not necessarily the same from one elemental addition to the next, but it is essential to separate the equilibrium and kinetic influences if the phenomenon is to be better understood. Accordingly, the liquidus surface and eutectic reactions have been located in the relevant part of the Al-Si-Sr system by careful thermal analysis and the results correlated with the microstructure. Comparison is made with the parallel behavior of alkali metal additions. (11 refs.)

109244 Alloy chemical comparison of the refractory metal—noble metal phase diagrams T_5-T_{10} (T_5=V, Nb, Ta; T_{10}=Pd, Pt). R.Waterstrat (American Dental Assoc. Health Found. Res. Unit., NBS, Washington, DC, USA), B.C.Giessen.
Alloy Phase Diagrams. Proceedings of a Symposium, Boston, MA, USA, Nov. 1982 (New York, USA: North-Holland 1983), p.423-8
The six T_5-T_{10} metal alloy phase diagrams containing Pd or Pt have now all been established. The alloy phases occurring in these systems are tabulated and reviewed with respect to their structures. (10 refs.)

109245 The behaviour of a metallic dispersion under microgravity conditions. G.H.Otto (DFVLR, Inst. for Space Simulation, Koln-Porz, Germany).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.63-9
The metallic system gallium-mercury with a liquid state miscibility gap is used to perform a dispersion experiment under microgravity conditions. Unlike previous experiments the sample will not be solidified but cooled into the miscibility gap only. The resulting liquid/liquid dispersion and its development upon further cooling will be recorded by X-ray transmission photography. Three different cooling rates will be executed with the same sample which is designed to be recyclical. The influence of time and gradient dependent effects, like homogenization, droplet growth, Marangoni convection, or Stokes' sedimentation on the stability of the dispersion will be considered. The experiment is scheduled to be reflown on STS-7. (15 refs.)

109246 Low-gravity experiments on liquid phase miscibility gap (LPMG) alloys—materials experiments assembly (MEA). S.H.Gelles (S.H. Gelles Associates, Columbus, OH, USA), A.J.Markworth, C.E.Mobley.
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.307-12
Four experiments planned for performance on future Space Shuttle flights are described. They are to be performed in the Materials Experiments Assembly (MEA) and are concerned with understanding the evolution of microstructure in liquid phase miscibility gap (LPMG) alloys especially the reasons for the occurrence of massive separation in the SPAR II and SPAR V experiments on Al-In Alloys. The experiments are as follows: 1. Gradient cool experiment on Al-90 wt.% In. 2. Isothermal experiment on Te-Tl alloys. 3. Plunger experiment on Al-90 wt.% In alloy in alumina. 4. Plunger experiment on Al-40 wt.% In alloy in SiC coated graphite. (13 refs.)

PHAB—an alloy phase diagram bibliographic database: a part of the ASM/NBS data program for alloy phase diagrams .... See Entry 105048

On the formation of transition metal-rich glassy phases in the systems Ni-As, Pd-As and Pt-As .... See Entry 107558

On the identification of new and normal phases in the system of cadmium-antimony alloys .... See Entry 107952

Enthalpies of formation of Au-Ge and Au-Ag-Ge liquid alloys at 1373K .... See Entry 107981

Investigation of the thermodynamics of oxygen and the determination of phase boundaries in the system copper-oxygen-bismuth at 1200°C . See Entry 107989

Thermo-electromotive force of solid and liquid indium-based metallic solutions .... See Entry 108395

The research of superconductivity in the Ti-Pd system .... See Entry 108587

Study of the behaviour of Al-Zn alloys by SAXS in the temperature range of the instable solid solution .... See Entry 109046

Features of formation and breakdown of microcrystalline and amorphous phases in splat-cooled cerium-silver alloys .... See Entry 109272

Investigation of the crystallisation of alloys in systems containing peritectic transformations .... See Entry 109274

A continuum approach to transformation kinetics of metals . See Entry 109278

81.30D Phase diagrams of other materials

109247 Interactions of LiBr with calcite and calcium oxide powders. D.Deruto, G.Belleri, L.Barco (Istituto di Chimica, Facolta di Ingegneria, Univ. di Genova, Genova, Italy), V.Longo.
Ceram. Int. (Italy), vol.9, no.2, p.53-8 (1983).
The interactions of LiBr with calcite and calcium oxide powders have been studied with and without the calcite decomposition reaction, using DTA and TG analysis plus SEM and RX observations. Interactions in the LiBR-$CaCO_3$ system show two possible phase transformations at the temperature of 748K and 786K. The second one is due to the formation of an eutectic liquid phase in the LiBr-rich region. The rate of decomposition of calcite powders was measured in dry nitrogen and in a high partial pressure of CO_2 with and without LiBr. The addition of LiBr causes the decomposition reaction to occur at a lower temperature. The LiBr changes the mechanism of the reaction. The decomposition process occurs through a liquid-phase path given by the eutectic of LiBr-$CaCO_3$. The total rate of reaction as well as the temperature dependence are related to the liquid phase. The $CaCO_3$ powders obtained have a very dense structure with a high degree of crystallization. Probably the LiBr-CaO eutectic provides a solution path for CaO recrystallization. The effectiveness of salt addition in lowering the decomposition temperature of carbonates seems promising in saving energy, as well as in promoting changes in morphology of important commercial oxide powders. (13 refs.)

109248 Formation of solid solutions in vacuum condensed Al_2O_3-ZrO_2 systems. G.I.Batalin, V.D.Kushkov, O.V.Kachur, O.M.Zaslavs'kii, I.S.Kozlov.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.5, p.78-81 (1983). In Ukrainian.
X-ray phase analysis and X-ray microanalysis methods were used to study the Al_2O_3-ZrO_2 vacuum condensates obtained by electron-beam evaporation and vacuum condensation. Data are presented on the phase composition of vacuum condensates in a wide range of component concentrations and condensation temperatures. It is shown that the composition of solid zirconium oxide-base solutions formed in vacuum Al_2O_3-ZrO_2 condensates does not correspond to the component content in the samples. (9 refs.)

109249 $CuGaS_{2x}Se_{2(1-x)}$ solid solutions. I.V.Bodnar', A.P.Bologa (Inst. of Solid-State & Semiconductor Phys., Acad. of Sci., Belorussian SSR).
Inorg. Mater. (USA), vol.18, no.8, p.1060-4 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1257-61 (Aug. 1982).
As a result of the investigations carried out, the phase diagram of the system $CuGaS_2$-$CuGaSe_2$ has been constructed for the first time. For the system, the solidus and liquidus lines were calculated in the approximations of the theory of ideal and regular solutions. Monocrystals of the ternary compounds $CuGaS_2$, $CuGaSe_2$, and solid solutions $CuGaS_{2x}Se_{2(1-x)}$ were grown by the chemical transport reaction method and their dislocation structure studied. (19 refs.)

109250 Phase diagram of the PbSe-CdTe system. S.D.Raevskii, K.R.Zbigli, G.F.Kazak, M.D.Prunich (All-Union Sci.-Res., Structural-Engng. & Technol. Inst. of Current Sources, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1068-71 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1267-70 (Aug. 1982).
The phase diagram of the PbSe-CdTe system has been studied by differential thermal, X-ray diffraction, and metallographic analyses. The system is not quasi-binary. The width of the region of solid solutions on the PbSe side is ~27.5 mole % CdTe at 880°C, and on the CdTe side it is less than 2.5 mole % PbSe at 850°C. The unit cell parameters of the solid solutions on the PbSe side vary with the composition as $\alpha=6.121-0.081x$ Å. In the $PbSe+CdTe \rightleftharpoons PbTe+CdSe$ system the equilibrium is shifted to the right. (11 refs.)

109251 Phase equilibria in the binary systems $Pb(PO_3)_2$-$PbMoO_4(PbWO_4)$ and $Pb_2P_2O_7$-$PbMoO_4(PbWO_4)$. G.A.Bukhalova, I.V.Mardirosova, N.P.Ocheret (Rostov Structural Engng. Inst., Rostov, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1168-71 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1376-9 (Aug. 1982).
Phase equilibria in systems composed of lead phosphates and molybdates (tungstates) were studied by the methods of differential thermal, visual polythermal, and X-ray phase analysis. The phase diagrams of the systems $Pb(PO_3)_2$-$PbMoO_4$, $Pb(PO_3)_2$-$PbWO_4$, $Pb_2P_2O_7$-$PbMoO_4$ and $Pb_2P_2O_7$-$PbWO_4$ were found to be of the eutectic type; in two of the latter the formation of limited solid solutions based on the starting compounds was observed. (7 refs.)

109252 Interaction of phosphorus with zirconium and cobalt. Ya.F.Lomintskaya, Yu.B.Kuz'ma (I. Franko L'vov State Univ., L'vov, Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.8, p.1176-7 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1385-6 (Aug. 1982).
In the system Zr-Co-P, the compounds ZrCoP (structure of the TiNiSi type, $\alpha=0.6332$, $b=0.3698$, $c=0.7160$ nm), $Zr_2Co_4P_3$ ($Hf_2Co_4P_3$, $\alpha=1.210$, $c=0.3662$ nm), and $Zr_2Co_{12}P_7$ ($Zr_2Fe_{12}P_7$, $\alpha=0.8950$, $c=0.3557$ nm) and a solid solution of phosphorus in Zr_2Co, the boundary of which is described by the formula Zr_4CoP, are known. A systematic study of the interaction of phosphorus with zirconium and cobalt is presented. (12 refs.)

109253 Phase diagram of the systems $Cu_{2-x}S$-ZnS and $Cu_{2-x}Se$-ZnSe. I.B.Mizetskaya, G.S.Oleinik, L.N.Trishchuk (Inst. of Semiconductors, Acad. of Sci., Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.11, p.1538-40 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1792-4 (Nov. 1982).
The phase diagrams of the systems $Cu_{2-x}S$-ZnS and $Cu_{2-x}Se$-ZnSe have been investigated by the methods of DTA and microstructural analysis. It has been ascertained that the systems are of the peritectic type with restricted solubility in the solid state. The limits of existence of solid solutions based on the copper chalcogenides are 42 and 55 mole % of the zinc chalcogenides at 1185 and 1142°C, respectively, for the former and the latter system. Copper sulfoselenides can be used as solvents for obtaining single crystals of zinc sulfoselenides from solutions in a melt. (12 refs.)

109254 Phase equilibria in the Ag_2Se-ZnSe and Ag_2Se-CdSe systems. L.I.Trishchuk, G.S.Oleinik, I.B.Mizetskaya (Inst. of Semiconductors, Acad. of Sci., Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.11, p.1540-2 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1795-7 (Nov. 1982).
The phase equilibria in the Ag_2Se-ZnSe and Ag_2Se-CdSe systems have been investigated by the methods of differential thermal and microstructural analysis. It has been established that the phase diagram of the Ag_2Se-ZnSe system is of the eutectic type (a composition of 13.5 mole % ZnSe and a temperature of 850°C correspond to the eutectic point). The limiting solubility of zinc selenide in silver selenide at 850°C is 12 mole %. The phase diagram of the Ag_2Se-CdSe system is of the peritectic type (a composition of 62 mole % CdSe and a temperature of 970°C correspond to the peritectic point). Solid solutions based on Ag_2Se exist over the concentration range 0-68 mole % CdSe. The solubility in the solid state in both systems sharply decreases with falling temperature. The compound Ag_2Se can be used as a solvent in the cultivation of ZnSe and CdSe single crystals from solution in melt. (4 refs.)

109255 Phase equilibria of the Bi-Se-I system in the BiSeI-Bi and BiSeI-BiI sections. G.I.Chervenyuk, P.F.Babyuk, D.P.Belotskii, T.G.Chervenyuk (Chernovtsy State Univ., Chernovtsy, USSR).
Inorg. Mater. (USA), vol.18, no.11, p.1569-72 (Nov. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.11, p.1827-9 (Nov. 1982).
The phase diagrams of the BiSeI-Bi and BiSeI-BiI sections of the Bi-Se-I ternary system have been constructed. It has been shown that the BiSeI-Bi section is quasi-binary and that the BiSeI-BiI section is nonquasi-binary with phase separation on the BiI side extending to 17 mole % BiSeI. An increase in the selenium content in the alloys results in reduction of the separation of phases. (9 refs.)

109256 Reactions in the Cu_2Se-In_2Se_3-Se ternary system. T.I.Koneshova, A.A.Babitsyna, V.T.Kalinnikov (N.S. Kurnakov Inst. of General & Inorganic Chem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.9, p.1267-70 (Sept. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.9, p.1483-6 (Sept. 1982). [received: Sept. 1983]
As a result of the investigation of interaction in the Cu_2Se-In_2Se_3 binary system and in the Cu_2Se-In_2Se_3-Se ternary system a projection of the liquidus surface was constructed from the CuSe-In_2Se_3 and $CuInSe_2$-Se sections. It was confirmed that solid solutions based on the ternary compounds $CuInSe_2$ and $CuIn_3Se_5$ exist in this system. (12 refs.)

109257 The Tl_2Se-As system. V.V.Kirilenko, V.A.Samokhov, N.G.Velikova, R.N.Shchelokov, A.V.Medvedev (N.S. Kurnakov Inst. of Central & Inorganic Chem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.9, p.1270-2 (Sept. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.9, p.1487-8 (Sept. 1982). [received: Sept. 1983]
By means of differential thermal, X-ray phase, and microstructural analyses and microhardness measurements, the authors have investigated the phase diagram of the Tl_2Se-As cross section of the Tl-As-Se system. The cross section is quasi-binary. The chemical compound Tl_4AsSe_2, melting congruently at 658K, is found. The phase diagram is also characterized by the presence of a eutectic between Tl_4AsSe_2 and As and a continuous series of solid solutions between Tl_4AsSe_2 and Tl_2Se. (5 refs.)

109258 The $TlAsSe_2$-Tl system. V.V.Kirilenko, V.A.Samokhov, N.G.Velikova, R.N.Shchelokov, A.V.Medvedev (N.S. Kurnakov Inst. of General & Inorganic Chem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.9, p.1272-6 (Sept. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.9, p.1489-93 (Sept. 1982). [received: Sept. 1983]
By DTA and XPA methods, together with an investigation of the microstructure and measurements of the microhardness, the authors have studied the phase diagram of the $TlAsSe_2$-Tl system, which is quasi-binary. In the system they find three chemical compounds: Tl_4AsSe_2, which melts congruently at 658K; Tl_2AsSe_2, which melts congruently at 563K; and $Tl_6As_5Se_{10}$, which melts congruently at 491K. There are regions of homogeneity based on Tl_4AsSe_2 and Tl_2AsSe_2. The phase diagram is also characterized by the existence of a region of phase separation in the liquid state. The authors have determined the glass points of the amorphous alloys and have calculated Tg by the method adopted in the chemistry of high-molecular compounds. A structural model is proposed for the glass-forming compounds Tl_2AsSe_2 and $Tl_6As_5Se_{10}$. (8 refs.)

109259 The Tl_4AsSe_2-AsSe system. V.V.Kirilenko, V.A.Samokhov, N.G.Velikova, R.N.Shchelokov, A.V.Medvedev (N.S. Kurnakov Inst. of General & Inorganic Chem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.9, p.1277-81 (Sept. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.9, p.1494-9 (Sept. 1982). [received: Sept. 1983]
By means of DTA, XPA, microstructural investigations, and microhardness measurements the authors have investigated the phase diagram of the cross section AsSe-Tl_4AsSe_2. They show that this cross section is quasi-binary and is characterized by the presence of two new ternary chemical compounds, $Tl_8As_5Se_7$ and $Tl_8As_{13}Se_{15}$, formed by peritectic reactions at 565 and 513K, respectively. The interaction between $Tl_8As_5Se_7$ and $Tl_8As_{13}Se_{15}$ is eutectic, the composition of the eutectic is 70 mole% AsSe, and its melting point is 500K. Regions of homogeneity based on Tl_4AsSe_2 and $Tl_8As_5Se_7$ are found. The authors have made a triangulation of the ternary system Tl-As-Se into nine partial subsystems. They have determined the glass points of the amorphous alloys. To these they have applied the method of calculation of T_g(K) adopted in the chemistry of high-molecular substances. They show that this method can serve for a preliminary estimate of the character of the chemical interaction in glass-forming chalcogenide systems. (15 refs.)

109260 Crystal chemistry and phase relations in the system Li_2O-Fe_2O_3-TiO_2. Yu-Chyi Yau, J.M.Hughes (Dept. of Geology, Miami Univ., Oxford, OH, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.7, p.479-81 (July 1983).
Above 755°C, compounds along the spinel join $LiFe_5O_8$-$Li_4Ti_5O_{12}$ form a complete solid solution and below that temperature a two-phase region separates the ordered $LiFe_5O_8$ and the disordered spinel phase. At 800° and 900°C, cubic $LiFeO_2$ (*ss*) and monoclinic Li_2TiO_3 (*ss*) exist on the monoxide join $LiFeO_2$-Li_2TiO_3. The distributions of cations in both the spinel and monoxide structures were calculated as a function of equilibrium temperature and composition. Subsolidus equilibria in the system Li_2O-Fe_2O_3-TiO_2 at 800° and 900°C were determined for compositions containing ≤ 50 mol% Li_2O. (18 refs.)

109261 Revised phase diagram of the system ZrO_2-CeO_2 below 1400°C. E.Tani, M.Yoshimura, S.Somiya (Dept. of Materials Sci. & Engng., Tokyo Inst. of Technol., Yokohama, Japan).
J. Am. Ceram. Soc. (USA), vol.66, no.7, p.506-10 (July 1983).
The phase diagram of the system ZrO_2-CeO_2 was reinvestigated using hydrothermal techniques. Cubic, tetragonal, and monoclinic solid solutions are present in this system. The tetragonal solid solution decomposes to monoclinic and cubic solid solutions by a eutectoid reaction at 1050° ± 50°C. The solubility limits of the tetragonal and cubic solid solutions are about 18 and 70 mol% CeO_2, respectively, at 1400°C, and about 16 and 80 mol% CeO_2, respectively, at 1200°C. Solubility limits of the monoclinic and cubic solid solutions are about 1.5 and 88 mol% CeO_2 at 1000°C, and 1.5 and 98 mol% CeO_2 at 800°C, respectively. The compound $Ce_2Zr_3O_{10}$ is not found in this system. (19 refs.)

109262 Solid solubility of GeO_2 in SnO_2. A.Watanabe, T.Kikuchi, M.Tsutsumi, S.Takenouchi, K.Uchida (Nat. Inst. for Res. in Inorganic Materials, Ibaraki, Japan).
J. Am. Ceram. Soc. (USA), vol.66, no.7, p.C104-5 (July 1983).
Subsolidus equilibrium relations were reexamined in the SnO_2-rich portion of the system GeO_2-SnO_2 (60 to 98 mol% SnO_2). A limited solid solution based on SnO_2 was confirmed; ≈ 4 mol% GeO_2 dissolved in SnO_2 at 1250°C, and glass was formed on quenching over the compositional range above 4 mol% GeO_2. Phase relations in the system are discussed with reference to the polymorphism of GeO_2 and its glass-forming ability, and a possible phase diagram is given. (9 refs.)

109263 Thermochemistry of Na_2O-WO_3 system at 1065 to 1239K. R.Y.Lin (GTE Labs., Waltham, MA, USA), J.F.Elliott.
Metall. Trans. A (USA), vol.14A, no.8, p.1713-20 (Aug. 1983).
Physico-chemical properties of the Na_2O-WO_3 binary oxide system have been studied. The activity of Na_2O in Na_2O-WO_3 melts has been determined for temperatures from 1065 to 1239K and for the composition range of N_w (mole fraction of WO_3) from 0.5 to 0.84. It has been calculated that at 1200K and for $0.52<N_w<0.08$, the relative partial molar free energy of Na_2O is $G_N{}^M=95.10-347.2N_w$;(kJ/nole). For temperatures between 1065K and 1213K and compositions between $N_w=0.5$ and $N_w=0.8$, the relative partial molar enthralpy was found to be $H_N{}^M=-709.8+262.58/N_w$; (kJ/mole). The free energies of the compounds in this system were also estimated. (16 refs.)

109264 A molybdenum sulfur binary phase diagram. W.B.Johnson (Dept. of Metall. Engng., Ohio State Univ., Columbus, OH, USA), W.S.Hong, D.W.Readey.
Scr. Metall. (USA), vol.17, no.7, p.919-22 (July 1983).
An Mo-S binary phase diagram is proposed for compositions below 66.67 atom per cent sulfur based upon the evaluation of previously published results. (22 refs.)

The system HfO_2-RE oxide with high RE oxide contents ......See Entry 107587

Remarks on the La_2O_3-Li_2O binary system between 750° and 1000°C ....See Entry 107613

Fusion in phosphate systems at temperatures up to 2970K ....See Entry 107877

Choice of solvent for liquid-phase epitaxy of $Ga_xIn_{1-x}As_yP_{1-y}$ solid solutions ....See Entry 109174

Mechanism and kinetics of formation of ferrite in the solid phase in the CaO-Fe_2O_3 system [Mossbauer observations] ....See Entry 109205

81.30F Solidification

(see also 64.70D Solid-liquid transitions)

109265 The occurence, effect, and control of twinned columnar growth in aluminum alloys. D.A.Granger, J.Liu (Alcoa Tech. Center, Alcoa Center, PA, USA).
J. Met. (USA), vol.35, no.6, p.54-9 (June 1983).
The cast structure known as twinned columnar growth (TCG) is characterized by large colonies of twinned columnar grains which are most likely to occur when conditions are unfavorable for the nucleation and growth of new grains during solidification. Casting methods and alloy systems that are most susceptible to TCG formation are identified, and the effects of the structure on mechanical properties are quantified for sections where remnants of the defect exist after fabrication processing. Observed loss in ductility is associated with planes of weakness which can be traced back to TCG structure in the ingot. Methods available to control ingot grain structure, and arrest the formation of TCG, through an understanding of the solidification process are discussed. (15 refs.)

109266 Impinging melt flow and metallic ribbon formation in the single-roll rapid solidification process. K.Miyazawa, T.Choh (Dept. of Metall. Engng., Nagoya Univ., Nagoya, Japan).
J. Jpn. Inst. Met. (Japan), vol.47, no.8, p.717-23 (Aug. 1983). In Japanese.
Metallic ribbon formation from a cylindrical melt jet in the single-roll rapid solidification process has been investigated to explore the dependence of ribbon geometry on the impinging melt flow on a rotating roll. Results of the experiment using round orifice nozzles and Pb-Sb eutectic alloy show that the spreading of melt on the roll increases with decreasing roll surface velocity and with increasing melt flow rate and melt temperature in the nozzle. Effects of the key process parameters on the ribbon geometry are discussed through considering characteristics of the flow. (28 refs.)

109267 Unidirectional solidification behaviors at high cooling rates in Al-Fe-Mn ternary eutectic alloys. Kang Yul Lee, Kwang Chae Choe, Hyun-Kee Cho.
J. Korean Inst. Met., vol.21, no.5, p.451-8 (May 1983). In Korean.
Unidirectional solidification experiments were conducted on Al-Fe-Mn ternary eutectic alloys at a temperature gradient 80°C/cm in the range of solidification rates of 1-38 mm/min in order to investigate the solidification and mechanical behavior. It has been established that the morphology of the composite structure changed from the plate type into the square pillar or rod type as the solidification rate increased. The chemical composition of fibers at low solidification rates was $Fe(Mn)Al_3$, and that at high solidification rates was $(FeMn)Al_6$. The faster solidification rate produced the higher ultimate tensile strength. But the ultimate tensile strength decreased by misalignment of fibers at very high solidification rates. The ultimate tensile strength of unidirectionally solidified and aged specimens have the same value as that of only unidirectionally solidified specimens. (12 refs.)

109268 A study on the modification of eutectic Al-Si alloys by Sr in permanent mold casting. Choon Sik Kang (Dept. of Metall. Engng., Coll. of Engng., Seoul Nat. Univ., Seoul, Korea), Seung Ho Ahn.
J. Korean Inst. Met., vol.21, no.5, p.500-6 (May 1983). In Korean.
Al-Si alloys have been modified by Na. However, because of the fading tendency of Na, modification of Al-Si alloys by Sr is currently being researched. Besides Na addition, a high cooling rate also results in modification. An experiment was performed to study the modification of Al-Si alloys by Sr in permanent mold casting and was focused on Sr content for complete modification, improvement of mechanical properties, thermal analysis and shrinkage. At 0.3% Sr, when the mold is preheated to 200°C, complete modification was accomplished and mechanical properties were considerably improved. The thermal analysis curve and shrinkage tendency may be used for determining the degree of modification in the permament mold casting. (22 refs.)

109269 Structural formation of high-speed steels during crystallization. P.F.Nizhnikovskaya, E.P.Kalinushkin, L.M.Snagovskii, G.F.Demchenko.
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.777-84 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.23-30 (Nov. 1982).
It is concluded that the $L+\delta\rightarrow\gamma$ peritectic transformation in tungsten-molybdenum high-speed steels goes to completion prior to the start of the eutectic reaction $(L\rightarrow\gamma+K)$, which may precede segregation of austenite from the liquid (with a high carbon content). In this case, the eutectic is crystallized on the base of the metastable M_2C carbide. Conditions for the formation of thermodynamically more stable MC and M_6C carbides are created during slow cooling characteristic for the central zones and upper horizons of an ingot. Eutectics based on these carbides begin to crystallize at comparatively high temperatures, when the peritectic transformation has yet to go to completion. In a certain temperature interval, these transformations occur simultaneously; in this case, they can be suppressed by the eutectic crystallization owing to the characteristic features of the peritectic transformation. As a result, δ-ferrite (the products of its decomposition) is present in the steel. (17 refs.)

109270 Structure and properties of alloys of the Al-Mn system quenched from the liquid state. V.M.Fedorov, T.I.Lebedeva (All-Union Inst. of Light Alloys, VILS, Moscow, USSR).
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.808-10 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.46-8 (Nov. 1982).
It was found that an increase in cooling rate during granule crystallization for the alloy system Al-Mn to 10^5 deg/sec makes it possible to move the boundary for anomalous supersaturation of manganese solid solution in aluminum in the direction of greater manganese concentration. The possibility of further increasing solid solution supersaturation provides an additional strengthening effect during its decomposition and an increase in strength properties for semifinished products made at room and elevated temperature. However, the maximum strengthening during decomposition moves in the direction of lower heating temperature, and solid solution decomposition proceeds more rapidly. Therefore, in order to obtain the maximum properties for semifinished products granule deformation should be carried out at the lowest possible temperature. (6 refs.)

109271 On the difference between 'baykovite' and finely dispersed ledeburite. A.A.Zhukov, A.N.Kokora, R.L.Snezhnoy.
Russ. Metall. (GB), no.1, p.78-81 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.91-4 (1982).
Baykovite is shown to a be a new structural component in iron carbon alloys, possessing a phase composition the same as ledeburite, but differing from it in its creation. Baykovite is formed from iron supersaturated cementite during the cooling process by the stratiation of its lattice predominantly along the (001) planes into plates of 'stoichiometric' cementite Fe_3C and austenite interlayers. The direction of baykovite banding is independent of heat outflow direction, whereas the structure of ledeburite is determined primarily by this factor. (10 refs.)

109272 Features of formation and breakdown of microcrystalline and amorphous phases in splat-cooled cerium-silver alloys. A.A.Yakunin, A.B.Lysenko.
Russ. Metall. (GB), no.1, p.125-7 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.144-9 (1982).
The quenching of liquid Ce-Ag alloys in various concentration ranges made it possible to synthesise X-ray amorphous phases of greatly differing nature, both amorphous and microcrystalline. The splat cooled alloys whose composition is similar to that of the low-temperature eutectic (10-35 Ag) had a truly amorphous structure. The X-ray amorphous phase formed in the quenching of the Ce+(5-6)%Ag alloys was a conglomerate of the microcrystals of α-Ce with a high concentration of stacking faults and of the BCC_m phase with around 8%Ag. (5 refs.)

109273 Form of growth of primary phases and micromorphology of controlled eutectics. D.G.Borshchevskaya, T.Ya.Evina.
Russ. Metall. (GB), no.2, p.172-5 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.189-93 (1982).
The eutectic alloys of various system combination with silver, Ag-Cu, Ag-Bi, Ag-Ge and Ag-Pb were used for the investigation. Silver crystals in all the eutectics have both rounded and flat faced forms of growth. In the Ag-Bi and Ag-Pb alloys, with a decreasing concentration and increasing degree of supercooling of the solution, a change in the mechanism of growth of silver crystals is observed (from layered to normal or vice versa). The morphology of directionally crystallised binary Ag-Cu, Ag-Si, Ag-Bi, Ag-Ge and Ag-Pb eutectics is determined by forms of growth and some kinetic features of the development of interlinked phases. (10 refs.)

109274 Investigation of the crystallisation of alloys in systems containing peritectic transformations. V.I.Psarev, V.G.Kiriy, A.V.Kuznetsov, I.V.Psareva, A.L.Ivanova.
Russ. Metall. (GB), no.2, p.175-82 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.193-200 (1982).
An investigation was undertaken in order to establish relationships in stable and metastable crystallisation of alloys in systems with peritectic transformations (Sb-Zn; Al-Mn, Sn-Au, Ge-Te and In-Te) at cooling velocities of the melts from 50 deg/h to 10^5 deg/sec. On the basis of established relationships, some additions were introduced into the phase diagrams of the systems which take some features of the metastable crystallisation of alloys into consideration. A retardation in restructuring the internal structure of melts on passing through the peritectic horizontal lines, shown on the state diagram of the Al-Mn system, can be one of the main causes of the two sided shifts of the peritectic transformations during heating and cooling of the melts. Intermediate compounds $AuSn_2$ and $AuSn_4$ of the Sn-Au system melt monocongruently, which prohibits the possibility of prolonging the liquidus line into the subcritical zone. Some corrections in the construction of the state diagram of the Sn-Au system were introduced. (14 refs.)

109275 Regularities in the precipitation of W-Re alloys from a mixture of their hexafluorides with hydrogen. Lakhotkin Yu.V., A.I.Krasovskiy.
Russ. Metall. (GB), no.3, p.25-8 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.3, p.27-31 (1982).
Investigation of the kinetics of precipitation of W-Re alloys from a mixture of their hexafluorides with hydrogen indicated that between 450-800°C the precipitation rate of rhenium in the alloys is controlled by the diffusion of rhenium hexafluoride to the substrate. It was established that on a simultaneous precipitation of tungsten and rhenium, the latter considerably increases the solidification rate of tungsten. The relative increase in the solidification rate of tungsten on its co-precipitation with rhenium increases with a decreasing substrate temperature, an increasing rhenium content in the alloy, and depends on the phase composition of the alloy. Investigation of the morphology of the surface of growth of the alloy indicated that separating the phases of the structural type A-15 in the matrix of the solid solution of the alloy containing 9% rhenium changes the acceleration mechanism of solidification tungsten. The mechanism of the kinetic acceleration of tungsten solidification during its co-precipitation with rhenium was proposed. (7 refs.)

109276 Ostwald ripening and solidification behaviour of near-monotectic Zn-Pb alloys. A.Kneissl, P.Pfefferkorn (Montanuniv. Leoben, Leoben, Austria), H.Fischmeister.
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.55-61
Liquid hyper-monotectic Zn-Pb alloys are immiscible within a certain temperature range. The large difference in density between lead and zinc leads to rapid gravity segregation. The objective of the Spacelab experiment 1 ES 313 is to maintain a suspension of lead droplets in a zinc-rich liquid matrix and to study the rate of Ostwald ripening without disturbance by segregation. In preparation of the Spacelab experiment, this paper deals with the solidification behaviour and Ostwald ripening of near-monotectic Zn-Pb alloys under terrestrial conditions. It is shown that the experimental conditions during the Spacelab flight should allow measurements of coarsening by Ostwald ripening and should grant the solidification of the suspension without disturbance by the motion of the solidification front. (22 refs.)

Nuclear response and phase transformation of melt grown, SbI_3-doped HgI_2 .... See Entry 106220

Relationship between some thermodynamic parameters and the tendency of metallic melts to glassify .... See Entry 107880

Monotectic alloy solidification—determination of the liquidus surface in the system succinnonitrile-ethanol-glycerol .... See Entry 107883

Microcrystalline iron-base alloys made using a rapid solidification technology .... See Entry 109186

Structure and properties of rapidly solidified 7075 P/M aluminum alloy modified with nickel and zirconium .... See Entry 109187

Mechanism and kinetics of formation of ferrite in the solid phase in the $CaO\text{-}Fe_2O_3$ system [Mossbauer observations] .... See Entry 109205

Phase equilibria at 1173K in the Ni-Ti-Al system .... See Entry 109241

Transformation behaviour of laser processed Fe-5%Cr, Fe-5%Ni and Fe-6%Cr-2%Ni alloys .... See Entry 109282

Formation and thermal stability of an oxide dispersion in a rapidly solidified Ti-Er alloy .... See Entry 109320

Structure and wear properties of Al-Sn alloy produced by electroslag remelting .... See Entry 109524

Submicron conductor array fabricated from a recrystallized eutectic thin film .... See Entry 109604

Non-destructive evaluation of the microstructure of hypoeutectic Al-Si foundry alloys AS7G03 .... See Entry 109646

81.30H Constant-composition solid-solid phase transformations: polymorphic, massive, and order-disorder

(see also 64.70K Solid-solid transitions)

109277 The isothermal δ-γ transformation of ferritic-austenitic iron-chromium-nickel alloys. R.Mundt, H.Hoffmeister (Lab. fur Werkstoffkunde und Schweisstech., Hochschule der Bundeswehr Hamburg, Hamburg, Germany).
Arch. Eisenhuettenwes. (Germany), vol.54, no.7, p.291-4 (July 1983).
By quenching from ferritizing temperatures of 1350 and 1250°C, the isothermal δ-γ transformation of two iron-chromium-nickel alloys with 26.0% Cr, 6.9% Ni and 30.0% Cr, 7.05% Ni respectively, at temperatures between 700 and 1200°C is studied. Three different transformation stages are revealed indicating grain boundary diffusion controlled growth in the first and last stage while volume diffusion seems to act at least partially in the second stage. Isothermal TTT diagrams are established and activation energies calculated. (19 refs.)

109278 A continuum approach to transformation kinetics of metals. K.Tanaka (Dept. of Aeronautical Engng., Univ. of Osaka Prefecture, Osaka, Japan), R.Iwasaki, S.Nagaki.
Bull. Univ. Osaka Prefect. Ser. A (Japan), vol.31, no.1, p.1-9 (1982).
A continuum model for the solid-solid transformation kinetics of diffusion type is proposed. The theoretical procedure to figure the continuous cooling transformation diagram (C-C-T diagram) and the time-temperature-transformation diagram (T-T-T diagram) is discussed. Some numerical results are given for the austenite-pearlite transformation of steels. (16 refs.)

109279 Inhibition mechanism of the anatase-rutile phase transformation by rare earth oxides. S.Hishita (Dept. of Industrial Chem., Univ. of Tokyo, Tokyo, Japan), I.Mutoh, K.Koumoto, H.Yanagida.
Ceram. Int. (Italy), vol.9, no.2, p.61-7 (1983).
The effect of rare earth oxide additions on the anatase-rutile transformation in doped TiO_2 was investigated. Y_2O_3, La_2O_3, CeO_2, Nd_2O_3, Sm_2O_3, Gd_2O_3, Tb_4O_7, Ho_2O_3, Dy_2O_3, Er_2O_3, Tm_2O_3 and Yb_2O_3, were found to suppress the transformation. The transformation process occurs in three stages. In the first stage, rare earth metal ions dissolve into interstitial sites in anatase. The resulting decrease in oxygen vacancies caused by the solid solution suppresses the nucleation of the transformation. In the second stage, the activation energy of the transformation was found to be 124±3 Kcal/mol and 138±4 Kcal/mol for pure anatase and anatase with 1 mol% Dy_2O_3, respectively. The transformation mechanism of this stage is not necessarily affected by additives. The final stage is affected by the amount of rare earth oxide-titania compound phase. (22 refs.)

109280 Influence of plastic deformation on phase transitions during ageing of titanium alloy VTZ-1. M.V.Mal'tsev, N.I.Kashnikov (A.A. Zhdanov Polytech. Inst., Gorki, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.110-14 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of phase transitions occurring during ageing of alloy VTZ-1 quenched to give a structure containing a mechanically unstable β-phase deformed to different extent by compression. Plastic deformation produced α''-martensite with a preferential orientation. A unit cell of the β-phase, which did not undergo the transition, was distorted during deformation becoming tetragonal but retaining its initial volume. Such distortions were oriented relative to the deformation axis. Deformation after quenching accelerated stratification of the β-phase and transition of the depleted β-phase to the α''-modification. (3 refs.) *A.T.*

109281 Investigation of compounds of the type $(A_{0.5}^{2+}Bi_{0.5})(B_{0.5}^{2+}Nb_{0.5})O_3$. L.G.Kosyachenko, V.V.Kochetkov, A.G.Belous, V.V.Bogatko, Yu.N.Venevtsev (L.Ya. Karpov Sci.-Res. Phys. Chem. Inst., Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1146-51 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1352-8 (Aug. 1982).
Phase transitions were observed in the perovskites $(Sr_{0.5}Bi_{0.5})(Mg_{0.5}Nb_{0.5})O_3$, $(Sr_{0.5}Bi_{0.5})(Zn_{0.5}Nb_{0.5})O_3$, $(Ba_{0.5}Bi_{0.5})(Mg_{0.5}Nb_{0.5})O_3$, and $(Ba_{0.5}Bi_{0.5})(Zn_{0.5}Nb_{0.5})O_3$. A series of data was presented which was evidence for the presence of a spontaneously polarized state in the indicated compounds. (12 refs.)

109282 Transformation behaviour of laser processed Fe-5%Cr, Fe-5%Ni and Fe-6%Cr-2%Ni alloys. P.A.Molian, W.E.Wood (Dept. of Materials Sci., Oregon Graduate Center, Beaverton, OR, USA).
J. Mater. Sci. (GB), vol.18, no.9, p.2555-62 (Sept. 1983).
The effects of rapid cooling of the order of 10^4°C sec^{-1}, achieved through the laser surface alloying process, on the transformation behaviour of Fe-5%Cr, Fe-5%Ni and Fe-6%Cr-2%Ni alloys have been investigated. The solidification structures and microstructures were characterized by optical and transmission electron microscopy. The significant findings are that Fe-5%Cr alloy undergoes a massive transformation to ferrite while Fe-5%Ni and Fe-6%Cr-2% Ni alloys undergo a transformation to a structure consisting of both ferrite and martensite. The substructures of ferrite and martensite were observed to contain essentially dislocations. These alloys also exhibited two carbide precipitations, namely epsilon carbide and cementite. Solidification studies revealed that cellular solidification structures were present in 5%Ni and 6%Cr-2%Ni alloys with a cell spacing of 3 μm but no solidification structures were observed in 5%Cr alloy. The influence of nature of solute and cooling rate on solidification behaviour, transformation mode and morphology of structures have been discussed. (25 refs.)

109283 Transformation structures and strengthening mechanisms of laser processes Fe-Cr alloys. P.A.Molian, W.E.Wood (Dept. of Materials Sci. & Engng., Oregon Graduate Center, Beaverton, OR, USA).
J. Mater. Sci. (GB), vol.18, no.9, p.2563-71 (Sept. 1983).
The microstructures and microhardness of laser processed Fe-Cr surface alloys were investigated as functions of composition (5 to 50 wt.% Cr) and melt penetration depth (100 to 1500 μm). The transformation structures were characterized by optical metallography and thin foil transmission electron microscopy. The microstructures were ferritic irrespective of compositions and melt depths. The alloys containing chromium up to 12% (within the γ-phase field) exhibited a massive ferritic morphology while the alloys containing chromium more than 12% (beyond the γ-phase field) showed an equiaxed ferritic morphology. Transmission electron microscopy studies revealed that the substructure of ferrite consisted of dislocations, the dislocation density increased with increased chromium content. Melt depth, unlike composition, did not have significant effect on the morphology and substructure of ferrite grains. Small amounts of ε-carbide and M_3C carbide phases were observed in these alloys. Both the carbides were found to decrease with an increase in the chromium of the fusion zone. (17 refs.)

109284 Austenitization of steel during chip formation. J.L.Hau-Bracamonte, M.L.H.Wise (Dept. of Metallurgy & Materials, Univ. of Birmingham, Birmingham, England).
Metall. Trans. A (USA), vol.14A, no.8, p.1743-5 (Aug. 1983).
The flow-zone structure of 0.4% C steel chips produced by turning at −196°C has been studied by a combination of microhardness measurements and optical, scanning, and tranmission electron microscopy. This has shown conclusively that pearlite can transform to austenite during cutting despite the extremely high heating rate (e.g. 6×10^5°Cs^{-1}) and short time (e.g. 1.5 to 5.5 ms) at temperature during which transformation can occur (e.g. ≥750°C). (15 refs.)

109285 On the possibility of the transfer of iron on a quasi-liquid state during polymorphic transformation in hydrogen [dynamic superplasticity]. V.I.Shapovalov, V.Yu.Karpov.
Russ. Metall. (GB), no.1, p.53-5 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.59-63 (1982).
A strong influence of hydrogen on the dynamic superplasticity of Fe in a wide range of pressures was detected. It consisted of an anomalous fall in yield point transforming the metal into a quasiliquid state. The phenomenon was observed of a directional spontaneous change in specimen shape when thermocycling in the temperature gradient zone in the presence of hydrogen. (6 refs.)

109286 On the phase transformations in samarium at temperatures 200-600°C. A.A.Spasskaya, V.V.Shishkov.
Russ. Metall. (GB), no.1, p.128-30 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.150-3 (1982).
The phase transformation in Sm in the temperature range 200 to 400°C is associated with the process of dissolution of the oxide phase. Transformation close to 600°C occurs at a constant temperature and is an allotropic transformation. The reason for the appearance of the transformation is discussed. (10 refs.)

109287 Process occurring in supercooled austenite before pearlitic transformation. A.V.Kulemin, S.Z.Nekrasova, R.I.Entin, V.A.Meshalkin.
Russ. Metall. (GB), no.3, p.63-5 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.3, p.68-70 (1982).
Processes preceding pearlitic transformation in variously alloyed steels 50G4 (0.5% C, 4.3% Mn), 50Kh3 (0.5% C, 3.1% Cr), and 45Kh2N4M (0.45% C, 2% Cr, 4% Ni, 0.3% Mo) were investigated using an ultrasonic method. The measurements were carried out in the lower branch of the pearlitic region, at which temperatures the kinetics of transformation is determined mainly by the diffusion mobility of atoms. (6 refs.)

109288 Influence of rapid cooling on the polymorphic transformations in pure metals. D.A.Mirzayev, V.G.Ul'yanov.
Russ. Metall. (GB), no.3, p.90-4 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.3, p.103-9 (1982).
A stepwise dependence of the temperature of the beginning of the polymorphic transformation on the cooling velocity was found in the fifth group of polymorphic metals (titanium, zirconium, iron, cobalt). In the case of titanium, zirconium and cobalt a specific morphology of the transformation products corresponds to each step. The experimental data for these metals are in agreement with the kinetic theory of polymorphic transformations. The stepwise kinetics of the polymorphic transformation in iron are partly due to the slowing down of the interphase boundary by interstitial impurities. (18 refs.)

Crystallography of dislocations inherited in martensitic transformations and twinning .... See Entry 107586

Structural instability of $Hf_xZr_{1-x}V_2$ Laves phases .... See Entry 107605

Phase transformation under intense shock pressure loading ... See Entry 107830

Thermodynamics of order-disorder transformations in vanadium carbide .... See Entry 107920

Phase equilibria in iron ternary alloys. X. Critical evaluation of constitution of cobalt-iron-vanadium system .... See Entry 109218

The Zr-Fe phase diagram (0-66.6 at.% Fe) .... See Entry 109229

Direct observation of transformations during heating of steels in the column of an electron microscope .... See Entry 109295

A study of a cellular phase transformation in the ternary Ni-Al-Mo alloy system .... See Entry 109306

Toughening of structural ceramics .... See Entry 109319

Changes in the properties of β brass having a shape-memory effect in the process of aging .... See Entry 109359

Effect of composition and structure on the hot ductility of CrMn corrosion-resisting steels .... See Entry 109421

Slow crack growth behavior in transformation-toughened Al_2O_3-$ZrO_2(Y_2O_3)$ ceramics .... See Entry 109455

Acoustic emission study of microcracking damage in polycrystalline $(V,Cr)_2O_3$ during thermal cycling of the near-room-temperature phase transition .... See Entry 109489

Effect of deformation and heat treatment on phase transitions and properties of titanium alloys .... See Entry 109492

81.30K Martensitic transformations

(see also 64.70K Solid-solid transitions)

109289 Effect of disorder on the martensitic phase transformation in Nb_3Sn. C.L.Snead,Jr., H.Kumakura, M.Suenaga (Metall. & Materials Sci. Div., Brookhaven Nat. Lab., Upton, NY, USA).
Appl. Phys. Lett. (USA), vol.43, no.3, p.311-13 (1 Aug. 1983).
Specimens of Nb_3Sn tape have been irradiated at ~380K with reactor-spectrum neutrons to fluences of 1.3×10^{19} n/cm^2 ($E>1$ MeV) and the internal friction and dynamic Young's modulus measured from 6 to 300K. The softening of the lattice with decreasing temperature is seen to decrease from 40% of the room-temperature value at 10K for unirradiated Nb_3Sn to 94% at a fluence of 1.3×10^{19} n/cm^2. The internal friction δ due to tetragonal domain-wall motion of the transformed material decreased with increasing fluence, being completely suppressed after $\sim4\times10^{18}$ n/cm^2. The transformation temperature T_m decreased from ~49K for the virgin specimen to 22K for a fluence of 3.8×10^{18} n/cm^2 with no evidence of any tetragonal transformation at all for higher fluences. The lattice-dynamical and electronic changes responsible for these effects are not known at this time, but are seen to be correlated with neutron-induced disorder. (18 refs.)

109290 The relation between the martensite retransformation rate and shape memory in Cu-12.4% Al alloy. Z.Bojarski, H.Morawiec, P.Matyja (Inst. of Phys. & Chem. of Metals, Silesian Univ., Katowice, Poland).
Cryst. Res. & Technol. (Germany), vol.18, no.7, p.K86-9 (1983).
The occurrence of shape memory effect in Cu-12.5% Al alloy was first reported by Nagasawa (1971). The quenched and deformed specimen, when rapidly heated to 450°C, almost completely recovered its original shape. The authors determine the influence of reheating rate and eutectoid decomposition on percentage shape recovery. (2 refs.)

109291 Internal friction in Cu-Al-Zn alloy in the region of a reversible martensitic transformation. Z.Bojarski, J.Ilczuk, H.Morawiec (Inst. of Phys. & Chem. of Metals, Silesian Univ., Katowice, Poland).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.123-7 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of the influence of a cyclic martensitic transformation on the temperature dependence of the internal friction in an alloy of the Cu-8.5 wt.% Al-14.5 wt.% Zn composition. These temperature dependences revealed a difference in the course of the reversible martensitic transition for a sample quenched from a high temperature and one subjected to the first heating-cooling cycle. (7 refs.) *A.T.*

109292 Influence of the texture, grain shape, and substructure of austenite after warm rolling on the martensite structure. V.I.Izotov (Inst. of Metall. & Phys. of Metals, Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.139-45 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Optical and electron microscopy were used in a study of the influence of the crystallographic texture, shape, size, and substructure of grains in austenite deformed by warm rolling on the morphology of the 'cooling martensite' and on the deformation of 80N22 and 25Kh17N6F alloys. It was found that the degree of fragmentation of the martensite in flattened textured austenite grains depended on the nature of the martensite and was governed by the angle between the habit and texture planes. Such forms of the deformed austenite structure as double twins and fragments with large-angle misorientations caused fragmentation of crystals of the resultant martensite, and twins were found to retain the FCC lattice. (11 refs.) *A.T.*

109293 Characteristic features of the phase transformation in In-Hg alloys. Y.Koyama (Dept. of Metall., Tokyo Inst. of Technol., Tokyo, Japan), H.Suzuki, O.Nittono.
J. Jpn. Inst. Met. (Japan), vol.47, no.8, p.655-62 (Aug. 1983). In Japanese.
The FCC⇌FCT phase transformation in indium-(6.8, 7.0 at%) mercury alloys has been studied by means of X-ray diffractometry and a metallographic technique. The alloys when cooled from a high temperature, corresponding to FCC phase to a temperature above room temperature, undergo a phase separation from FCC to FCC+FCT($c/a>1$). On the other hand, when they are cooled to a temperature below room temperature at a cooling rate more than 0.1K/s, the FCC→FCT martensitic transformation takes place, and surfaces of the FCT alloys show a banded relief associated with the martensitic transformation. The shape memory effect is observed in the FCT→FCC reverse transformation on heating, and the amount and behavior of shape recovery are strongly influenced by the heating rate. The characteristic features of the phase transformation are well explained by considering the effect of atomic diffusion. The FCC⇌FCT martensitic transformation is analyzed on the basis of the Landau theory, and some physical quantities such as the second-order elastic constant and change in entropy are calculated. (16 refs.)

109294 Diffuse scattering of electrons in the alloy $Ti_{50}Ni_{46}Nb_4$ during the pre-precipitation of the X-phase. A.G.Khundzhua, M.I.Zakharova (Dept. of Solid State Phys., Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.94-7 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.81-4 (1982).
The method of diffraction electron microscopy is used to study the fine crystalline structure of the B2 solid solution in the alloy $Ti_{50}Ni_{46}Nb_4$. During an isothermal anneal at 550°C the X-phase with the face-centered cubic structure and lattice constant $a_x=2\sqrt{7}a_{B2}=15.8$ Å precipitates. Immediately after hardening of the alloy of 1100°C the body-centered cubic B2 lattice contains regions with crystal structure close to the structure of the X-phase, which are responsible for the characteristic configuration of the intense diffuse electron scattering. (6 refs.)

109295 Direct observation of transformations during heating of steels in the column of an electron microscope. M.L.Bernshteyn, L.M.Kaputkina, S.D.Prokoshkin, N.A.Nikishov.
Russ. Metall. (GB), no.3, p.71-80 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.3, p.76-89 (1982).
The compositions of the investigated steels were chosen in such a way as to enable typical morphological varieties of martensite to be obtained in them through quenching, and also different T_A values on heating. The following combinations of the type of morphology of the original martensite and T_A level were obtained: (a) packet (block) martensite, low T_A (alloy N25); (b) lamellar marteniste, low T_A (60N20); (c) packet martensite, high T_A (38KhS); (d) lamellar martensite, high T_A (120Kh6); (e) mixed (lamellar+-packet) martensite, high T_A (U8, 80Kh5). (14 refs.)

109296 Stress-induced martensitic transformation in a Ti-Ni single crystal. F.Takei (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan), T.Miura, S.Miyazaki, S.Kimura, K.Otsuka, Y.Suzuki.
Scr. Metall. (USA), vol.17, no.8, p.987-92 (Aug. 1983).
The stress-induced transformation in Ti-Ni single crystals, which have been solution-treated at a high temperature to obtain a single parent phase, is reported. (20 refs.)

Crystallography of dislocations inherited in martensitic transformations and twinning .... See Entry 107586

Effect of ageing on martensitic transformation during the deformation of metastable austenitic steels .... See Entry 107711

Computer study of the BCCj⇄FCC structure change by homogeneous deformations .... See Entry 107862

Stability of the martensitic phase boundaries in shape-memory alloys .... See Entry 107923

Mossbauer and magnetisation studies of the alloy $Fe_{0.69}Pd_{0.31}$ .... See Entry 108843

Influence of plastic deformation on phase transitions during ageing of titanium alloy VTZ-1 .... See Entry 109280

Transformation behaviour of laser processed Fe-5%Cr, Fe-5%Ni and Fe-6%Cr-2%Ni alloys .... See Entry 109282

On the microstructure of quenched, normalized and full-annealed, copper-modified 4340 steel .... See Entry 109344

Changes in the properties of β brass having a shape-memory effect in the process of aging .... See Entry 109359

Metastable austenitic Cr-Mn steels .... See Entry 109525

81.30M Precipitation

(inc. segregation; see also 64.75 Solubility, segregation and mixing)

109297 Effect of titanium on the grain boundary segregation of phosphorus in Fe-Ti-P and Fe-Ti-C-P alloys and on the embrittlement of steels. H.Erhart, H.J.Grabke, R.Moller (Max-Planck-Inst. fur Eisenforschung, Dusseldorf, Germany).
Arch. Eisenhuettenwes. (Germany), vol.54, no.7, p.285-9 (July 1983).
Presents the results of an investigation on equilibrium segregation of phosphorus at the grain boundaries of Fe-Ti-P and Fe-Ti-C-P alloys, and its reduction by binding with Ti, by displacement from the grain boundaries by C and by trapping at TiC precipitates. Finally, grain boundary segregation of P in deep drawing steels and the effects of C and Ti contents are discussed. (16 refs.)

109298 Time dependence at 550 and 700°C of $M_{23}C_6$ precipitate composition in AISI 304 stainless steel. A.Boeuf, R.Caciuffo, S.Crico, R.Rebonato, F.Rustichelli (Comm. of the European Communities, JRC, Ispra, Italy), J.P.Morlevat.
Mater. Lett. (Netherlands), vol.2, no.1, p.49-52 (July 1983).
The time dependence at 550 and 700°C of $M_{23}C_6$ precipitate composition in AISI 304 stainless steel has been investigated using the X-ray fluorescence induced by electron bombardment. By increasing the ageing time, $M_{23}C_6$ precipitates become enriched in Cr and depleted in Fe. (7 refs.)

109299 A study of antimony segregation in Fe-Ni alloys. L.S.Burmaka, V.Hajko, O.M.Ivasishin, Yu.N.Ivashchenko, V.Karel, V.G.Kostyuchenko, A.Kosturiak (Inst. of Phys. of Metals, Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.566-72 (1982). [received: Aug. 1983]
Antimony segregation in Fe-30% Ni type alloys is examined using fractographic and chemical analysis, Auger electron spectroscopy and secondary-ion mass spectroscopy. Antimony is shown to segregate in a thin surface layer at the grain boundaries, the level of segregation and the layer structure being dependent on heat treatment conditions and responsible for the fracture behavior of the alloys. The presence of Fe_3Sb_2 precipitates at grain boundaries after long holding treatment increases the contribution of intercrystalline ductile fracture. (6 refs.)

109300 Characteristics of precipitation of a supersaturated solid solution in Al-Zn alloy. A.N.Baranovskii, R.R.Romanova, V.G.Pushin (Inst. of Metal Phys., Ural Sci. Centre, Acad. of Sci., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.146-54 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The fine structure of samples of Al-30 wt.% Zn alloy was investigated by electron microscopy after low- and high-temperature ageing. It was found that the metastable phases (rhombohedral α_R' and cubic α') precipitated in the alloy were due to a single isostructural process and they differed from one another by the degree of coherence with the matrix. This isostructural precipitation (Guinier-Preston zones$\rightarrow\alpha_R'\rightarrow\alpha'$) was a 'dead-end' process and had only an indirect influence on the formation of precipitates of the stable β-phase. The occurrence of two orientational relationships between the β-phase and the matrix was observed for the first time. The sequence of formation of phases during precipitation of the supersaturated solid solution in alloys of the Al-Zn system was analyzed. (16 refs.) *A.T.*

109301 Grain-boundary segregation in low-alloy titanium-vanadium alloys. G.I.Kolodkina, I.I.Kryukov, A.I.Rybnikov, S.S.Ushkov (I.I. Polzunov Sci.-Industrial Combine on Investigation & Design of Power-Industry Equipment, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.160-4 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Two characteristic features were observed for these alloys after heat treatment and these features distinguished them from technical-purity titanium. Firstly, there was a strong reduction (and in the case of alloys with 1-2% V a complete absence) of embrittlement in the region of 500°C. Secondly, after ageing at 850°C the impact strength decreased considerably compared with that in the initial state and that found after heat treatment at 700 and 900°C. A very important result was that at moderate temperatures corresponding to the α-phase range the presence of vanadium slowed down precipitation from the α-matrix of such low-solubility elements as iron and nickel. Moreover, vanadium increased the thermal stability of the mechanical properties of titanium. (10 refs.) *A.T.*

109302 Homogeneous nucleation of a precipitating phase in ordering alloys with domain walls. V.D.Sukhanov, O.D.Shashkov (Inst. of Metal Phys., Ural Sci. Centre, Acad. of Sci., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.165-70 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Homogeneous nucleation of a new phase was observed in several ageing and ordering alloys in the Cu-Pd-Ag and Cu-Pd-Fe systems, in spite of the existence in the ordered matrix of defects in the form of domain walls. It was established that the formation of three-dimensional networks of precipitates along domain walls in these alloys could occur during the particle coagulation stage. (11 refs.) *A.T.*

109303 On precipitation in rapidly solidified aluminium-silicon alloys. P.van Mourik, E.J.Mittemeijer, Th.H.De Keijser (Lab. of Metall., Delft Univ. of Technol., Delft, Netherlands).
J. Mater. Sci. (GB), vol.18, no.9, p.2706-20 (Sept. 1983).
The precipitation of silicon in rapidly solidified Al-Si alloys was studied. For alloys with 2.4 and 11.0 wt.% Si (2.3 and 10.3 at.% Si, respectively) the lattice parameters of the Al-rich and of the Si-rich phases were measured after ageing at 397, 425 and 448K. For alloys with 2.6 and 13.0 wt.% Si crystallite sizes and lattice strains were determined by analysis of the X-ray diffraction line broadening. After ageing the lattice parameters of the Al-rich and the Si-rich phases were influenced by the difference in thermal expansion between both phases. After correction for this effect the amount of silicon dissolved in the Al-rich phase was estimated as a function of ageing time. The behaviour of the lattice microstrains on ageing was explained as a result of the disappearance of stresses due to quenching and the introduction and subsequent dissipation of stresses due to precipitation. After completed precipitation stresses due to the difference in thermal expansion between both phases still exist at room temperature. (45 refs.)

109304 A preliminary study of precipitation in Ti^{4+}-doped polycrystalline alumina. R.A.Langensiepen, R.E.Tressler, P.R.Howell (Dept. of Materials Sci. & Engng., Pennsylvania State Univ., University Park, PA, USA).
J. Mater. Sci. (GB), vol.18, no.9, p.2771-6 (Sept. 1983).
Precipitation processes in two titanium-doped aluminas (0.14 and 0.60 cation % titanium) have been examined using a variety of analytical electron micro-

scopy techniques. The results strongly suggest that, for an ageing temperature of 1573K, rutile is the only precipitate formed in the 0.14 cation % titanium material. However, evidence for the precipitation of both rutile and β-Al_2TiO_5 (the latter at triple junctions) was obtained in the 0.60 cation % titanium sample. (11 refs.)

109305 Precipitation of $Mg_2Zr_5O_{12}$ in MgO-partially-stabilized ZrO_2. S.C.Farmer, L.H.Schoenlein, A.H.Heuer (Dept. of Metall. & Materials Sci., Case Inst. of Technol., Case Western Reserve Univ., Cleveland, OH, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.7, p.C107-9 (July 1983).
Decomposition of cubic, MgO-stabilized ZrO_2 solid solutions has been studied. Precipitates of the ordered compound, $Mg_2Zr_5O_{12}$, form, but only when a two-stage heat treatment involving nucleation at a low temperature followed by growth at a higher temperature is used. Other decomposition products are also present after such a heat treatment. (12 refs.)

109306 A study of a cellular phase transformation in the ternary Ni-Al-Mo alloy system. M.J.Kaufman, J.A.Eades (Dept. of Metall., Univ. of Illinois, Urbana, IL, USA), M.H.Loretto, H.L.Fraser.
Metall. Trans. A (USA), vol.14A, no.8, p.1561-71 (Aug. 1983).
Orthorhombic Ni_3Mo has been observed as a product of a cellular precipitation reaction occurring at grain boundaries in both Ni-12Al-15Mo and a ternary eutectic Ni-12.8 Al-22.2Mo (compositions in at.%) when heat treated at intermediate temperatures (600 to 850°C). Convergent beam electron diffraction and energy dispersive X-ray spectroscopy techniques have been employed to characterize the structure and composition of this phase in these alloys. Since this phase is usually heavily faulted, the diffraction symmetries are reduced, causing ambiguities in analysis. Therefore, a binary (nominally) stoichiometric Ni_3Mo alloy was produced and heat treated in a manner designed to minimize faulting. Convergent beam patterns obtained from this material exhibited symmetries that identify it as having the mmm point group; further analysis of the diffraction patterns led to the conclusion that the space group is Pmmm. These patterns were then used to aid in the interpretation of those taken from the ternary alloys. Orthorhombic Ni_3Mo was also observed within the grains of the ternary eutectic alloy following prolonged aging treatments; the orientation relationship between the Ni_3Mo and the FCC matrix was determined to be identical with that in the cellularly transformed regions. (18 refs.)

109307 Effect of the application of uniaxial stress on precipitation in an Al(Cu) alloy. S.Kawarazaki, N.Kunitomi (Faculty of Sci., Osaka Univ., Osaka, Japan), R.M.Nicklow, H.G.Smith.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.401-4 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The effects of uniaxial stress applied during the aging time for precipitation growth on the formation of GP zones in an Al-1.8% Cu alloy have been studied by means of neutron scattering. When a compression is applied along the [100] direction the precipitates grow preferentially on the (100) planes. Making use of this result, the effect of the formation of GP zones on the resonance anomaly in the [ζ00]T phonon branch previously observed in the alloy has also been studied with respect to the relative direction between the phonon wave vector **q** and the plane of the precipitate. The experimental result indicates that the precipitates perpendicular to **q** are more effective for the formation of the resonance anomaly than those parallel to **q**. (2 refs.)

109308 Conditions for combined precipitation of sulphide and nitride phases in silicon iron. B.M.Mogutnov, L.A.Shvartsman, A.A.Kononov.
Russ. Metall. (GB), no.2, p.90-5 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.104-9 (1982).
To obtain particles of sulphide inhibitor phase of the required dispersion in silicon iron the cooling rates in hot rolling must be the greater, the higher the temperatures (T_p) of complete solution of MnS; and rolling must be started at a temperature no lower than T_p. The volume fraction of inhibitor phases in the sulphide variant of inhibition can be increased by using the nitrogen dissolved in the steel and harmonising the thermodynamic conditions for MnS and AlN precipitation. For this purpose, steel of the optimal composition for this technology should be alloyed with not more than 0.030% aluminium. When boron nitride is used as the additional inhibiting phase iron boride can be formed at hot-rolling temperatures. Austenite formation at these temperatures somewhat lowers the temperature of complete BN solution. (13 refs.)

109309 Precipitation of metastable and equilibrium phases in the decomposition of the β-solid solution in zirconium alloys. M.I.Zakharova, A.A.Aminov, A.G.Khundzhua.
Russ. Metall. (GB), no.3, p.66-70 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.3, p.71-5 (1982).
Phase transformations in zirconium alloys with Nb, Mo, Al, V and Re in the decomposition of the high-temperature BCC solid solution, which is in the metastable state after quenching from 1100°C, were studied. (9 refs.)

109310 Precipitation of helium and its effects on mechanical properties of metals. H.Trinkaus (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.312-18
A survey of the precipitation of He in metals is presented. Low temperature precipitation is associated with athermal processes like metal interstitial emission and loop punching. The related extremely high He densities and experimental techniques to study them are discussed. High temperature precipitation is presented as a typical example of a thermal two-component nucleation-process. It is shown that under certain conditions the evolution of a He bubble population can give information on the permeation of He. Finally, the effects of the formation of He bubbles on mechanical properties of metals is discussed. (33 refs.)

Effect of ageing on martensitic transformation during the deformation of metastable austenitic steels .... See Entry 107711

Void formation and solute segregation in ion-irradiated niobium-base alloys .... See Entry 107786

Precipitation of gas pores in metallic melts during cooling under microgravity .... See Entry 107885

Microprobe investigation of solid solutions in the system ZrO_2-MgO-$MgCr_2O_4$ .... See Entry 107942

Calculation of the segregation coefficient of boron in the Si-SiO_2 system .... See Entry 107944

Second phase development in Sr-doped TiO_2 .... See Entry 107947

Phase separation and defects in crystals studied by small-angle neutron scattering .... See Entry 107954

Regularities in the precipitation of W-Re alloys from a mixture of their hexafluorides with hydrogen .... See Entry 109275

Transformation behaviour of laser processed Fe-5%Cr, Fe-5%Ni and Fe-6%Cr-2%Ni alloys .... See Entry 109282

On the phase transformations in samarium at temperatures 200-600°C .... See Entry 109286

Diffuse scattering of electrons in the alloy $Ti_{50}Ni_{46}Nb_4$ during the pre-precipitation of the X-phase .... See Entry 109294

Development of a new grade of stainless maraging steel and its aging characteristics .... See Entry 109312

Investigation of 'reverse solution' in beryllium bronze .... See Entry 109315

Effect of oriented aluminium nitride precipitates on the texture in 3% silicon iron .... See Entry 109336

Banding in the microstructure of hot strip of HSLA steel .... See Entry 109341

Nature of new X-ray diffuse scattering effects in ageing Al-Zn alloys .... See Entry 109348

Further observations on the formation mechanisms of precipitate-free zones in an aged Al-16 wt pct Ag alloy .... See Entry 109353

Features of the formation of the $M_{23}C_6$ phase in pearlitic class steels during tempering .... See Entry 109363

Structural changes and strengthening in strain aging of austenitic steel .... See Entry 109367

Influence of temperature and the degree of deformation on the structure and properties of medium-carbon steel .... See Entry 109368

New quenching experiments with high purity and carbon doped iron .... See Entry 109374

Influence of creep on the precipitate structure under conditions of long-term creep—investigation of a Fe-Cu model alloy .... See Entry 109431

Anisotropic embrittlement in high-hardness ESR 4340 steel forgings .... See Entry 109477

Modification of Kh12M steel .... See Entry 109526

Magnetic properties of alloy 40KhNYu-VI .... See Entry 109535

Mossbauer investigations on magnetically ordered precipitates in Cu-Ni-Fe .... See Entry 109536

High-performance Ni-Cr-Mo-W alloys .... See Entry 109575

Sensitization of 12 wt pct chromium, titanium-stabilized ferritic stainless steel .... See Entry 109579

Numerical calculation of the decarburisation of medium and high carbon steels at temperatures below the A_1 point .... See Entry 109589

81.40 TREATMENT OF MATERIALS AND ITS EFFECTS ON MICROSTRUCTURES AND PROPERTIES

109311 Microindentation kinetics at premelting temperature. V.G.Kononenko, Chan Kueu Zung.
Ukr. Fiz. Zh. (USSR), vol.28, no.8, p.1198-203 (Aug. 1983). In Russian.
The microindentation kinetics is investigated at premelting temperature. Analysis of possible pit formation mechanisms shows that an experimentally observed anomaly of a rapid indentor dip may be connected with spontaneous generation of dislocation and anomaly of high dislocation mobility at premelting temperature. (9 refs.)

Restoration of components of diesel-electric locomotives .... See Entry 107801

Study of comparative characteristics of adhesional strength of epoxide resins on the basis of sulfone and bis-phenol A .... See Entry 109209

Precipitation of helium and its effects on mechanical properties of metals .... See Entry 109310

81.40C Solid solution hardening, precipitation hardening, dispersion hardening

109312 Development of a new grade of stainless maraging steel and its aging characteristics. P.P.Sinha, A.Natarajan, K.V.Nagarajan, B.K.Sarkar (Vikram Sarabhai Space Centre, Trivandrum, India).
Trans. Indian Inst. Met., vol.35, no.2, p.98-107 (April 1982). [received: Aug. 1983]
A new stainless maraging composition containing 8% Ni, 11% Cr, 5.2% Mo, 12.4% Co and 0.1% Ti has been developed to yield a maximum UTS of around 175 kg/mm^2 coupled with 6.8% elongation. The aging characteristics of this steel in the temperature range 350° to 600°C for durations up to 15 hours have been studied using hardness measurement and metallography techniques. The alloy shows age-hardening behaviour similar to conventional maraging steel. The precipitation reaction occurs by a pipe diffusion mechanism in the dislocation rich matrix. The basic strengthening precipitate has been identified as needles of Fe_2Mo. Also the Fe-Cr-Mo χ-phase having typical Widmannstatten structure has been observed to precipitate in highly segregated regions. The presence of χ-phase and banded structure has not been found to affect the tensile properties, but they impair the impact strength considerably. The aging reaction is also accompanied by reversion of martensite to austenite. (18 refs.)

109313 Precipitation hardening in surface layers of an aluminium-zinc-magnesium alloy. B.Jayakumar, N.K.Srinivasan (Dept. of Metall. Engng., PSG Coll. of Technol., Coimbatore, India).
Trans. Indian Inst. Met., vol.35, no.2, p.167-70 (April 1982). [received: Aug. 1983]
Experimental investigations relating to the response of precipitation hardening in the surface layers of an Al-Zn-Mg alloy are reported. Microhardness as well as bulk hardness measurements were made on specimens of varying thickness. During natural aging, thin specimens of 3.75 mm thickness failed to develop sufficient hardness in the surface layers, while the bulk hardness increased rapidly in the first few hours. Two stages were observed in the natural aging behaviour. For artificial aging, thicker specimens hardened at a lower rate than thin specimens. The results are interpreted in terms of vacancy losses and vacancy magnesium interaction in the surface layers. (16 refs.)

109314 On the theory of acoustic softening of low-carbon steel. I.K.Vagapov, S.A.Kirillov, V.V.Klubovich (Inst. of Solid State & Semiconductor Phys., Acad. of Sci., Minsk, Byelorussian SSR).
Phys. Met. (GB). Translation of: Metallofizika, Kiev (USSR), vol.4, no.3, p.557-65 (1982). [received: Aug. 1983]
The effect of acoustic softening of low-carbon steel was examined using the Gilman-Johnston dislocation model. Under the assumption of the superimposition of static and acoustic stresses, the stress-strain diagram was estimated

numerically for uniaxial tension of low-carbon steel by application of ultrasonics. Variation of the average velocity and density of mobile dislocations during ultrasonic-affected tension was investigated. A microscopic-level interpretation of the acoustic softening effect was provided and compared with experiment. (14 refs.)

109315 Investigation of 'reverse solution' in beryllium bronze. Kh.G.Tkhagapsoev (Kabardino-Balkarsk State Univ., USSR).
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.818-22 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.54-7 (Nov. 1982).
Short heating to 500°C of beryllium bronzes hardened and aged at 300-340°C and also aged after cold plastic deformation was found to lead to softening as the result of reverse solution. The efects of reverse solution were caused by the dispersion of the structure and did not depend upon the nature of the precipitate phases. Beryllium bronze acquired resistance to reverse solution if in aging the α-solid solution decomposition occurred according to the interrupted precipitation mechanism. Treatment for reverse solution at 500°C with a hold of 10 sec may be used as a method of softening of beryllium bronzes in place of the traditional intermediate hardening. (7 refs.)

109316 Increasing the operating life of BrB2 bronze bellows. I.G.Dobrovol'skii, T.M.Khonyak, V.S.Shlyakhovoi (Polytech. Inst., Belorussian SSR).
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.822-4 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.58-9 (Nov. 1982).
A reduction in the hardening temperature of BrB2 bronze from 780 to 720°C was found to make it possible to increase the service life by more than 1.5 times as the result of grain refinement. The small decrease in tensile strength after low temperature hardening had practically no influence on the hysteresis of bellows. (no refs.)

109317 Precipitation hardening caused by a difference in shear modulus between particle and matrix. E.Nembach (Inst. fur Metallforschung, Univ. Munster, Munster, Germany).
Phys. Status Solidi a (Germany), vol.78, no.2, p.571-81 (16 Aug. 1983).
The interaction force between a spherical precipitate, whose shear modulus differs from the one of the matrix, and a dislocation is calculated numerically. From the maximum and the range of this interaction force, the critical resolved shear stress τ_c is derived. If the total precipitated volume fraction stays constant and the particle radius r_p is varied between 8 and 50 times, the Burgers vector, τ_c increases monotonously with r_p. This is in contrast to the findings published by other authors. Modulus hardening is weak compared with other mechanisms of precipitation strengthening. (18 refs.)

109318 Hardening by thermal vacancies and quenching strains in singly-oriented Pb single crystals. A.R.Yavari (Lab. de Thermodynamique et Phys.-Chimie Metall., Domaine Univ., St. Martin D'Heres, France).
Phys. Status Solidi a (Germany), vol.78, no.2, p.583-8 (16 Aug. 1983).
Yield strength measurements at 77K on singly-oriented Pb single crystals of easy glide orientation, quenched and reheated to various temperatures reveal a two stage evolution with increasing post-quenching annealing temperatures. The temperature of the two stages correspond to those obtained by resistivity measurements and are interpreted in terms of formation and annealing out of vacancy clusters. It is shown that the observed quench-hardening of up to 500% is well represented by a mechanism where moving dislocations must create jogs to pass through a random distribution of vacancy clusters. A large reproducible contribution of quenching strains to the hardening is isolated by treatments excluding thermal vacancy supersaturation. It is found that strain generated dislocations alone cannot account for this hardening, thus suggesting a large contribution from strain generated vacancies. (16 refs.)

109319 Toughening of structural ceramics. P.Boch (CNRS ENSCI, Limoges, France), G.Fantozzi, G.Orange.
Rev. Int. Hautes Temp. & Refract. (France), vol.19, no.3, p.119-57 (1982). In French.
The use of 'structural' ceramics to build high efficiency thermal engines is impeded by the brittleness of these materials, which explains the efforts to improve their toughness. Part one of this paper gives a short review of the ways which have been chosen: development of new compounds with high specific toughness, compressive loading of the pieces, fibrous composites and composites with dispersed phases. This latter case is studied on the example of zirconia based ceramics, mainly partially stabilised zirconia. Part two of the paper is devoted to the various mechanisms occurring in the zirconia based ceramics: constrained phase transformation from the tetragonal to the monoclinic phase and microcracking related to such a transformation. The present theories about the improvement of toughness are summed up and discussed. (90 refs.)

109320 Formation and thermal stability of an oxide dispersion in a rapidly solidified Ti-Er alloy. D.G.Konitzer (Dept. of Metall., Univ. of Illinois, Urbana, IL, USA), B.C.Muddle, H.L.Fraser.
Scr. Metall. (USA), vol.17, no.7, p.963-6 (July 1983).
It was found that the cooling rates associated with laser surface melting are sufficiently rapid to retain a supersaturated solid solution of Er in Ti at ambient temperature. Heat treatment of this rapidly solidified material at 973K leads to the formation of a refined dispersion of Er_2O_3 in Ti where the particle size is ~5-25 nm. Prolonged aging at 973K produces little change in the scale of the dispersion, and thus demonstrates a thermal stability that might well be exploited in design of alloys for elevated temperature applications. (10 refs.)

Some applications of convergent beam electron diffraction in metallurgical research ....See Entry 107492

Effect of ageing on martensitic transformation during the deformation of metastable austenitic steels ....See Entry 107711

Preparation and strength of forsterite-zirconia ceramic composites ....See Entry 109197

Diffuse scattering of electrons in the alloy $Ti_{50}Ni_{46}Nb_4$ during the pre-precipitation of the X-phase ....See Entry 109294

Features of the formation of the $M_{23}C_6$ phase in pearlitic class steels during tempering ....See Entry 109363

Interrelationship between twinning and slip in single crystals of heterophase alloys with a low energy of stacking faults ....See Entry 109392

High temperature creep in a Cu-2% Fe alloy ....See Entry 109404

Deformation processing of an aluminium alloy containing particles: studies on Al-5 pct Si alloy 4043 ....See Entry 109408

Effect of chromium content and heat treatment on creep of chromium bronze ....See Entry 109411

Mechanism of hardening of high-molybdenum content maraging steel ....See Entry 109422

Slow crack growth behavior in transformation-toughened Al_2O_3-$ZrO_2(Y_2O_3)$ ceramics ....See Entry 109455

Load frequency dependence in fatigue life of nitrided steel ....See Entry 109498

Modification of Kh12M steel ....See Entry 109526

Magnetic properties of alloy 40KhNYu-VI ....See Entry 109535

81.40E Cold working, work hardening; annealing, recovery and recrystallisation; textures

109321 Hardness changes during ferrite recrystallization in microalloyed steels. P.Deb, V.Raghavan (Indian Inst. of Technol., New Delhi, India).
Trans. Indian Inst. Met., vol.35, no.5, p.461-5 (Oct. 1982). [received: Aug. 1983]
The hardness changes and the ferrite recrystallization kinetics have been studied for different thermomechanical treatments in three microalloyed steels and a reference C-Mn steel. The hardness decreases most rapidly in the first five minutes of the recrystallization anneal. The rate of change of hardness decreases continuously with increasing log (annealing time) in the C-Mn steel. In microalloyed steels, the hardness versus log of annealing time often enters a relatively flat region, before the hardness drop increases again. An approximate linear relationship is observed in all cases between the recrystallized volume fraction and the corresponding hardness. For all steels, the hardness is more for a given volume fraction of recrystallized ferrite, after annealing at a lower temperature. In addition, the hardness-versus-recrystallized fraction plots exhibit quite different slopes. The graphs corresponding to different annealing temperatures for the C-Mn-Nb-V steel show a diverging trend, as the recrystallized fraction increases. This behaviour is attributed to the additional softening effect resulting from coarsening of alloy carbide particles at the higher temperatures of the recrystallization anneal. (4 refs.)

109322 Structural and magnetic studies of pure and substituted gamma iron oxide. V.Prakash, V.Rao, S.Pramanik (Nat. Metall. Lab., Jamshedpur, India).
Trans. Indian Inst. Met., vol.35, no.5, p.513-15 (Oct. 1982). [received: Aug. 1983]
Gives a brief description of methods of preparation of pure and Co-substituted gamma iron oxide. Experimental characterisation of powders by X-ray diffraction, electron microscopic and magnetic studies have been described. Mossbauer studies have also been carried out. (12 refs.)

109323 Universal dependence of the metal hardening parameters on the intensity of shock action. A.A.Deribas, V.F.Nesterenko, T.S.Teslenko.
Combust. Explos. & Shock Waves (USA), vol.18, no.6, p.670-5 (Nov.-Dec. 1982). Translation of: *Fiz. Goreniya & Vzryva (USSR)*, vol.18, no.6, p.68-74 (Nov.-Dec. 1982).
On the basis of an analysis of available experimental results, the authors arrive at the deduction that the fundamental quantity governing the residual properties of materials after shock-wave landing is the pressure on the wave-front in a 1-10 μsec shock compression time range. (33 refs.)

109324 Influence of heat treatment conditions on recrystallization in Fe-3% Si alloy after critical deformation. L.D.Kurmaeva, B.K.Sokolov, L.V.Smirnov (Inst. of Metal Phys., Acad. of Sci., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.204-6 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of the influence of the size of the matrix grain on the critical strain ϵ_{cr} needed for the formation of a coarse-grained structure. An allowance was made for the existence of texture. An increase in the initial grain size increased the critical strain irrespective of the texture and the state of the second phase affected both ϵ_{cr} and the critical grain size. An increase in the degree of dispersion of particles of the second phase in samples with the same grain size and the same texture increased ϵ_{cr}. (8 refs.) *A.T.*

109325 Recovery in deformed copper and nickel single crystals. R.E.Cook, G.Gottstein, U.F.Kocks (Materials Sci. Div., Argonne Nat. Lab., Argonne, IL, USA).
J. Mater. Sci. (GB), vol.18, no.9, p.2650-64 (Sept. 1983).
The static recovery behaviour of copper and nickel single crystals deformed in multiple slip was investigated in mechanical tests and in HVEM in situ annealing experiments. Recovery of Type I, as previously identified in aluminium, was observed in both its microscopic and macroscopic features: a sharpening of the cell-wall structure without a change in substructure scale, correlated with a short transient in the strain-hardening behaviour during retesting. The substructure development with increasing recovery time and temperature is similar to that during dynamic recovery, i.e. with increasing strain in a continuous test. After longer recovery times or at higher annealing temperatures the specimens recrystallize; after larger strains they recrystallize dynamically. An intermediate stage akin to the Type II recovery found in aluminium was never observed, either in its macroscopic manifestation of a long reloading transient or as a general coarsening of the subgrain structure. Examples of local sub-boundary mobility and dissolution were, however, seen in situations close to static or dynamic recrystallization. (40 refs.)

109326 The quantitative representation of fiber- and sheet-texture in metals in cubic crystal system. I. Computer programs for texture analysis. Huhn Jun Kim, Chang Young Lee, Soon Chul KIM, Byung Chil Chun.
J. Korean Inst. Met., vol.21, no.5, p.459-68 (May 1983). In Korean.
Texture measurements by the neutron diffraction method are analyzed using Bunge's series expansion method and the effect of series truncation is studied for samples of various texture sharpness. Two computer programs, TXFIB and TXSHT, developed for the analysis of the respective fiber- and sheet-type texture, are described. Using these computer programs, the orientation distribution function can be expanded in the series of generalized spherical harmonics up to the 58th term from 6 experimental pole figures as input. Estimations of various errors involved in the texture analysis and texture sharpness index are also included in the programs. (18 refs.)

109327 On the recovery and annealing kinetics of cold-worked Ni-4.5 at% Cu alloy. A.R.Ali (Phys. Dept., Cairo Univ., Giza, Egypt), G.Said.
Phys. Status Solidi a (Germany), vol.78, no.2, p.463-7 (16 Aug. 1983).
The process of recovery in cold-worked Ni-4.5 at.% Cu alloy is investigated in the temperature range 25 to 1000°C by observing the associated changes in electrical resistance and magnetic susceptibility. Two annealing stages centred around 130 and 320°C are observed with corresponding activation energies of 1.1 and 1.5 eV, respectively. These are attributed to the release of interstitials trapped on impurity Cu atoms and to the migration of vacancies with the possible formation of vacancy-Cu pairs or complex aggregates, respectively. Above 550°C, the recovery process is examined by using both grain size and susceptibility measurements. At the start of the high annealing process the activation energy (E) is found to be 3.6 eV and the process is related to the climb motion of dislocations. The increase in E with the annealing process is climb motion of dislocations. The increase in E with the interpreted in terms of the initiation of another annealing reaction with complex kinetics and assigned to the formation of low-angle subgrain boundaries. (9 refs.)

109328 Solid solution hardening of Cd-Zn single crystals at 1.5, 2.8, and 4.2K. V.Navratil, M.Hamersky (Dept. of General Phys., J.E. Purkyne Univ., Brno, Czechoslovakia), P.Lukac, V.P.Soldatov, V.I.Startsev.
Phys. Status Solidi a (Germany), vol.78, no.2, p.633-8 (16 Aug. 1983).
Cd-Zn single crystals are deformed in creep at temperatures of 1.5, 2.8, and 4.2K. From the creep experiments the work hardening curves are constructed and the critical resolved shear stress is found to increase with $c^{2/3}$ where c is the atomic concentration of zinc as solute. The concentration dependence of the critical resolved shear stress can be explained according to the theory of Labusch (1972). (29 refs.)

109329 Application of the boundary value integral equations method to the investigation of press working of metals. P.I.Polukhin, V.P.Polukhin, N.F.Andrianov, A.V.Novikov.
Russ. Metall. (GB), no.1, p.153-6 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.179-84 (1982).
The possibility of employing a method involving boundary value integral equations in the investigation of press working of metals is substantiated. Application of this method makes it possible to reduce substantially computer time in the numerical investigation of such problems because the dimensionality is reduced. (13 refs.)

109330 Examination of the recrystallisation of copper deformed at high strains. A.V.Burov, S.D.Shevelkin.
Russ. Metall. (GB), no.1, p.145-7 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.169-72 (1982).
An increase in the total strain to 90% and in the initial strength of rolled copper strips is accompanied by an increase in the strength of the thermodynamic stimulus to recrystallisation. Consequently, the softening temperature of highly deformed copper decreases to 400°C. The higher recrystallisation susceptibility of highly deformed copper, hardened during ageing after working, makes it possible to reduce additionally the temperature of production annealing of copper strips to 300-350°C. (11 refs.)

109331 Conditions of closing pores and voids by working cast metal. V.M.Segal, D.A.Pavlik.
Russ. Metall. (GB), no.1, p.156-60 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.184-8 (1982).
An equation has been obtained for the change of porosity of cast metal during its plastic deformation. Criteria for the welding of microdefects by a hot working process are proposed. Distinctive features of welding of macrovoids by working the metal in nonuniform states of stress and strain are considered. The possibility of complete welding of voids by working cast metal in simple shear is shown. (4 refs.)

109332 Investigation of residual stresses in wire drawing. Yu.I.Nyashin.
Russ. Metall. (GB), no.1, p.160-3 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.188-91 (1982).
The nature of residual stress distribution in a real production process of cold drawing of a steel wire has been studied as well as the dependence of the stress distribution on the conditions in which the deformation process is carried out. Ways of improving the quality of the product by reducing the residual stresses are considered. (8 refs.)

109333 Dynamic recovery and dynamic recrystallization. L.N.Larikov.
Russ. Metall. (GB), no.2, p.62-8 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.69-76 (1982).
During the hardening with a high degree of perfection only those defects which appeared during hardening can be dynamically removed. In the case of real materials both the newly formed and the previously present lattice defects can be dynamically removed. The dynamic recovery includes: dynamic relaxation of point defects, annihilation of dislocations with opposite signs, dynamic polygonisation of three types and dynamic recovery with reorientation. Dynamic primary recrystallisation, dynamic collecting recrystallisation and dynamic secondry recrystallisation can occur depending on the type of material and the conditions of its deformation. Processes of dynamic recrystallisation seldom occur in the pure form; as a rule they are accompanied by dynamic recovery. (23 refs.)

109334 Properties of structural aluminium alloys in the recrystallised and polygonised states. V.I.Dobatkin.
Russ. Metall. (GB), no.2, p.68-72 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.76-81 (1982).
On the basis of the results of testing thermally hardened aluminium alloys with recrystallised and polygonised structures, the application of materials with a polygonised structure is recommended for all cases of comparatively short operating periods and in a majority of cases for articles with a higher resource. The limit factors for higher resource materials could be the lamination corrosion and long term strength at elevated temperatures. These characteristics should be experimentally checked in respect of the operating conditions of the structure. (9 refs.)

109335 The formation of vacancies during primary recrystallisation. S.S.Gorelik, M.S.Blanter.
Russ. Metall. (GB), no.2, p.79-82 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.90-4 (1982).
During the primary recrystallisation of metals and alloys, a considerable amount ($>10^{-4}$) of excess vacancies is formed. Apparently, this is due to annihilation of dislocations and absorption of dislocations by migrating boundaries. The 'recrystallisation' vacancies have a prolonged accelerating influence on the diffusion and some influence on other structurally sensitive phenomena and properties. This influence is manifested particularly strongly after high degrees of deformation and high velocities of the recrystallisation heating. A long effective 'time of existence' of the 'recrystallisation' vacancies and the influence of the velocity of heating on it, can be explained by the high probability of the formation of accumulations of these vacancies (vacancy, clusters, submicropores) and subsequent 'dissolution' of these accumulations by vacancies feeding the material. Excess vacancies formed during the recrystallisation after work hardening can be utilised for acceleration of some processes. (14 refs.)

109336 Effect of oriented aluminium nitride precipitates on the texture in 3% silicon iron. R.I.Malinina.
Russ. Metall. (GB), no.2, p.98-104 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.113-19 (1982).
The precipitation of AlN nitrides in 3% silicon iron and also the presence of other nonmetallic inclusions lead to an increase in the dislocation density in the already recrystallised metal. Consequently, grain refinement takes place during HTA at 800-900°C. The oriented precipitates of the AlN nitrides together with the quenching stresses result in the formation of a three-dimensional elasto-anisotropic stress state in the microregions which causes preferential growth of the nuclei with cubic orientation during HTA and consequently increases the proportion of the cubic component of the texture. (14 refs.)

109337 Influence of cold deformation on the structural stability and heat-resisting properties of 15Kh1M1F steel. M.B.Balakhovskaya, N.A.Khusainova, E.I.Gofman.
Russ. Metall. (GB), no.2, p.133-4 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.147-9 (1982).
15Kh1M1F steel was subjected to heat treatment involving normalisation and annealing at 1050°C, with subsequent high-temperature tempering at 750°C with holding for 10 h. This heat treatment resulted in two structure variants, high-tempered bainite and ferrite-carbide mixture. The metal was then subjected to cold plastic deformation by extension. The degree of deformation was 11-13%. Heat-resistance tests were carried out at 570°C. It was found that cold plastic deformation has a considerable influence on the stability of heat-resisting steel. The bainitic structure is the more stable under conditions of prolonged high-temperature heating of 15Kh1M1F steel subjected to cold plastic deformation, but for the undeformed steel the ferrite-carbide structure is more stable. (2 refs.)

109338 Effects of hardening and localization of strain in strain aging of technical purity iron. Yu.P.Gul', M.M.Ryabchii, V.V.Ryabchii, I.F.Kaminskaya (Dnepropetrovsk Metall. Inst., Dnepropetrovsk, USSR).
Strength Mater. (USA), vol.14, no.10, p.1381-5 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.82-5 (Oct. 1982). [received: Sept. 1983]
The hardening effect in strain aging of Armco was found to increase with an increase in the degree of preliminary strain by tension (by increasing the density of introduced dislocations) regardless of the character of strain distribution in the sample if the aging time was sufficient for occurrence of hardening according to the 'stopper' mechanism. With nonuniform strain distribution in the sample (completion of preliminary strain within the limits of 'geometric loss of strength'). Intensification of strain hardening in strain aging was accompanied by strengthening of the tendency of strain aged technical purity iron toward localization of strain. Equations were obtained making it possible to describe the influence of strain aging on localization of strain in uniaxial tension. (10 refs.)

Dislocation configurations induced by cyclic deformation in silicon crystals ...... See Entry 107701

Effects at boundaries of recrystallized twins in overheated FCC crystals ...... See Entry 107715

The nature of grain boundary sliding and the superplastic flow ...... See Entry 107717

Influence of plastic deformation on magnetic interaction in $FePt_3$ alloy ...... See Entry 108754

Experimental studies of laterally seeded recrystallized, polysilicon on silicon dioxide ...... See Entry 109176

Cementite decomposition in steel under plastic deformation .. See Entry 109212

Effect of repeated plastic deformation on the state of the carbide phase in steels ...... See Entry 109213

Austenitization of steel during chip formation ...... See Entry 109284

Stress-induced martensitic transformation in a Ti-Ni single crystal ...... See Entry 109296

Heat treatment and diamond burnishing of gray cast iron ..... See Entry 109356

Relationships governing structure formation in the hot working of austenite in alloy steels ...... See Entry 109365

Structural changes and strengthening in strain aging of austenitic steel ...... See Entry 109367

Anomalous grain-size distributions during continuous grain growth ...... See Entry 109369

Effect of swaging on the 1000°C compressive slow plastic flow characteristics of the directionally solidified eutectic alloy γ/γ'-α ...... See Entry 109396

On the mechanical properties of the heat treated and cold drawn low carbon steel wire ...... See Entry 109399

Deformation processing of an aluminium alloy containing particles: studies on Al-5 pct Si alloy 4043 ...... See Entry 109408

Static and dynamic deformation mechanisms of a high-density polyethylene having row-nucleated crystalline texture of a-axis orientation as observed by orientation distribution function of crystallites ...... See Entry 109414

Estimation of the yield point of textured polycrystals (with computer calculation of the yield point of titanium) ...... See Entry 109418

Drawability of sheet material ...... See Entry 109434

Dependence of the hardness of α'-uranium alloys on the factor of dimensional non-correspondence ...... See Entry 109497

Effect of cold work on anodic polarization of low carbon steel ...... See Entry 109574

Titanium α-nitrogen solid solution formed by high temperature nitriding: diffusion of nitrogen, hardness, and crystallographic parameters .. See Entry 109578

81.40G Other heat and thermomechanical treatments

109339 Rapid thermal annealing of Se and Be implanted InP using an ultrahigh power argon arc lamp. A.N.M.M.Choudhury, K.Tabatabaie-Alavi, C.G.Fonstad (Dept. of Electrical Engng. & Computer Sci., MIT, Cambridge, MA, USA), J.C.Gelpey.
Appl. Phys. Lett. (USA), vol.43, no.4, p.381-3 (15 Aug. 1983).
A 100-kW water-walled DC argon arc lamp has been used for the first time to post anneal ion-implanted InP samples. Temperatures as high as 925°C and short cycle times (3 and 10 s) are used for the process. Se and Be were ion implanted into room temperature and hot substrate InP samples. A sputter deposited SiO_2 layer, 120 mm thick, covering all wafer surfaces was used as an encapsulant during the lamp anneal. Hot substrate Se implants (400 keV, 1.8×10^{14} cm^{-2}, 200°C) show an average mobility of 1415 cm^2/Vs and an activation of ~63%, and room-temperature Be implants (50 keV, 3.35×10^{13} cm^{-2} and 150 keV, 5.74×10^{13} cm^{-2}) an average mobility of 88 cm^2/Vs and activation of ~45%. This annealing technique is straightforward and gives activations and mobilities comparable to, or better than, the best furnace anneals with shape profiles and simplified surface encapsulation. (12 refs.)

109340 Rapid thermal annealing of Be, Si, and Zn implanted GaAs using an ultrahigh power argon arc lamp. K.Tabatabaie-Alavi, A.N.M.Masum Choudhury, C.G.Fonstad (Dept. of Electrical Engng. & Computer Sci., MIT, Cambridge, MA, USA), J.C.Gelpey.
Appl. Phys. Lett. (USA), vol.43, no.5, p.505-7 (1 Sept. 1983).
The use of a 100-kW water-walled DC argon lamp to anneal ion-implanted GaAs is reported. Annealing cycles of 3 and 10 s and peak temperatures from 950 to 1200°C have been used to anneal Be, Si, and Zn implanted, following

representative implant schedules of technological importance. It is demonstrated that this technique is superior to conventional furnace anneal techniques in terms of the doping profiles, peak carrier concentrations, activation efficiencies (particularly at high doses), and mobilities achieved. The annealing technique should be applicable to large volume GaAs integrated circuit production and 100-mm-diam wafers can be annealed in a single exposure with better than 2% temperature uniformity (Si data). (12 refs.)

109341 Banding in the microstructure of hot strip of HSLA steel. R.Kaspar, Q.Chen, A.Streisselberger (Max-Planck-Inst. fur Eisenforschung, Dusseldorf, Germany).
Arch. Eisenhuettenwes. (Germany), vol.54, no.7, p.273-6 (July 1983). In German.
Presents results of simulation of hot rolling by plane strain compression tests. Finishing temperatures, cooling rate and coiling temperature as important parameters are discussed. The elimination of banding due to activation of ferrite formation is also discussed. (10 refs.)

109342 Influence of heat treatment on structure and properties of a HSLA steel. Z.A.Chaudhury, D.S.Sarma (Dept. of Metall. Engng., Banaras Hindu Univ., Varanasi, India).
Trans. Indian Inst. Met., vol.35, no.2, p.119-25 (April 1982). [received: Aug. 1983]
The influence of annealing, normalizing, oil quenching and water quenching treatments on the microstructure and mechanical properties of a high strength low alloy steel containing 0.1% C, 1% Cr, 1.5% Mn, 0.2% V and 0.003% B has been studied. The annealed steel shows a banded structure of ferrite and pearlite while the normalized steel exhibits a mixture of ferrite and granular bainite. Transmission electron microscopic studies show that the granular bainite structure in this steel is similar to that of upper bainite. The oil-quenched and water-quenched steels possess the lath martensite structure with effects of autotempering in the former. In the normalized condition the steel has yield and ultimate tensile strengths of 609 and 788 MPa respectively with 28% elongation, properties typically observed for bainitic steels. (10 refs.)

109343 Thermomechanical treatment of a commercial purity Al-Mg-Si alloy. S.V.S.Narayana, C.S.Harendranath, A.K.Mallik (Indian Inst. of Technol., Bombay, India).
Trans. Indian Inst. Met., vol.35, no.5, p.421-31 (Oct. 1982). [received: Aug. 1983]
A study has been made on the influence of thermomechanical treatments on the ageing response of a commercial purity Al-Mg-Si alloy. While cold working prior to ageing (T8 treatment) reduced the ageing response of the alloy, cold working after a preageing treatment (T10 treatment) resulted in certain beneficial effects on the ageing behaviour of the alloy. The T10 treatment also resulted in slightly improved tensile properties. Heat treatment was found to have no effect on the low-cycle fatigue response of the alloy. Dislocation substructures studied around the fatigue fracture region showed variation with heat treatment. The alloy, in the conventionally aged condition, compared well with a superpure alloy in so far as ageing behaviour and tensile properties are concerned. However, low cycle fatigue behaviour was found to be poor. (19 refs.)

109344 On the microstructure of quenched, normalized and full-annealed, copper-modified 4340 steel. F.H.Samuel (Metall. Div., Nat. Res. Center, Cairo, Egypt), A.A.Hussein.
Trans. Indian Inst. Met., vol.35, no.6, p.615-23 (Dec. 1982). [received: Aug. 1983]
Presents a collection of some significant microstructural features that have been observed in a Cu-modified 4340 steel heat treated according to four schedules: brine quench, oil quench, normalizing and full annealing. By analogy to Cu-free 4340 steel, a lower extent of retained austenite was observed in the oil quenched state and none at all in the normalized state. The role of this retained austenite in temper embrittlement is discussed. In addition, cementite and not ϵ-carbide is the product of autotempering in the oil quenched state. A new feature of the so called 'granular bainite' was observed in the normalized state. This state consists of carbide-embedded bainite granules dispersed in a matrix of massive ferrite supersaturated with carbon. The full-annealed microstructure exhibits ferrite areas which were revealed as bainitic laths, and another part consisting of relatively thick cementite plates in another ferrite matrix. Such cementite is crystallographically oriented with respect to ferrite via the Bagaryatski relationship. (22 refs.)

109345 Proposed model for degradation of Gunn diodes as observed from study of the I-V characteristics. R.Gulati, I.Chandra, B.L.Sharma (Solid State Phys. Lab., Delhi, India).
Def. Sci. J. (India), vol.33, no.2, p.113-17 (April 1983). [received: Aug. 1983]
The effect of heat treatment on functional Gunn diodes has been investigated in the temperature range of 200-300°C. The influence of electric field during heat treatment has also been studied. The simple variations in I-V characteristics with annealing time have been utilized to interpret the contact behaviour. (8 refs.)

109346 An electron-microscopic examination of low-alloy steel fine structure after controlled rolling and direct quenching. V.I.Bolchakov, K.F.Starodubov (Acad. of Sci., Ukrainian SSR), I.V.Kuksenko.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.8, p.76-8 (1983). In Ukrainian.
Low carbon steel (alloyed by manganese with small additions of niobium and vanadium) quenched directly after controlled rolling is studied for mechanical properties and structure. The plates were water-quenched directly after controlled rolling at 800°C. The effect of quenching rate is also shown. Such a treatment permits yield strengths up to 800 MPa to be obtained under satisfactory impact strength. Mechanical properties of the steel after conventional controlled rolling are studied and presented for comparison. Fine structure of the steel was studied by means of transmission electron microscopy. (5 refs.)

109347 Influence of two-stage ageing on the spatial distribution of γ'-phase particles and on the mechanical properties of alloys with different elastic-distortion fields. E.V.Ugarova, N.T.Travina (Inst. of Metall. & Phys. of Metals, Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.134-8 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of Ni-Al-Cr alloys and of a refractory alloy EI661. A statistical analysis was made of electron micrographs obtained for alloys with different elastic-distortion fields. The relationships governing the formation of spatial distributions of particles after ageing in one and two stages were determined. The parameters of the spatial distribution of particles were compared with the mechanical properties of samples deformed by uniaxial tension. It was found that two-stage annealing was not suitable for improvement in the plasticity. The best properties were obtained when the average elastic distortions (strains) in the matrix were $\sim$0.2-0.5%. (4 refs.) *A.T.*

109348 Nature of new X-ray diffuse scattering effects in ageing Al-Zn alloys. E.T.Emirbekov, G.V.Kleshchev (Pedagogical Inst., Chelyabinsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.202-4 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
The number, shape, orientation, and size of diffuse scattering regions of a new type were determined. It was concluded that the various shapes of these regions represented superpositions of basic cylindrical regions and these were identified with microcavities $\sim$2.38 Å thick associated with the vacancy loops. It was therefore concluded that diffuse scattering of a new type, observed during the zone stage of precipitation represented scattering of X-rays by vacancy loops. (4 refs.) *A.T.*

109349 Thermal stabilisation of beryllium bronzes. N.Vasil'ev, Yu.A.Kaplun, Zh.P.Pastukhova.
Izv. VUZ Mashinostr. (USSR), no.7, p.140-3 (1983). In Russian.
A study is made of the thermal stabilisation of a beryllium bronze following strengthening ageing. Thermal stabilisation at 100-200°C is shown to cause a reduction in the level of residual stresses and an increase in the structural stability of the alloy. Thermal stabilisation under conditions in which the alloy is influenced by stresses generated by an external load causes a substantial rise in the elasticity limit and relaxation resistance of the alloy, thus permitting an improvement in the stability characteristics of the elastic components. (2 refs.) *L.M.H.*

109350 Effect of heat treatment temperature (HTT) on density, weight and volume of glass-like carbon (GC). B.N.Mehrotra, R.H.Bragg, A.S.Rao (Dept. of Materials Sci. & Mineral Engng., Univ. of California, Berkeley, CA, USA).
J. Mater. Sci. (GB), vol.18, no.9, p.2671-8 (Sept. 1983).
Room temperature measurements have been made of the density, weight and linear dimensions of glass-like carbon (GC) that was heat treated in the temperature range of 1000 to 2700°C for three hours in inert gas atmosphere. The density of GC decreased with increase in heat treatment temperature (HTT), reaching a maximum decrease of 12.4% at 2700°C; and the weight loss increased with increasing temperature to a maximum of about 1.9%. The volume increased and showed a quadratic dependence on the HTT, reaching a maximum value of about 10.2%. Subsequent application of hydrostatic pressures up to 1551 MPa (225000 psi) produced only a small increase in bulk density. It is concluded that the weight loss is not the major cause of the density decrease, instead the volume expansion of pores is mainly responsible for this behaviour. The weight loss is suggested to be due to the release of the last vestiges of hydrogen and the volume expansion is shown to be due to two different mechanisms operating in different temperature regimes. A gas pressure mechanism is predominant up to the HTT of 1600°C and at greater HTT thermal stress mechanism predominates. (32 refs.)

109351 The workability of molybdenum arc-melted with the group III transition metals. S.Morozumi (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan), T.Komuro, S.Suzuki.
J. Jpn. Inst. Met. (Japan), vol.47, no.8, p.710-16 (Aug. 1983). In Japanese.
Compacts of molybdenum powder mixed with various amounts of holmium, lanthanum mischmetall, scandium and yttrium, were arc-melted under an argon atmosphere. Button-like ingots were chemically analyzed for carbon, oxygen and added elements in the ingots, tested for the warm workability, and examined by metallography. As it was found that scandium had an excellent effect on the workability of molybdenum, ingots melted with various amounts of scandium up to 0.5 percent were tested further for the workability and tensile properties at temperatures from 203 to 353K. (19 refs.)

109352 Heat treatment of the Cu-Ni-Sn alloys. P.Kratochvil, J.Mencl, M.Saxlova (Univ. Karlovy, Praha, Czechoslovakia).
Kovove Mater. (Czechoslovakia), vol.21, no.4, p.453-60 (1983). In Czech.
Supersaturated solid solution (Cu-9Ni)-Sn decomposes spinodally during appropriate annealing treatment. Spinodal decomposition predetermines the spacing and the degree of order of the (meta)stable precipitates that originate during prolonged annealing in the matrix. Alloys with 2, 4, 4.5 and 6 wt.%Sn annealed at 573K, 623K and 673K have been studied. Dependence of the proof stress R_p 0.2 and ductility A_5 on the time of annealing is presented. Microstructure development after precipitation annealing causes the increase of the proof stress and the simultaneous decrease of ductility. Results can be used in processing technology. (10 refs.)

109353 Further observations on the formation mechanisms of precipitate-free zones in an aged Al-16 wt pct Ag alloy. S.M.Merchant, M.R.Notis, D.B.Williams (Dept. of Metall. & Materials Engng., Lehigh Univ., Bethlehem, PA, USA).
Metall. Trans. A (USA), vol.14A, no.8, p.1745-8 (Aug. 1983).
It is shown that solute diffusion effects can adequately describe the presence of asymmetric solute concentration profiles and symmetric PFZ around grain boundaries in an aged Al-16 wt.% Ag alloy. These effects are also responsible for the lack of precipitate (γ') coarsening at the edge of the GPFZ and cause reprecipitation within the WPFZ formed during the initial conventional aging treatment. (10 refs.)

109354 Effect of electrothermal treatment on the carbide phase in die steel 8Kh4V2S2MF. A.S.Kholin, A.N.Chekhovoi, A.I.Abramov, V.B.Yakovlev.
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.798-800 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.38-40 (Nov. 1982).
The morphology of the carbide phase after electrothermal treatment and after conventional heat treatment with heating in a salt melt was investigated. The volumetric portion and size of the carbides were investigated under an electron microscope using statistical analysis. The carbide phase in complex-alloy die steel 8Kh4V2S2MF was appreciably broken up on increasing the temperature of electric heating for quenching from 1000 to 1200°C (a heating rate of 20 deg/sec in the region of the phase transformations). Electrothermal treatment ensured a finer carbide phase than heat treatment in accordance with the optimal regime with heating in a salt melt. (2 refs.)

109355 Effect of normalizing on the structure and properties of cast iron with spheroidal graphite for rolls. V.I.Vakula, S.I.Rudyuk, V.V.Korobeinik (Sci.-Res. Inst. of Metals, Kiev, Ukrainian SSR).
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.801-5 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.41-4 (Nov. 1982).
In order to determine the efficiency of using high-temperature treatment and to develop optimum normalizing schedules a study was made of the effect of austenitizing conditions on the properties of high-strength cast iron (2.97% C; 1.44% Si; 0.54% Mn; 0.36% Cr; 0.85% Ni; 0.07% Mg; 0.03% P; 0.02% S) for section mill rolls of the design SShKhN48 (TU 14-2-158-74) with a barrel diameter and length of 320 and 800 mm, respectively. The properties of cast iron in the cast condition and after annealing at 650°C were determined for comparison. (8 refs.)

109356 Heat treatment and diamond burnishing of gray cast iron. L.A.Khvorostukhin, N.A.Bystrova, L.I.Belykh (Moscow Aviation Technol. Inst., Moscow, USSR).
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.805-7 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.44-5 (Nov. 1982).
Results are given of a study of the effect of burnishing schedules and heat treatment on elasticity and wear resistance of piston rings made of cast iron KhNV. Heat treatment was carried out by three schedules: (1) Oil quenching from 850°C+tempering at 350-600°C (in 50°C intervals) for 2 h. (2) Normalizing at 850°C. (3) Isothermal hardening with heating to 850°C and isothermal soaking for 2 h at 350°C. (4) The same with isothermal soaking for 2 h at 550°C. Burnishing was carried out at a load of $P_y=100$-300 N and a feed of 0.05 mm/rev for three passes ($i=3$) of a diamond tip with a radius of the spherical part $R_{sp}=2.0$ mm. (2 refs.)

109357 Change in structure and properties in stepped aging of V95 aluminum alloy plates. I.N.Firdlyander, V.S.Sandler, S.N.Borovskikh, I.I.Vlaskina.
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.811-14 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.49-52 (Nov. 1982).
It is concluded that stepped aging of V95 alloy, leading to a decrease in the yield strength of not less than 9-12% (T2 condition) and 15-20% (T3 condition) in comparison with the Tl condition, provides a change in corrosion characteristics of not less than $\sim$85 and 100%, respectively, of the possible change in these properties. A decrease in the hardening rate within the investigated limits leads to a decrease in the maximum of the tensile and yield strengths by 20-30 MPa and makes it possible to reduce the aging time until reaching the maximum in these characteristics by $\sim$2 h. In addition, the strength characteristics in overaging, the investigated corrosion characteristics, and the electrical resistance do not change but the character of precipitates in aging does change. (4 refs.)

109358 Twinning in heating of cast oxygen-free copper. E.I.Krupnikova-Perlina, V.G.Osintsev, V.A.Bliznyuk, A.F.Morozov (State Sci.-Res. & Design Inst. for Alloys & Treatment of Nonferrous Metals, USSR).
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.815-17 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.52-4 (Nov. 1982).
Investigates the structure of cast MOb 99.992-99.995% pure oxygen-free copper ($<5\times10^{-4}$ Sb, $<2\times10^{-4}$ As, $<4\times10^{-4}$ Mn, $<2.5\times10^{-3}$ Ni, $<2\times10^{-4}$ Sn, $<1\times10^{-4}$ Cr, $<5\times10^{-4}$ Pb, $<1\times10^{-4}$ Mg, $<5\times10^{-4}$ Si, $<1\times10^{-4}$ Bi, $<1\times10^{-3}$ Zn, $<1\times10^{-3}$ O, 1-3×10^{-4} Rem) and the character of its fracture in bending. The electrical conductivity of the copper at 20°C is 60 MS/m and the density 8.94×10^3 kg/m^3. The copper was melted and cast in a unit with a mixer under a layer of roasted charcoal in an atmosphere of generator gas. It is concluded that in the heating of cast oxygen-free copper to 300-600°C recrystallization occurs with the formation of acicular twins, which leads to the appearance of cracks in the copper ingots. (11 refs.)

109359 Changes in the properties of β brass having a shape-memory effect in the process of aging. T.V.Vozhdai, G.Z.Zatul'skii, V.K.Larin (Kiev Polytech. Inst., Kiev, Ukrainian SSR).
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.824-7 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.59-61 (Nov. 1982).
It is concluded that the Cu 23.7% Zn 4.55% Al alloy has good technological and special properties after quenching. Prolonged aging of the alloy at 100° does not induce noticeable changes in the properties because of SME. With rising aging temperatures the initial and final temperatures of the reverse martensitic transformation drop, the initial deformation of the samples under constant stress decreases, and the deformation not removed during heating in the temperature range of the reverse martensitic transformation also increases. The effect of aging on the properties of β brass exhibiting SME is due to decomposition of martensite, which is responsible for the increase in stability in the course of prolonged operation at temperatures above 100°. (4 refs.)

109360 Determining distortion of steel structural materials. G.A.Adoyan, Yu.S.Aldoshin, A.M.Gerchikov, S.A.Shevchuk (Experimental Sci.-Res. Inst. of Machine Tools, USSR).
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.863-5 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.12, p.49-50 (Dec. 1982).
The described device makes it possible to determine under laboratory conditions the distortion of steel machine parts induced by relaxation of residual stresses. If a part made of steel 35 is distorted only due to relaxation of residual stresses at standard temperature then the distortion can be prevented by heating to low temperature ($\sim$100-150°C) for 3-4 h. When the sample is heated at successively higher temperatures and the distortion is determined after heating each time then the distortion decreasees noticeably in the temperature range of 200-350°C. (2 refs.)

109361 An investigation into the kinetics of migration of ferrite grain boundaries in a low-carbon steel during decarburisation. V.I.Movchan, N.A.Grudeva, N.V.Podobedova.
Russ. Metall. (GB), no.1, p.86-9 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.99-101 (1982).
An investigation of a low-carbon steel during the process of decarburisation allowed the calculation of the kinetics of boundary migration, an experimental determination of the kinetic coefficient expressed in the form of grain boundary diffusion and the determination of the activation energy for the process. (4 refs.)

109362 Thermodynamics and kinetics of steel decarburisation in annealing. Yu.M.Lakhtin, Ya.D.Kogan, G.A.Solodkin, E.Ya.Timoshenko.
Russ. Metall. (GB), no.1, p.101-5 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.115-19 (1982).
A thermodynamic assessment is given of the decarburising effect of nitriding atmospheres under different process conditions, which enables the compositions of atmospheres suppressing decarburisation during annealing to be predicted. Atmospheres of ammonia diluted by methane and 100%-cracked ammonia are considered. The influence of the composition of the atmosphere on the carbon potential is analysed. The composition of atmospheres preventing decarburisation during nitriding are calculated for various temperatures. A kinetic analysis is carried out of the change in decarburised-layer depth in relation to the process parameters. (4 refs.)

109363 Features of the formation of the $M_{23}C_6$ phase in pearlitic class steels during tempering. M.M.Sandomirskiy, T.V.Belyayeva, G.D.Pigrova.
Russ. Metall. (GB), no.1, p.108-11 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.123-6 (1982).
Repeated prolonged heating of pearlitic steels in the subcritical-temperature region, accompanied by acclerated cooling after each treatment cycle favours the occurrence of the carbide transformation with formation of the $M_{23}C_6$ phase. In chromium steels the $M_{23}C_6$ phase can be formed during tempering with chromium and iron present in roughly equal atom fractions, and even with somewhat smaller chromium contents. An elevated silicon content in pearlitic steel retards formation of $M_{23}C_6$ phase. A certain amount of silicon is dissolved in the $M_{23}C_6$ carbide phase formed during tempering of pearlitic steel. (13 refs.)

109364 Recrystallisation of Al-Sc alloys. M.E.Drits, L.S.Toropovam, Yu.G.Bykov, L.B.Ber, S.G.Pavlenko.
Russ. Metall. (GB), no.1, p.148-52 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.173-8 (1982).
The formation of anomalously supersaturated solutions with a higher concentration of scandium than the corresponding maximum solubility (about 0.4%) was detected in cast Al-Sc alloys. The temperature range of recrystallisation of Al-Sc alloys depends on the degree of dispersion of $ScAl_3$ particles in the starting deformed state and on changes in the degree of dispersion during recrystallisation heatings. During the heating of hardened alloys at temperatures 200-300°C decomposition occurs which hinders the recrystallisation. The high stability of the non-recrystallised structure of Al-Sc alloys is due to the formation on decomposition of the solid solution of fine spherical and uniformly distributed coherent particles of $ScAl_3$. (9 refs.)

109365 Relationships governing structure formation in the hot working of austenite in alloy steels. M.L.Bernshteyn, L.M.Kaputkina, S.D.Prokoshkin, S.V.Dobatkin.
Russ. Metall. (GB), no.2, p.82-90 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.94-104 (1982).
In hot working at strains of up to 7-10%, the austenite of the alloy steels is characterised by the development of rapid strain hardening which leads to the formation of a hot hardening structure, characterised by a higher density of dislocations distributed uniformly or a cellular-type substructure. An increase in strain (to ϵ_{max} which corresponds to the establishment of dynamic equilibrium between the hardening and softening processes) results in the development of softening (dynamic polygonisation), although hardening still predominates. Directional polygonal sub-boundaries appear and subgrains with a higher density of free dislocations form. An increase in strain (to ϵ_{max}) is accompanied by an increase in the volume fraction of the polygonised regions, the fraction of the equiaxed subgrains increases, the sub-boundaries are improved and the density of free dislocations decreases. On reaching strains slightly higher than ϵ_{max}, the steady state stage is characterised by the formation of a stable equiaxed polygonised substructure whose mean parameters remain constant during subsequent deformation changes and are controlled by repolygonisation. (24 refs.)

109366 Spontaneous recrystallisation of the steel matrix near non-metallic inclusions. S.I.Gubenko.
Russ. Metall. (GB), no.2, p.96-8 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.110-13 (1982).
Spontaneous steel-matrix recrystallisation due to non-metallic inclusions is local in character. The reason for its appearance are the volume effects arising in consequence of transformations in inclusions and leading to stress concentrations in the matrix and local plastic shear. The conditions for it to occur and the character of the structure produced depend on the temperature to which the steel is heated and those at which transformations occur in the inclusions, the heating or cooling rates and the magnitudes of the stresses arising in the transformations. These stresses, in their turn, are determined by the temperature and the difference in the packing density of the crystal lattices of the various inclusions or the modifications of one inclusion. Spontaneous recrystallisation of the matrix near inclusions can occur at the transformation temperature in the inclusion, or on subsequent heating, which affects the mechanism and rate of the recrystallisation. The effects considered occur during heating of steels before hot deformation or during heat treatment, and also during cooling after deformation or annealing, and promote formation of a heterogeneous steel structure. (no refs.)

109367 Structural changes and strengthening in strain aging of austenitic steel. V.R.Baraz, V.V.Pokachalov.
Russ. Metall. (GB), no.2, p.104-8 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.119-23 (1982).
Cold drawing of 13Kh18N10G3S2M2 steel produces intensive strain aging and is accompanied by partial decomposition of γ-solid solution. Post-deformation heating at 500 and 700°C reinforces this process. Aging at 500°C produces an additional increase in steel strength, the main increment being observed with brief holding (1 min) and explained by the occurrence of strain aging. At 700°C strength-loss, associated with depletion of the γ-solid solution, carbide-particle coagulation and the development of recovery and recrystallisation have a great influence. Aging at this temperature is characterised by anomalous growth of electrical resistivity, which is observed in the range in which primary recrystallisation occurs. This effect can be due to the increase in excess-vacancy concentration, and also matrix-grain refinement due to occurrence of primary recrystallisation. (7 refs.)

109368 Influence of temperature and the degree of deformation on the structure and properties of medium-carbon steel. A.A.Baranov, A.A.Minayev, V.P.Gorbatenko, I.N.Lad'yanov.
Russ. Metall. (GB), no.2, p.108-13 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.123-8 (1982).
High-temperature heating of 35 and 33GT steels promotes stabilisation of austenite, with a consequent retardation of its diffusion decomposition during cooling. Hot plastic deformation accelerates diffusion decomposition of supercooled austenite in the steels studied. The structure and properties of the steels investigated depends, in a complicated way, on the rolling temperature and deformation parameters. This is governed by the conditions under which the strengthening and strength-loss processes of hot-deformed austenite develop, and by the character of the structure and substructure formed in it. (4 refs.)

109369 Anomalous grain-size distributions during continuous grain growth. J.S.Distl, P.I.Welch, H.J.Bunge (Inst. fur Metallkunde und Metallphys., Tech. Univ. Clausthal, Clausthal, Germany).
Scr. Metall. (USA), vol.17, no.8, p.975-8 (Aug. 1983).
The texture and grain size distribution of solution treated and precipitation treated AlMn1 alloy after a final annealing treatment. The two peaks observed on the distribution curves are considered to be due to grains of the growing and disappearing texture components. (7 refs.)

109370 Effects of prior tempering on the strain aging of a continuously annealed 0.05% C dual phase steel. P.H.Chang (Res. Engng., Inland Steel Res. Labs., East Chicago, IN, USA).
Scr. Metall. (USA), vol.17, no.8, p.1009-14 (Aug. 1983).
The effect of different tempering treatments on the subsequent strain aging behavior of a 0.05% C plain carbon dual phase steel was studied. It was found that the strength (tensile and yield) of the strain aged specimens can be either increased or decreased. These results were explained in terms of the complex interplay of strain aging of ferrite, tempering of martensite and replacement of ϵ-carbides (if present) by cementite. For the 0.05% C dual phase steel, a 100°C tempering, even up to 1200 sec, does not stabilize ferrite

and martensite, consequently the subsequent strain aging resulted in significant martensite softening and replacement of ϵ-carbides by cementite. This led to an overall decrease in tensile strength and a negative dependence of yield strength increase ($\Delta\gamma$) on aging time. (9 refs.)

109371 Structural irregularities in solid $(Pb_{1-x}Sn_x)_{1-y}Te_y$ solutions after annealing in a temperature gradient. T.T.Dedegkaev, D.Kh.Lagkuev, V.A.Moshnikov, D.A.As'kov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.28, no.2, p.252-3 (Feb. 1983). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.53, no.2, p.404-6 (Feb. 1983). [received: Sept. 1983]
Microscopic irregularities in crystals cause a serious deterioration in the performance of devices using such crystals. In solid solutions of $(Pb_{1-x}Sn_x)_{1-y}Te_y$, there is a finite probability that microscopic inclusions will form whether the crystals are grown from a melt (due to concentration supercooling) or subjected to long-term isothermal annealing (due to retrograde behavior of the T-y state diagram). For this reason there is definite practical interest in investigating whether the microscopic uniformity of $(Pb_{1-x}Sn_x)_{1-y}Te_y$ solid solutions can be improved. The authors report experimental findings on how annealing in a temperature gradient affects the microscopic uniformity of undoped $(Pb_{1-x}Sn_x)_{1-y}.Te_y$ crystals containing an excess of tellurium. (4 refs.)

109372 Rapid isothermal annealing of Si implanted semi-insulating GaAs by means of high frequency induction heating. A.Cetronio, M.Bujatti, P.D'Eustacchio, S.Ciceroni (Res. Labs., Selenia SpA, Rome, Italy).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.641-6
Experimental results obtained by rapid isothermal annealing of Si implanted semi-insulating GaAs are presented and compared with results obtained by electron-beam and conventional furnace annealing. For high Cr-doped material, the problem of redistribution cannot be avoided, and for undoped material, this technique yields very good activation (near 100%) and high mobility (approximately 4400 $cm^2/V.sec$). (7 refs.)

109373 Thermal pulse annealing of $Hg_{1-x}Cd_xTe$. K.C.Dimiduk, W.G.Opyd, M.E.Greiner, J.F.Gibbons, T.W.Sigmon (Stanford Electronics Labs., Stanford, CA, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.671-6
Thermal pulse annealing has been used to modify the near surface of $Hg_{1-x}Cd_xTe$. Using anneals of approximately 260°C for seven seconds, the crystal quality of epitaxial HgCdTe surfaces can be improved as observed by MeV He^+ ion channeling. Similar anneals have also been used to repair the damage resulting from a 250 keV, 10^{15} $^{11}B/cm^2$ implant into HgCdTe held at LN_2. For higher temperatures and/or longer anneals, surface Hg loss is observed. Rutherford back-scattering measurements are used to measure this loss. The resulting loss rate data is described by $N_{\square}=A \exp(-\Delta E/kT)$ where A and ΔE depend on the material composition with $A=10^{29}$, $\Delta E=1.8$ eV and $A=10^{36}$, $\Delta E=2.6$ eV for $x=0.23$ and 0.4, respectively. (7 refs.)

109374 New quenching experiments with high purity and carbon doped iron. H.Wever (Inst. fur Metallforschung, Tech. Univ., Berlin, Germany), O.Seydel, G.Frohberg.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.512-15
In α-Fe with C- and N-contents below 1 at.ppm a recovery stage is observed between 380 and 600K which can be associated with the annealing of vacancies, partly via C-vacancy-pairs. In C-doped α-Fe there are different precipitation characteristics of ϵ-carbide according to three different ranges of quenching rates. (10 refs.)

109375 Quenching and annealing experiments on high-purity iron with and without carbon. S.Takaki (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan), H.Schultz, H.Kimura.
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.516-19
The first successful repeated quenching and slow cooling experiment with one specimen was performed with a high-purity iron. High purity iron specimens doped with small amounts of carbon were quenched and isochronally annealed in ultra-high vacuum to minimize contamination during heating. The rate and the fraction of recovery of the quenched-in resistivity are much smaller in specimens with about 20 at.ppm carbon than in specimens with more than 100 at.ppm carbon. The recovery characteristics of the undoped high-purity iron is similar to that in specimens with about 20 at.ppm carbon. At present, the authors cannot separate the effect of quenched-in vacancies from that of carbon. (13 refs.)

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81.40J Elasticity and anelasticity

(see also 62.20D Elastic constants, 62.40 Anelasticity, internal friction, and mechanical resonances)

109376 Size effects and micromechanics of a porous solid. R.S.Lakes (Div. of Materials Engng., Coll. of Engng., Univ. of Iowa, Iowa City, IA, USA).
J. Mater. Sci. (GB), vol.18, no.9, p.2572-80 (Sept. 1983).
The rigidity of rods of a polymeric foam in bending and torsion is measured as a function of diameter. The dependence of rigidity upon specimen size is found to be inconsistent with a classically viscoelastic continuum model. The Cosserat continuum, which admits additional degrees of freedom associated with rotation of the microstructure, describes the foam more accurately than the classical continuum. Evidence is presented that additional degrees of freedom, associated with the deformation of the microstructure, must be incorporated in a complete continuum model of foamed materials. (28 refs.)

109377 Young's modulus of Fe-, Co-, Pd- and Pt-based amorphous wires produced by the in-rotating-water spinning method. A.Inoue, H.S.Chen, J.T.Krause, T.Masumoto, M.Hagiwara (Bell Labs., Murray Hill, NJ, USA).
J. Mater. Sci. (GB), vol.18, no.9, p.2743-51 (Sept. 1983).
Presents the Young's modulus of $Fe_{100-x-y}Si_xB_y$, $Fe_{100-x-y}P_xC_y$, $Co_{100-x-y}Si_xB_y$, $Pd_{77.5}Cu_6Si_{16.5}$, $Pd_{48}Ni_{32}P_{20}$ and $Pt_{60}Ni_{15}P_{25}$ amorphous wires determined from the Young's modulus sound velocity measurement. With increasing metalloid content, the Young's modulus increases from 1.58×10^{11} to 1.87×10^{11} N m^{-2} for Fe-Si-B, from 1.40×10^{11} to 1.52×10^{11} N m^{-2} for Fe-P-C and from 1.73×10^{11} to 1.75×10^{11} N m^{-2} for Co-Si-B systems. The increase in Young's modulus with the amount of metalloid elements is the largest for B, followed by Si, C and then P. The Young's modulus of Fe and Co-Si-B amorphous wires increases significantly with the replacement of iron or cobalt by IV-VII group transition metals. It was recognized that there existed a strong correlation between Young's modulus (E) and tensile fracture strength (σ_f); the ratio of σ_f to E is approximated to be 0.02 for all the amorphous wires investigated. These results imply that the Young's modulus is dominated mainly by the structural and compositional short-range orderings due to the strong interaction between metal and metalloid atoms which hinders the internal displacements. (31 refs.)

109378 Internal friction in 3NiCrMoV steel. J.Jurek, J.Krumpos, Z.Trojanova, P.Lukac (Katedra Fyziky Kovu Matematicko-Fyzikalni Fakulta UK, Praha, Czechoslovakia).
Kovove Mater. (Czechoslovakia), vol.21, no.4, p.439-44 (1983). In Czech.
Two peaks of internal stress in 3NiCrMoV steel samples are observed at 160K and at temperatures between 230 and 250K. The temperature of the first peak is independent of most experimental conditions. The position and height of the second peak depends on thermal working of the material. Interaction between dislocations and carbon and nitrogen interstitials seems to be responsible for these two peaks. (15 refs.)

109379 Dynamic mechanical properties of a polycarbonate/polystyrene copolymer: effects of casting solvent. G.C.Eastmond, K.Haraguchi (Donnan Labs., Univ. of Liverpool, Liverpool, England).
Polymer (GB), vol.24, no.9, p.1171-9 (Sept. 1983).
Dynamic mechanical properties of three polycarbonates, of polystyrene and of a blend and a copolymer of polystyrene with one polycarbonate have been investigated. While the properties of the blend were found to be a simple combination of those of the constituent homopolymers, modified α-relaxation behaviour was found for the polystyrene chains in the copolymer. The modifications, dependent on the casting solvent and thermal treatments used in sample preparation, were found to correspond to enhancement of the segmental motions in polystyrene chains, in spite of their attachment to more rigid polycarbonate. The modifications have been attributed to incorporation of excess free volume during solvent casting. A mechanism is proposed which correlates the excess free-volume fractions with the solubility parameters of the casting solvents. (30 refs.)

109380 Examination of the structure, magnetic and elastic properties of single crystals of alloy Fe-25% Co-30% Cr-3.4% Mo. A.E.Kolchin, B.G.Livshits, I.B.Sidorova.
Russ. Metall. (GB), no.3, p.95-7 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.3, p.110-13 (1982).
Crystals of alloy Fe-25% Co-30% Cr-3.4% Mo are elastically anisotropic with the anisotropy factor. A considerably larger than one at the temperature of isothermal thermomagnetic treatment. It was confirmed that in this alloy there are significant relative differences in the lattice parameters of the phases after both the final optimum heat treatment and the isothermal thermomagnetic treatment. The microstructure which determines the optimum magnetic properties of the alloy is obtained if the magnetic field during isothermal thermomagnetic treatment is in the (100) direction. Deviation from this direction causes the a_1 ferromagnetic phase to emerge oriented with its longitudinal axes or the axes of several particles in the direction intermediate between the direction of the magnetic field and (100). (8 refs.)

109381 Mechanical relaxation effects of self-interstitial-atoms in molybdenum. H.Jacques, K.-H.Robrock (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.159-62
Careful elastic after effect measurements have been performed in Mo after electron irradiation at 5K and after isochronal annealing in search for a reorientation process of ⟨110⟩-dumbbell self-interstitial-atoms. It was found, that this process does not occur, neither as a rotation in place nor during the free migration of the ⟨110⟩-dumbbells. It is proposed to attribute this observation to a two dimensional migration of the ⟨110⟩-dumbbell during which the orientation of the dumbbell axis is conserved. This particular jump explains also the complex behaviour of resistivity recovery observed in earlier studies. (10 refs.)

109382 Elastic modulus change in Mo due to Frenkel defects. S.Okuda, H.Mizubayashi (Inst. of Materials Sci., Univ. of Tsukuba, Ibaraki, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.163-6
Diaelastic polarization of self-interstitial atom (SIA) in Mo and Ag was studied by measurements of elastic modulus change after fast neutron irradiation at about 5K. The modulus changes per unit concentration of the defects due to this effect were obtained as follows: For Mo, $-\Delta E\langle100\rangle/cE\langle100\rangle\simeq56\sim24$, and $-\Delta E\langle111\rangle/cE\langle111\rangle\simeq18\sim12$. For Ag, $-\Delta E\langle100\rangle/cE\langle100\rangle\simeq45$ and $-\Delta E\langle111\rangle/cE\langle111\rangle\simeq45$. These values mean that $-\Delta C_{44}\langle-\Delta C'$ for Mo and $-\Delta C_{44}\rangle-\Delta C'$ for Ag. The results are in agreement with the model of ⟨110⟩ split SIA in Mo and of ⟨100⟩ split SIA in Ag. (11 refs.)

109383 Interstitial interaction in W observed by relaxation measurements. H.Mizubayashi, S.Okuda, T.Arai (Inst. of Materials Sci., Univ. of Tsukuba, Ibaraki, Japan).
Point Defects and Defect Interactions in Metals. Proceedings of the Yamada Conference V, Kyoto, Japan, 16-20 Nov. 1981 (Amsterdam, Netherlands: North-Holland 1982), p.167-70
In previous experiments, the relaxation peak due to rotational motion without migration of ⟨110⟩-split type self-interstitials in neutron irradiated W was observed at 5.5K ($\tau\simeq2$min) and at 8K ($f\simeq500$ Hz), and it showed the strong deviation from the $1/T$ law in its relaxation strength. Here, this deviation from the $1/T$ law is studied from the view point of interstitial interactions. (8 refs.)

Elastic media with microstructure I. One-dimensional models .... See Entry 105051

Interfacial matrix stresses in composites due to misfitting cylindrical constituents .... See Entry 107007

Response of an orthotropic cylindrical shell to sudden heating .... See Entry 107008

Structural instability of $Hf_xZr_{1-x}V_2$ Laves phases .... See Entry 107605

The effect of gamma radiation on the mechanical properties of corundum .... See Entry 107763

Paraelasticity in electron-irradiated molybdenum .... See Entry 107771

Effects of 14 MeV neutron irradiation on creep of nickel and niobium .... See Entry 107775

Dynamics and thermodynamics of anharmonic crystals near the instability point .... See Entry 107838

Method of studying viscoelastic properties of porous polymer films .... See Entry 108243

Entangled linear polymer chains in melts: n.m.r. and Rouse or reptation models; stress relaxation .... See Entry 108822

Effect of disorder on the martensitic phase transformation in Nb_3Sn .... See Entry 109289

Internal friction in Cu-Al-Zn alloy in the region of a reversible martensitic transformation .... See Entry 109291

Precipitation hardening caused by a difference in shear modulus between particle and matrix .... See Entry 109317

Influence of two-stage ageing on the spatial distribution of γ'-phase particles and on the mechanical properties of alloys with different elastic-distortion fields .... See Entry 109347

Thermal stabilisation of beryllium bronzes .... See Entry 109349

Heat treatment and diamond burnishing of gray cast iron .... See Entry 109356

Determining distortion of steel structural materials .... See Entry 109360

A structural study of the tensile drawing behavior of poly(ethylene terephthalate) .... See Entry 109413

Certain features of the change in physicomechanical properties of type SSTF material in aging under humid subtropical conditions .... See Entry 109430

Fracture of phosphate-bonded high-alumina refractories .... See Entry 109435

Reloading stress relaxation behavior and rupture for 19Cr-9Ni-1.4Mo-1.4W-Nb bolting steel .... See Entry 109462

81.40L Deformation, plasticity and creep

(see also 62.20F Deformation and plasticity, 62.20H Creep)

109384 Determination of minimum bending radii for bending of round wires and bars. R.Kopp, W.Knott (Inst. fur Bildsame Formgebung, Rheinisch-Westfalischen Tech. Hochschule Aachen, Aachen, Germany).
Arch. Eisenhuettenwes. (Germany), vol.54, no.7, p.277-84 (July 1983). In German.
Describes the crack testing method applied and gives the derivation of the equations for the minimum bending radius. The correlations between minimum bending radius, yield point, tensile strength, yield point/tensile strength ratio and hardness of various steel grades are discussed. A simple correlation between minimum bending radius and percentage reduction of area after fracture is developed. A discussion of this correlation on the basis of viscoplastic results is presented. (no refs.)

109385 Extension of the notion of foundry alloy accommodation limit. J.Boutault, C.Fromont, E.Plenard.
Fonderie - Fondeur d'Ajourd'hui (France), no.26, p.31-42 (June-July 1983). In French.
The authors describe the different means of determining the accommodation limit. They discuss the practical value of a complementary and new notion making it possible to guarantee a casting to be both accommodated and have a total deformation smaller than a threshold acceptable for a given use in mechanics. (3 refs.)

109386 Extended ductility in Al-Zn-Mg alloys. V.D.Kodgire, A.M.Rao, A.K.Mallik (Indian Inst. of Technol., Bombay, India).
Trans. Indian Inst. Met., vol.35, no.5, p.443-7 (Oct. 1982). [received: Aug. 1983]
High temperature uniaxial deformation behaviour of Al-6Zn-1Mg and Al-6Zn-2.3Mg alloys with small additions of titanium was investigated. The alloys were suitably processed to give final grain sizes of 24 and 20 μm, respectively. Tensile tests on strip samples using a screw driven machine were conducted over a temperature range of 673-773K (400-500°C) and at strain rates between 1.11×10^{-4} to 2.2×10^{-2}. A sigmoidal relationship between the

flow stress and strain rate was observed. Measurement of the strain rate sensitivity index as a function of strain rate and temperature showed good correlation with total elongation obtained. The maximum elongations obtained under constant crosshead velocity testing were ~80% and 120% respectively for the two alloys. Cavitation, which was observed at the grain boundaries increased with increasing strain and temperature but decreasing strain rate. Failure was associated with the growth and interlinkage of the cavities. (19 refs.)

109387 Deformation studies on Al-Mg-Zr alloy. J.Mukhopadhyay, A.M.Rao, A.K.Mallik (Indian Inst. of Technol., Bombay, India).
Trans. Indian Inst. Met., vol.35, no.5, p.451-5 (Oct. 1982). [received: Aug. 1983]
Al-Mg alloys are reported to be superplastic. The aim of the present investigation was to study the deformation behaviour of Al-5% Mg alloy with a small addition of zirconium (0.3%) as grain refiner. Grain size of about 26 μm was produced by an appropriate thermomechanical treatment. Investigations were carried out under uniaxial and biaxial state of stress over wide ranges of temperature and strain rate. The optimal temperature and strain rate for obtaining maximum elongation (~92%) were determined to be 573K (300°C) and 1.4×10^{-3} S^{-1} respectively. High temperature 573K (300°C) forming limit diagram shows that the limiting strain at this temperature increases three fold compared to that obtainable at room temperature. (15 refs.)

109388 On the role of Bauschinger effect in tensile tests following torsional prestrain. M.K.Rao (School of Engng., Univ. of Pittsburgh, Pittsburgh, PA, USA), G.S.Murty.
Trans. Indian Inst. Met., vol.35, no.6, p.543-7 (Dec. 1982). [received: Aug. 1983]
A comparative study of the (i) torsional prestrain effect on the subsequent tensile behavior and (ii) tensile prestrain effect on the subsequent compressive behavior has been made on mild steel, copper and aluminum with a view to assess the role of Bauschinger effect in explaining the observed region of high strain hardening rate in tension following torsional prestrain. While the lowering of flow stress due to change in the mode of testing from torsion to tension is less than that in tension-compression tests, the initial strain hardening rate in the former type of test is significantly higher than that due to stress reversal in tension-compression tests. These results are incompatible with the interpretation that the region of high strain hardening rate in tension following torsional prestrain is a consequence of Bauschinger effect. (5 refs.)

109389 Microstructure-property correlation in alloy Ti-6.5Al-3.3Mo-1.6Zr-0.3Si. D.Mukherjee, D.Banerjee, R.L.Saha (Defence Metall. Res. Lab., Hyderabad, India).
Trans. Indian Inst. Met., vol.35, no.6, p.583-94 (Dec. 1982). [received: Aug. 1983]
Ti-6.5Al-3.3Mo-1.6Zr-0.3Si is a $\alpha+\beta$ titanium alloy with good creep properties. A wide variety of microstructures were developed in this alloy through heat treatment in the $\alpha+\beta$ and β region following $\alpha+\beta$ processing. The prior β grain size in β- heat treated samples and the primary α volume fraction in $\alpha+\beta$ heat treated samples was characterised quantitatively. Tensile and creep rupture data were obtained for the nine microstructure generated and fracture surfaces of the tensile tested samples examined by SEM. The results indicate that β_{-} heat treated samples possess superior creep properties but somewhat poorer tensile ductility than $\alpha+\beta$ heat treated samples. The yield strength decreases with cooling rate from heat treatment temperatures for both $\alpha+\beta$ and β treated samples. The property variation with microstructure can be explained with the existing understanding of the effect of microstructure on properties in titanium alloys. (7 refs.)

109390 Plastic deformation behavior of mild steel along spiral strain trajectory. Y.Ohashi, E.Tanaka, T.Ueno (Dept. of Mech. Engng., Nagoya Univ., Nagoya, Japan).
Mech. Mater. (Netherlands), vol.2, no.2, p.111-22 (Aug. 1983).
An experiment was performed on the deformation of mild steel along a series of three-dimensional bilinear strain trajectories with each of 18 kinds of spiral part consisting of various combinations of constant curvatures and torsions of strain trajectory. Combined loadings of axial force, torque and internal pressure were applied to thin-walled tubular specimens of initially isotropic material by means of an automatic combined loading testing machine. The hypothesis of local determinability is discussed and its practical usefulness is examined in light of the experimental results. A simple constitutive relation is established by means of the hypothesis and its accuracy is discussed. (12 refs.)

109391 Influence of dislocation density on microchemical inhomogeneity of the thermal influence zone of welded Nb alloys. E.A.Asnic, R.I.Barabash, O.V.Bilots'kii, M.M.Nerodenko, O.V.Polenur.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.5, p.75-8 (1983). In Ukrainian.
Plastic deformation of the heat-affected zone in the process of niobium alloy welding increases dislocation density in this zone and concentration of interstitial impurities (nitrogen and oxygen). An increase of impurity concentration may induce failure in this zone. (9 refs.)

109392 Interrelationship between twinning and slip in single crystals of heterophase alloys with a low energy of stacking faults. Yu.I.Chumlyakov, V.F.Esipenko, L.S.Bushnev, A.D.Korotaev (V.D. Kuznetsov Siberian Physicotech. Sci.-Res. Inst., State Univ., Tomsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.171-8 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Crystals of the Cu-12% Al-2.3% Co (at.%) alloy with a specific orientation were hardened by particles of noncoherent phases. The mechanism of plastic deformation was studied as a function of the dispersion of the particles. Critical parameters of the dispersion, ensuring twinning beginning directly from the yield stress, were found. When the particle size was increased, the conditions for a change in the plastic deformation mechanism from slip to twinning were attained during slip. A model was developed to describe the change in the plastic deformation, which preceded twinning, as a function of the energy of stacking faults in the matrix and as a function of dispersion of the particles. The predictions of the model were checked experimentally. (19 refs.) *A.T.*

109393 Strength and plasticity of two-phase ferrite martensitic steels. B.M.Bronfin, M.I.Gol'dshtein, A.A.Emel'yanov, A.Z.Shifman, V.P.Shveikin (S.M. Kirov Ural Polytech. Inst., Sverdlovsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.179-85 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
A study was made of the influence of microstructure parameters on the strength and plasticity of low-carbon two-phase steels with the ferrite martensitic structure. Relationships were obtained for the time dependence of the breaking strength and for the uniform elongation as a function of the ferrite grain size and of the volume fraction of martensite in the steel structure. Nomograms were constructured for the prediction of the ferrite grain size and of the amount of martensite in a structure of a steel needed to achieve specified values of the strength and uniform elongation. (13 refs.) *A.T.*

109394 The effect of superconducting transition on slipping and twinning in indium and its alloys. I.N.Kuz'menko, S.V.Lubenets, V.V.Pustovalov, L.S.Fomenko.
Fiz. Nizk. Temp. (USSR), vol.9, no.8, p.865-72 (Aug. 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
Single crystals of pure indium and In-Pb alloys (6 and 8 at.%Pb) are tested for compression with the constant rate $\dot{\epsilon}=10^{-5}\div10^{-4}$ sec^{-1} at temperatures 0.48 and 1.7K, and the effect of sample state on yield point and twinning stress as well as the effect of *N-S* transition on flow stress under slip and twinning are considered. The effect of an electron subsystem state on the parameters of plastic strain under slip (monotone or jump-like) is found to be appreciable. For the In-Pb alloys which up to $\epsilon=6\%$ are deformed only due to twinning, neither twinning stress nor flow stress is dependent on sample state. (12 refs.)

109395 High temperature ductility of iron and some steels. C.J.Rosa (Dept. of Materials Sci., Univ. of Cincinnati, Cincinnati, OH, USA).
High Temp. Sci. (USA), vol.16, no.2, p.69-81 (April 1983). [received: Sept. 1983]
Hot-torsion results, from C-Mn steels and low-C alloy steels, obtained under a shear strain rate of 11.8 s^{-1} indicate that the optimum hot-ductility temperature range lies between 1500 and 1550K. It is shown that the evaluated surface shear stress varies linearly from 66 to 39 MPa with increasing temperature from 1339 to 1477K. These data are useful for rotary piercing of billets in the production of seamless pipes. (20 refs.)

109396 Effect of swaging on the 1000°C compressive slow plastic flow characteristics of the directionally solidified eutectic alloy γ/γ'-α. J.Daniel Whittenberger (NASA, Lewis Res. Center, Cleveland, OH, USA), G.Wirth.
J. Mater. Sci. (GB), vol.18, no.9, p.2581-8 (Sept. 1983).
Swaging between 750 and 1050°C has been investigated as a means to introduce work into the directionally solidified eutectic alloy γ/γ'-α (Ni-32.3 wt.%Mo-6.3 wt.%Al) and increase the elevated temperature creep strength. The 1000°C slow plastic compressive flow stress-strain rate properties in air of as-grown, annealed, and worked nominally 10 and 25% materials have been determined. Swaging did not improve the slow plastic behaviour. In fact large reductions tended to degrade the strength and produced a change in the deformation mechanism from uniform flow to one involving intense slip band formation. Comparison of 1000°C tensile and compressive strength-strain rate data reveals that deformation is independent of the stress state. (12 refs.)

109397 Effect of intercritical quenching on microstructure and tensile properties of steels 15 and 15Mn2Nb. D.-Z.Yang, X.-W.Sun, T.-C.Lei (Dept. of Metals & Technol., Harbin Inst. of Technol., Harbin, China).
J. Mater. Sci. (GB), vol.18, no.9, p.2727-31 (Sept. 1983).
The microstructure and tensile properties of steels 15 and 15Mn2Nb after quenching from intercritical ($\gamma+\alpha$) temperatures were studied. It was shown that steel 15 has an 'island-type' dual-phase structure (ferrite plus martensite) after intercritical quenching, while the steel 15Mn2Nb has the 'lamellar' structure with alternatively arranged ferrite and martensite needles. Such a lamellar dual-phase structure obviously has improved strength and ductility and is suggested as one of the effective methods in developing high strength dual-phase steels. (4 refs.)

109398 An experimental study of the effect of prestressed loose carbon strands on composite strength. Zhifan Chi (Northwestern Polytech. Univ., China), Tsu-Wei Chou.
J. Compos. Mater. (USA), vol.17, no.3, p.196-209 (May 1983).
The strength behavior of composites reinforced with prestressed fiber strands is determined. A theoretical analysis of the feasibility of strength enhancement by fiber prestressing has been demonstrated previously (see ibid., vol.17, p.26, 1983). Fiber prestressing is achieved by bending of the loose bundles and the weak points of the fibers are thus eliminated. The experimental results show that after prebending the fibers to an appropriate level the strength of composites can be enhanced. Although the increase in composite mean strength is small, the variation of composite strength is greatly reduced, and the strength at high survivability level is enhanced most significantly. (6 refs.)

109399 On the mechanical properties of the heat treated and cold drawn low carbon steel wire. Won Tae Kim (Seoul Nat. Univ., Seoul, Korea), Tong Hoon Kim.
J. Korean Inst. Met., vol.21, no.5, p.482-8 (May 1983). In Korean.
Tensile test and microstructural analysis were performed to investigate the effects of dual phase heat treatment and cold drawing so as to promote the mechanical properties of 0.07% C steel wire. The strength of the dual phase steel wires varied with volume fraction, shape and size of martensite and grain size of ferrite. The strength of the dual phase steel wire was approximately proportional to a reciprocal of square root of mean free path. The elongation of dual phase steel wires varied with volume fraction, distribution, and size of martensite. The carbon content in martensite changed the strength of martensite, which affected the elongation of the specimens. Low carbon steel wire of 1257 MPa in tensile strength and 4 percent in elongation was obtained, when low carbon steel rod with 475 MPa and 38% in tensile strength and elongation, respectively, was heat treated and cold drawn. (13 refs.)

109400 Cyclic stress-strain behaviors of carbon steel and Cr-Mo steel. K.Kanazawa, K.Yamaguchi, K.Kobayashi (Nat. Res. Inst. for Metals, Tokyo, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.357, p.605-9 (June 1983). In Japanese.
Cyclic stress-strain curves were obtained by the incremental step method for a carbon steel SB 49 and a chromium-molybdenum steel SCMV 4. The temperature and strain rate dependences of the cyclic stress-strain curves were discussed and the curves were compared with those obtained by the companion specimens method. Cyclic hardening and cyclic softening behaviors were observed for SB 49 and SCMV 4, respectively. The cyclic stress-strain curve lay at the higher stress level side than the monotonic stress-strain curve for SB49; for SCMV 4 it was the other way. The cyclic stress-strain curve depended on strain rate. With decreasing strain rate, the stress amplitude for SB49 increased at 200 and 300°C, but decreased at 400 and 500°C. Similar dependences were observed in SCMV 4 steel. The cyclic stress-strain curve can be expressed very well by the experimental equation as $\Delta\epsilon_T/2=(\Delta\sigma/2)/E'+\{(\Delta\sigma/2)/K'\}^{1/n'}$. (9 refs.)

109401 Study on elastic-plastic deformation analysis using a cyclic stress-strain curve. T.Igari, K.Setoguchi, M.Yamauchi (Nagasaki Tech. Inst., Mitsubishi Heavy Industries, Ltd., Nagasaki, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.357, p.610-14 (June 1983). In Japanese.
Presents the results of the elastic-plastic deformation analysis using a cyclic stress-strain curve with an intention to apply this method for predicting the

low-cycle fatigue life. Uniaxial plastic cycling tests were performed on $2^1/_4$Cr-1Mo steel to investigate the correspondence between the cyclic stress-strain curve and the hysteresis loop, and also to determine what mathematical model should be used for analysis of deformation at stress reversal. Furthermore, a cyclic in-plane bending test was performed on a flat plate to clarify the validity of the cyclic stress-strain curve-based theoretical analysis. The cyclic stress-strain curve corresponds nearly to the ascending curve of hysteresis loop scaled by a factor of $^1/_2$ for both stress and strain. Therefore, the cyclic stress-strain curve can be determined from the shape of hysteresis loop, for simplicity. (7 refs.)

109402 Effects of V-addition and welding method on the change of microstructure during creep process for 308 type stainless weld metals. T.Zaizen, Y.Otoguro, S.Aoki, K.Suzuki, S.Bando (Products Res. & Dev. Labs., Nippon Steel Co., Sagamihara, Japan).

J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.357, p.625-9 (June 1983). In Japanese.

The microstructure and the fractography were determined by transmission and scanning electron microscopies on Tp 308 and Tp 308-V stainless steel weld metals made by GTAW and SAW methods. In the early stage of the creep process, dislocations are multiplied in austenite and locked by fine precipitates formed in austenite. Besides, the precipitates formed in δ derrite grow up to 0.05μ diameter. The formation of cell structure in austenite and the growth of precipitates in δ ferrite proceed during the creep process. (4 refs.)

109403 Transient creep in iron at low stresses and homologous temperatures 0.40-0.54. J.Novotny, J.Fiala, J.Cadek (CSAV, Brno, Czechoslovakia).

Kovove Mater. (Czechoslovakia), vol.21, no.4, p.397-411 (1983). In Czech.

Transient creep of high purity iron at low stresses (0.1 to 3.5 MPa) and at homologous temperatures 0.40 to 0.54 was investigated using the technique of helicoid specimens. At intercept grain sizes less than $\sim 123\ \mu m$ (Region 1), at which Coble creep operates, the transient creep strain increases with increasing applied stress linearly and with temperature monotonously. The transient creep period length t_t does not depend on applied stress and increases exponentially with decreasing temperature. The transient creep strain is caused primarily by the bowing-out of links of the three dimensional dislocation network and by the release and motion of some of these links. The relative importance of the second of these processes increases with temperature. The climb of the links is most probably dislocation core diffusion controlled. At intercept grain sizes greater than $\sim 123\ \mu m$ (Region 2), at which Harper-Dorn creep operates, the transient creep strain ϵ_t increases with applied stress linearly; however, the influence of testing temperature is eventually overlapped by the effects of mechanical and thermal treatment before the creep exposure. This applies to transient creep period length t_t as well. The same processes as in Region 1 were suggested to be responsible for transient creep in Region 2. (23 refs.)

109404 High temperature creep in a Cu-2%Fe alloy. K.Kucharova, F.Dobes, A.Orlova, K.Milicka, J.Cadek (SAV, Brno, Czechoslovakia).

Kovove Mater. (Czechoslovakia), vol.21, no.4, p.412-24 (1983). In Czech.

Results of an investigation of creep in Cu-2wt.%Fe alloy strengthened by coherent gamma-iron particles in a temperature and stress region of 673 to 873K and 10-95 MPa, respectively, are presented and discussed. The discussion leads to the conclusion that, most probably, at very low stresses, the Coble diffusion deformation mechanism associated with a threshold stress dominates. As another possible mechanism controlling the steady state creep rate in the whole investigated region of experimental conditions, the thermally activated cutting of gamma-iron particles dependent on the creation of an interface boundary was suggested. (25 refs.)

109405 Variations in density of movable dislocations in the zone of microplastic strain. S.A.Golovin, D.M.Levin (Tulsky Polytech. Inst., Tula, USSR), A.Puskar.

Kovove Mater. (Czechoslovakia), vol.21, no.4, p.445-52 (1983). In Slovak.

The measurement of internal damping for gradual increase of strain amplitude $\delta(\uparrow\gamma)$ and following gradual decrease of strain amplitude $\delta(\downarrow\gamma)$ after reaching selected limit values γ_m made it possible for the authors to determine their difference which is the result of energy scatter on the dislocations which were formed during gradual increase of γ up to the value γ_m. The experiments performed with Cu-9.2 at.% Al and Cu-13.8 at.%Al alloys have shown that with the increase of γ_m $\Delta\delta$ also increases which is connected with the increase in the density of 'fresh' dislocations ρ_p in the material. The experimental results obtained can be processed by the use of the model developed by Golovin and Levin (1982). On the basis of the analysis it can be concluded that in the initial stage of microplasticity $\rho_p \sim \gamma_p{}^3$ and during its following $\rho_p \sim \gamma_p{}^{3/2}$, up to the start of microplastic strain, i.e. up to reaching the yield point of material. (20 refs.)

109406 Control of superplastic cavitation by hydrostatic pressure. C.C.Bampton, M.W.Mahoney, C.H.Hamilton, A.K.Ghosh (Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA), R.Raj.

Metall. Trans. A (USA), vol.14A, no.8, p.1583-91 (Aug. 1983).

It has been shown that the application of hydrostatic gas pressures during superplastic deformation of fine grained 7475 Al can entirely prevent the intergranular cavitation normally encountered at atmospheric pressure. A critical ratio of hydrostatic pressure to flow stress may be defined for each superplastic forming condition above which virtually no cavitation occurs. In superplastic deformation conditions where intergranular cavitation plays a significant part in final tensile rupture, the superplastic ductility may be improved by the application of hydrostatic pressures. Similarly, detrimental effects of large superplastic strains on service properties may be reduced or elimited by the application of suitable hydrostatic pressures during superplastic forming. In this case, superplastically formed mateiral may have the same design allowables as conventional 7475 Al sheet. (14 refs.)

109407 Development of forming limits for superplastic formed fine grain 7475 Al. M.W.Mahoney, C.H.Hamilton, A.K.Ghosh (Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA).

Metall. Trans. A (USA), vol.14A, no.8, p.1593-8 (Aug. 1983).

Forming limits in conventional sheet metal forming are given by strain levels obtainable prior to the onset of a localized neck or tear in the sheet. While the external appearance of such a neck is not observed in superplastic metals until strains become quite large, the formation of internal cavities could dictate the tolerable levels of strain in formed components. These useful strain limits for a superplastic 7475 Al alloy have been explored. The approach used was to establish the influence of strain state (uniaxial, plane strain, and balanced biaxial) on the inception and growth characteristics of cavities and to correlate the extent of cavitation with material properties. Based on these data, it was then possible to establish strain states for which little or no loss in properties was observed, and thereby to define forming limits for superplastic forming this material. These results, coupled with comparisons against strains developed in actual parts as well as analytically predicted strains, show that a wide range of structural parts can be superplastically formed within the constraints of the recommended forming limits. (15 refs.)

109408 Deformation processing of an aluminium alloy containing particles: studies on Al-5 pct Si alloy 4043. K.P.Rao (Dept. of Metallurgy, Indian Inst. of Technol., Madras, India), S.M.Doraivelu, H.M.Roshan, Y.V.R.K.Prasad.

Metall. Trans. A (USA), vol.14A, no.8, p.1671-9 (Aug. 1983).

Al-5 wt.% Si alloy is processed by upset forging in the temperature range 300K to 800K and in the strain rate range 0.02 to 200 s^{-1}. The hardness and tensile properties of the product have been studied. A 'safe' window in the strain rate-temperature field has been identified for processing of this alloy to obtain maximum tensile ductility in the product. For the above strain rate range, the temperature range of processing is 550K to 700K for obtaining high ductility in the product. On the basis of microstructure and the ductility of the product, the temperature-strain rate regimes of damage due to cavity formation at particles and wedge cracking have been isolated for this alloy. The tensile fracture features recorded on the product specimens are in conformity with the above damage mechanisms. A high temperature treatment above $\approx$600K followed by fairly fast cooling gives solid solution strengthening in the alloy at room temperature. (8 refs.)

109409 Plastic flow phenomenology of 304 L stainless steel. S.L.Semiatin, J.H.Holbrook.

Metall. Trans. A (USA), vol.14A, no.8, p.1681-95 (Aug. 1983).

The isothermal plastic flow behaviour of annealed 304 L austenitic stainless steel in uniaxial compression and torsional modes of deformation has been established over a wide range of temperatures and strain rates. In uniaxial compression, it was found that high rates of strain hardening, which persist to large strains (≥ 0.7) at cold-working temperatures, are found only at small values of strain (≤ 0.2) at hot-working temperatures because of the influence of dynamic softening processes. The effect of deformation heating on flow behaviour, which occurs primarily at high strain rates, was most significant at cold-working temperatures. Deformation heating was observed to result in flow stress maxima and flow softening. A method of estimating high-strain rate, isothermal-flow curves in such instances was derived. Shear stress-shear strain curves derived from torsion tests exhibited dependences on temperature and strain rate similar to those observed in compression data. (35 refs.)

109410 Mechanical properties of large sections of low-carbon steel microalloyed with vanadium, cerium, and niobium. M.Ya.Belkin, V.P.Krivosheev, V.M.Belkin, V.T.Alekseenko, L.L.Litvinenko (Novo-Kramatorsk Machine Construction Factory, Kramatorsk Industrial Inst., USSR).

Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.756-9 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.7-10 (Nov. 1982).

Results are given from studies of the mechanical properties in various zones of large forgings of low-carbon steel from an ingot weighing 68 tons. It was found that microadditions of niobium, vanadium, and cerium improve the combination of mechanical properties—the ultimate tensile strength and particularly the proof stress increase substantially and the ductility also increases. Microadditions have an especially favorable effect on the proof stress and fracture toughness of the steel; these properties are quite uniform through the section. It should also be noted that the anisotropy of the properties is lower for the steel with microadditions, and the evenness of the properties through the section is much higher than for the steel without additions. (6 refs.)

109411 Effect of chromium content and heat treatment on creep of chromium bronze. D.K.Figurovskii, A.K.Nikolaev, V.M.Rozenberg (State Sci.-Res. & Design Inst. of Alloys & Treatment of Nonferrous Metals, USSR).

Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.828-31 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.61-3 (Nov. 1982).

Investigates the effect of heat treatment (which determines the stability of the structure) on the creep resistance of bronze containing 0.51 and 0.83% Cr (by weight). The bronze was water quenched from 980-1000°C and aged at 500 and 600° for 1 h. The structural changes were investigated using the Tesla BS-513 electron microscope. Creep tests were made in the range of 300-600°C under constant load on samples with a reduced section 100 mm long and 8 mm in diameter. The temperature was maintained within limits of ±1.5°. At testing temperatures below 0.5 T_m the structure of the alloy affected the creep resistance in the same way as during tensile strength tests. The more dispersed (but less stable) structure ensured higher strength and a lower steady creep rate. At temperatures above 0.5 T_m the less dispersed (but more stable) structure of the bronze was responsible for the lower creep rate. (8 refs.)

109412 Theoretical and experimental study of the plastic deformation of aluminium single crystals. II: Partially imposed plane compression. A.Skalli, J.H.Driver (Dept. Materiaux et Ingenierie, Ecole des Mines de Saint-Etienne, Saint Etienne, France), M.Wintenberger.

Mem. & Etud. Sci. Rev. Metall. (France), vol.80, no.6, p.293-302 (June 1983). In French.

For pt.I see ibid., vol.80, p.241, (1983). The method of Renouard and Wintenberger (1980) is applied to the case of large amplitude deformation in plane compression of FCC crystals under mixed conditions. The state of stress of slip amplitudes, crystal rotations and non-imposed deformations are calculated. (12 refs.)

109413 A structural study of the tensile drawing behavior of poly(ethylene terephthalate). S.R.Padibjo, I.M.Ward (Dept. of Phys., Univ. of Leeds, Leeds, England).

Polymer (GB), vol.24, no.9, p.1103-12 (Sept. 1983).

A study of single stage and two-stage drawing of poly(ethylene terephthalate) has been undertaken. Measurements of the modulus of the drawn films were combined with a range of structural measurements, including refractive index, X-ray diffraction and infrared spectroscopy. The development of molecular orientation during drawing is discussed in terms of the deformation of a molecular network, and reasons for the differences between single stage and two-stage drawing are proposed. The relationships between different measures of molecular orientation are considered with the aim of obtaining an understanding of the factors which influence the modulus values. It appears that the modulus relates primarily to the molecular chains which are in the extended trans conformation, irrespective of crystallinity. (15 refs.)

109414 Static and dynamic deformation mechanisms of a high-density polyethylene having row-nucleated crystalline texture of *a*-axis orientation as observed by orientation distribution function of crystallites. K.Shiro, K.Fujita, S.Suehiro, H.Kawai (Dept. of Polymer Chem., Kyoto Univ., Kyoto, Japan).

Polymer (GB), vol.24, no.9, p.1113-27 (Sept. 1983).

The rheo-optical properties of a high-density polyethylene having a row-nucleated crystalline texture of *a*-axis orientation were investigated in the machine direction (MD) and transverse direction (TD) of fabricating the specimen. The tensile complex dynamic compliance function J^* displays two dispersions designated as the α_1 and α_2 mechanical retardation processes with activation energies of about 21 and 35 kcal mol^{-1}, respectively, for both MD and TD specimens, and the complex dynamic stress-optical coefficient function M^* exhibits a single discrete dispersion designated as the α optical retardation process with an activation energy of about 24 kcal mol^{-1} for both specimens over the same frequency and temperature ranges as those covered for the dynamic mechanical measurements. The real and imaginary components of M^* converge from positive values to almost zero at the highest frequencies and lowest temperatures covered for both specimens, with the exception of the real component of the MD specimen which converges to a small but definitely negative value. The analysis of this anomalous behaviour of the MD specimen in terms of the optical retardation time spectrum has ascribed the negative convergence to a negative form birefringence that arises from a dynamic lamellar splaying or bending process responding in phase with the dynamic bulk stress. The dynamic X-ray diffraction studies have revealed the α optical dispersion and possibly the α mechanical dispersion to be mostly attributed to the crystal orientation dispersions involving intralamellar shearing processes, i.e. detwisting and tilting processes of the lamellar segments for the MD and TD specimens, respectively. (34 refs.)

109415 Influence of current-pulse duration on the rate of creep of zinc crystals. O.A.Troitskiy, V.I.Stashenko, V.I.Spitsyn.
Russ. Metall. (GB), no.1, p.141-4 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.164-8 (1982).
The creep of zinc crystals at the non-steady stage of 78K under the effect of current obeys the logarithmic law. The effect of pulsed currents is equivalent to applying additional effective stresses to the crystals. The deformation due to the current pulses of 110 to 240 μs durations (with $I_m=250$ A/mm^2 and $F=100$ Hz) increases; this effect is absent for pulses shorter than 100 μs. (7 refs.)

109416 Dependence of the long-term ductility of a Cr-MoV steel on changes in the structure. L.D.Mischenko, S.S.D'yachenko, V.P.Tarabanova.
Russ. Metall. (GB), no.1, p.172-5 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.202-5 (1982).
Under the long-term effect of temperature and stresses, two main processes causing structural changes take place in the structure of the steel: carbide coalescence and recrystallisation. The dependence of long-term ductility on the time factor for the heats of all the structural groups is governed by a common law. The δ-τ curves have a minimum. The time at which the curves passes through the minimum and the level of δ depends on the type and stability of structure formed in the steel. (3 refs.)

109417 Diagrams of structural states and maps of aluminium alloy structures. Yu.M.Vaynblat.
Russ. Metall. (GB), no.2, p.73-8 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.82-9 (1982).
It is shown that earlier proposed diagrams of structural states for a steady state stage of hot deformation of aluminium alloys form a basis for the control of the structure of semis; the diagrams are suppplemented with quantitative data on the structure and the deforming stress. The diagrams constructed in coordinates 'temperature of deformation—velocity of deformation' can serve as maps of mechanisms of deformation, the characteristic ranges of which are separated by lines of various values of the Zener-Holomon parameter. Division of diagrams into types, depending on the nature of the alloy, is proposed. Some examples of typical diagrams of structural states are given. (19 refs.)

109418 Estimation of the yield point of textured polycrystals (with computer calculation of the yield point of titanium). N.D.Reymer, R.A.Adamesku, P.V.Gel'd.
Russ. Metall. (GB), no.2, p.121-7 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.134-40 (1982).
A method has been devised for calculating the yield point of polycrystalline materials with arbitrary atomic structure and crystallographic texture. The results show the model of microplastic deformation and the method of calculating the yield point to be valid for materials with a hexagonal close-packed lattice. The type of crystallographic texture and its scatter in these materials make a decisive contribution to the yield point. In calculating $\sigma_{0.2}$ it is important to incorporate the second stage of microplastic deformation, since in this case there are a considerable number of grains that are plastically deformed. (12 refs.)

109419 Structure and properties of deformed alloys of the tungsten corner of the W-Mo-Re-Hf-C system. E.M.Savitskiy, K.B.Povarova, Yu.O.Tolstobrov, P.V.Makarov, E.K.Zavarzina, L.S.Kosachev, S.S.Semiletov, V.A.Balashov.
Russ. Metall. (GB), no.2, p.198-204 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.217-23 (1982).
Establishes the basic relationships of structure formation and the changes in mechanical properties during deformation of vacuum-melted low-alloy tungsten-base alloys in the W-Mo-Re-Hf-C system in which solid solution alloying (with molybdenum and rhenium) was employed and dispersion-hardened carbides of hafnium and tungsten were introduced. The introduction of up to 0.2 at.% Hf and up to 0.15 at.% C into tungsten-base solid solutions permits the formation of a dislocation structure during deformation, which is stabilised by the dispersed HfC particles, and the mechanical properties are improved. During hot and, in particular, during warm deformation a fibrous structure forms which gradually lowers the temperature of the ductile-brittle transition, and on reaching an overall reduction above 95% (for roads and wires of diameter below 3 mm) almost all the alloys were ductile at room temperature. (8 refs.)

109420 An investigation of the properties of internally oxidised Cu-Al-Ti-Hf alloys. V.L.Solopov, E.P.Daneliya, G.V.Daneliya, O.P.Lebasova.
Russ. Metall. (GB), no.3, p.98-103 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.3, p.114-20 (1982).
Internally oxidised Cu-Al-Ti-Hf alloys have higher strength properties with an insignificant increase in the specific electrical resistance compared with internally oxidised Cu-Al alloys known in the literature (1978). The best combination of the physico-mechanical properties is attained at small contents of titanium (0.01-0.05%) and hafnium (0.01-0.1%). (5 refs.)

109421 Effect of composition and structure on the hot ductility of CrMn corrosion-resisting steels. Ya.E.Gol'dshteyn, O.A.Bannykh, V.G.Mizin, A.E.Shelest, N.S.Khismatullina.
Russ. Metall. (GB), no.3, p.107-11 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.3, p.123-9 (1982).
The dependence of the hot ductility of the steel based on CrMnN austenite on its composition and phase transformations taking place during hot working has been examined. If the chromium content is higher than 16% and the manganese content exceeds 20%, the hot ductility of the steel greatly decreases. The reduction in the hot ductility of this steel is determined not as much by the amount of the alpha phase in the structure of worked metal as by the stability of the alpha phase and its susceptibility to breakdown with the precipitation of the sigma phase. The special features of failure of the sigma phase with the formation of colonies of microcracks which act as a basis for the subsequent development of macrodefects has been examined. The effect of nitrogen on the structure and properties of the steel is ambiguous. (5 refs.)

109422 Mechanism of hardening of high-molybdenum content maraging steel. Yu.E.Busalov, I.M.Kop'yev, H.Paul.
Russ. Metall. (GB), no.3, p.116-19 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.3, p.134-9 (1982).
Investigations were conducted into the dependence of the mechanical properties of the N9K20M14 maraging steel on the conditions of heat treatment after the preliminary working of wires with high reductions (96-99%). The optimum ageing temperature (approx. 500°C) at an ageing time of 2 h was determined. The mechanical properties of this steel after high-temperature, high-speed ageing (800°C, 0.75-1.5 s) have been examined, and show that the high-temperature ageing conditions result in a sharp rise in ductility (to 4%) compared with the low-temperature ageing conditions (δ=0.5-1%), and the high tensile strength is retained (410-420 kgf/mm^2). (4 refs.)

109423 Deformation-mechanism maps for silicon carbide. P.M.Sargent, M.F.Ashby (Engng. Dept., Cambridge Univ., Cambridge, England).
Scr. Metall. (USA), vol.17, no.7, p.951-7 (July 1983).
The maps summarise available data on the hardness, compressive strength and creep strength of hot pressed silicon carbide. (35 refs.)

109424 Orientation dependence of creep behavior of single crystal γ' (Ni_3Al). D.M.Shah (Materials Engng. & Res. Lab., Pratt & Whitney Aircraft Group, Middletown, CT, USA).
Scr. Metall. (USA), vol.17, no.8, p.997-1002 (Aug. 1983).
It is shown that qualitatively the creep anisotropy of single phase γ' is similar to nickel-base superalloys and can be quantitatively normalized in terms of a linear superposition of shear strains on either octahedral or cube or both slip systems. (25 refs.)

109425 Scalar and vector properties of anisotropic materials in a complex stressed state. II. Plastic deformations of anisotropic materials under simple loading. B.I.Koval'chuk, V.V.Kosarchuk, A.A.Lededev (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.8, p.1129-38 (Aug. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.8, p.114-21 (Aug. 1982).
For pt.I see ibid., vol.14, no.3, p.25 (1982). Examines small plastic deformations of anisotropic materials under a simple loading. Aluminum alloys D16T, Amg6, and AMtsS—were selected as test materials for the investigations. The tests were conducted at normal temperatures by loading thin-wall tubular specimens with an axial force and internal pressure with the realization of radial paths in real-stress space. It is demonstrated that the alloys under investigation are transversally isotropic with a plane of isotropy perpendicular to the Z axis of the specimen. The difference of the yield points in tension and compression for alloys D16T and AMg6 does not exceed 7%. For alloy AMtsS, the yield point in compression is lower than that in tension by 12%. (20 refs.)

109426 Effect of stacking-fault energy on the parameters of high-temperature creep of nickel-cobalt alloys. L.M.Nerodenko, E.V.Dabizha (E.O. Paton Inst. of Electric Welding, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.10, p.1331-7 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.40-6 (Oct. 1982). [received: Sept. 1983]
The authors investigated, with regard to the structural model, the effect of stacking faults on dislocation parameters which determine creep resistance in the steady-state stage. These parameters include the size of subgrains L, the spacing of steps on screw dislocations *l*, the microscopic elasticity limit, the mobile dislocation density, and the dislocation rate inside the subgrains and during crossing of the subgrain boundary. Two alloys of the nickel-cobalt system (Ni-25% Co and Ni-65% Co) were investigated. The analysis showed that the dependence of parameter n as a coefficient of retardation of mobile dislocation by the subboundaries on the size of the SFE is determined, apparently, by a change in the character of the subgrain boundaries caused by variation of the SFE in Ni-Co alloys. (39 refs.)

109427 Influence of pulsed current peak on the creep rate of zinc crystals. V.I.Stashenko, O.A.Troitskii (Phys. Chem. Inst., Acad. of Sci., Moscow, USSR).
Strength Mater. (USA), vol.14, no.10, p.1337-41 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.46-9 (Oct. 1982). [received: Sept. 1983]
An investigation was made of the creep of zinc crystals in the nonsteady stage at 78K under the action of pulsed currents of different peaks. The thermal portion of the current action was isolated. It was established that the creep of crystals in the mechanism of the electron-plastic effect is described by a logarithmic relationship as in normal deformation. The effective stresses caused by the drifting electrons entrapping the dislocations were determined. They were equal to $(1.7\text{-}7)\times10^4$ Pa with different values of L_m. The strain hardening exponents of crystals deformed with and without a current were also determined. (6 refs.)

109428 Rules of the plastic behavior of metal in deformation. V.S.Biront (M.I. Kalinin Krasnoyarsk Inst. for Nonferrous Metals, USSR).
Strength Mater. (USA), vol.14, no.10, p.1341-4 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.49-53 (Oct. 1982). [received: Sept. 1983]
An approach is proposed for determining the quantitative characteristics of the limiting condition of a material being deformed under the action of external static stresses and additional actions (temperature, additional loads by alternating sign stresses, ultrasonic action, etc.) which makes it possible to more reliably solve problems of crack formation and propagation in a metal being deformed in failure. With use of the relationship established it is possible to calculate the stresses and strains occurring in machine parts under complex stressed conditions during service. (2 refs.)

109429 Study of the behavior of closed steel spherical shells with single-stage internal explosive loading. V.I.Tsypkin, A.M.Cheverikin, A.G.Ivanov, S.A.Novikov, V.N.Mineev, A.T.Shitov.
Strength Mater. (USA), vol.14, no.10, p.1353-9 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.59-64 (Oct. 1982). [received: Sept. 1983]
Results are given of numerical and experimental studies devoted to revealing regularities in the behavior of different thickness spherical shells in the plastic deformation range up to failure with single-stage internal explosive loading. The deformation state was considered for closed spherical shells of mass M with outer radius R_0 and wall thickness δ_0 filled with air under normal conditions, and with an internal explosion of a change of explosive (VV). Shells were made of steel 35 and annealed to remove residual stresses in the welded joint zone. Mechanical properties of the shell material were monitored by testing control specimens. Tests were carried out on shells with a uniform internal radius $R_i=153$ mm and different wall thickness, and also geometrically similar shells reduced in size by a factor of four. (12 refs.)

109430 Certain features of the change in physicomechanical properties of type SSTF material in aging under humid subtropical conditions. E.A.Eskin, K.I.Kolesnik, A.S.Petrov, O.V.Startsev, V.P.Meletov (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.10, p.1392-7 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.91-6 (Oct. 1982). [received: Sept. 1983]
An investigation was made of the stability of the properties of type SSTF material, which is based on three-dimensional glass skeletons and phenol-formaldehyde binder, during a two-year hold under humid subtropical conditions, with a relative humidity of 70-98% and an average monthly temperature of the hottest month of more than 22°C. The storage conditions and exposure time had a significant influence on the surface layer condition and change in physicomechanical characteristics of SSTF material. During a two-year exposure there was a reduction in the strength and modulus of elasticity in bending, averaging 15-25%. There was a more significant (by 30-45%) decrease in compressive strength in the direction parallel to the layers. The primary reduction in the strength and modulus of elasticity both in bending and in compression occurred in the first 5 to 8 months of exposure. During aging there was an increase in porosity and a change in the value of the relative temperature deformation, which is an indication of occurrence of the physicochemical processes leading to the reduction in the mechanical properties of the material. (7 refs.)

109431 Influence of creep on the precipitate structure under conditions of long-term creep—investigation of a Fe-Cu model alloy. O.Schulze, G.Sauthoff (Max-Planck-Inst. fur Eisenforschung GmbH, Dusseldorf, Germany).
Z. Metallkd. (Germany), vol.74, no.8, p.504-12 (Aug. 1983). In German.
The precipitation behaviour of a Fe-Cu model alloy (1.8 mass%Cu) with and without concurrent creep deformation was studied at 550°C and 650°C. The strain rates were in the range of order of $10^{-8}\ s^{-1}$. In this case the deformation results from the climb of a practically constant number of dislocations. The experiments covered the ageing stages of the precipitate during which the transition from (partially) coherent and practically spherical particles to incoherent rod-like ones occurred. An influence of the concurrent creep on the ageing behaviour of the precipitate by accelerating the coherency decrease could not be found. The conclusions are valid for the behaviour of corresponding special carbides in creep-resistant steels. (26 refs.)

109432 Strain distribution and load transfer characteristics of a Cu-9.6 wt.% Al dual-phase structure. A.H.Yegneswaran, K.Tangri (Metall. Sci. Labs., Univ. of Manitoba, Winnipeg, Manitoba, Canada).
Z. Metallkd. (Germany), vol.74, no.8, p.521-4 (Aug. 1983).
The behaviour of the constituents of the dual-phase Cu-9.6 wt.% Al alloy during deformation was studied by both qualitative and quantitative metallographic analysis. The strain in the martensite was calculated and it was found that martensite strain increases with composite strain approaching the isostrain condition only near the fracture of the specimen. The estimated load transfer between the α matrix and β' grains at different strain levels clearly shows that the deformation of martensite in the dual phase alloy starts at a specimen strain of approximately 15%. (20 refs.)

109433 Superplasticity of high carbon steels. R.Nowosielski, L.Cieslak (Inst. fur Metallkunde und Schweisstech., Tech. Univ., Gliwice, Poland).
Z. Metallkd. (Germany), vol.74, no.8, p.549-56 (Aug. 1983). In German.
The investigation of superplastic phenomenon in carbon steels containing 0.8, 1.3 and 1.6%C, with different initial structures have been performed. Relations of flow stress, strain-rate sensitivity and elongation to strain rate were determinated. Values of the threshold stresses and the activation energy of superplastic deformation were measured too. The experimental results for α-Fe were compared with computed data according to the Ashby-Verrall model. (26 refs.)

109434 Drawability of sheet material. C.Marique, R.D'Haeyer, J.Gouzou, J.Mignon, A.Bragard.
Report EUR 6653 EN, Comm. European Communities, Luxembourg (1983), 51 pp. Contract 7210.KC/204.
This research has been devoted principally to the development and to the practical use of a mathematical model which allows one to predict the local strains and the proneness to wrinkling in deep drawing of cylindrical and conical parts, made from cold rolled sheets. The characterisation of the steels and the determination of the basic equations needed for the model's use are assessed by a study of the strain-hardening laws. A mathematical simulation on the onset of the necking phenomenon and its development is made. It is possible to predict the 'stress-strain' curve as delivered by a tensile test in plane strain. Practical uses of the model are presented: comparison between calculated and measured local strains values, drawing loads prediction, assessment of the influence of different parameters: lubrication, tooling geometry etc. (5 refs.)

Preparation of thorium metal sponge from thorium oxalate .. See Entry 106069

Thermal shock in nuclear reactors .... See Entry 106115

The dependence of the high temperature mechanical properties of austenitic stainless steels on implanted helium .... See Entry 106164

The development of small specimen mechanical test techniques .... See Entry 106166

Influence of temperature upon dislocation mobility and elastic limit of single crystal HgI_2 .... See Entry 106226

Plane strain extrusion studies by finite element method .... See Entry 107018

Phenomenological model of the description of deformation and failure and metals under complex nonisothermal loading .... See Entry 107020

Elastoplastic behavior of a laminar-fibrous material .... See Entry 107021

Interference effect of notches. II. An experimental investigation on interference effect of notches on strengths and deformation properties of notched bar with double U-notches .... See Entry 107051

Electronic structure and tetragonality of martensite .... See Entry 107600

X-ray diffraction investigation of the structure of deformed samarium-cobalt alloys .... See Entry 107604

Cross-slip on the first order pyramidal plane $(10\bar{1}1)$ of a-type dislocations $(\bar{1}2\bar{1}0)$ in the plastic deformation of α-titanium single crystals .... See Entry 107699

Direct observations of the effect of hydrogen on the behavior of dislocations in iron .... See Entry 107705

Energy absorption during deformation of yttrium and zirconium .... See Entry 107709

Effect of ageing on martensitic transformation during the deformation of metastable austenitic steels .... See Entry 107711

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81.40N Fatigue, embrittlement, and fracture

(inc. hardness; see also 62.20M Fatigue, brittleness, fracture and cracks)

109435 **Fracture of phosphate-bonded high-alumina refractories.** F.J.Gonzalez (Pennsylvania State Univ., University Park, PA, USA), J.W.Halloran.
Am. Ceram. Soc. Bull. (USA), vol.62, no.7, p.798-803 (July 1983).
Phase development and mechanical properties were studied in model refractories consisting of tabular alumina aggregate bonded by phosphoric acid and one of several calcined aluminas. Elastic modulus, flexural strength, work-of-fracture and fracture toughness were determined from room temperature to 1200°C. The least reactive alumina showed the best properties. All properties displayed a maximum at 800°C. This behavior is consistent with the presence of a glassy bonding phase. (6 refs.)

109436 **Development of Ti-6A1-4V gas bottle for satellite applications.** V.Ramachandra, G.Thomas, M.J.Nair, B.K.Sarkar (Metall. & Ceramics Div., Vikram Sarabhai Space Centre, Trivandrum, India).
Trans. Indian Inst. Met., vol.35, no.2, p.127-36 (April 1982). [received: Aug. 1983]
Ti-alloys, because of their high specific strength and passivity to liquid propellants, are of great interest to space technologists. Utilisation of Ti-6 Al-4 V (24×10^5 cm specific strength) for gas bottle application in satellites has therefore been extensive. Such gas bottles are presently imported and a programme was therefore undertaken at the Vikram Sarabhai Space Centre to develop this alloy gas bottle indigenously. The authors describe the successful fabrication of the alloy into gas bottles capable of withstanding burst pressures of the order of 1000 kg/cm^2. The testing of the gas bottles for the designed burst pressure and the results obtained are highlighted. (10 refs.)

109437 **Electron microfractography of fatigue fracture in aluminium alloys.** C.S.Harendranath, A.K.Mallik (Indian Inst. of Technol., Bombay, India).
Trans. Indian Inst. Met., vol.35, no.5, p.415-20 (Oct. 1982). [received: Aug. 1983]
The low cycle fatigue crack propagation stage of two aluminium-zinc-magnesium alloys subjected to various heat treatment cycles has been investigated, using electron microfractography. In particular, the nature and morphology of fatigue striations as related to heat treatment and properties are discussed. The striation morphology was found to be influenced by heat treatment. While the single aged and double aged alloys showed only regular, well defined ductile striations, thermomechanically treated alloys exhibited a transition in striation morphology from near ductile to brittle like ones. The thermomechanically treated alloys were also found to possess significantly higher low cycle fatigue lives as compared to the single and double aged alloys. (8 refs.)

109438 **Regularities of cyclic crack resistance under effect of contact stresses.** O.M.Romaniv, A.V.Dobrik, V.N.Siminkovich.
Dopov. Akad. Nauk UkRSR. Ser. A (USSR), no.8, p.35-8 (1983). In Ukrainian.
The contact stress effect on fatigue crack propagation in structural roll steel is estimated on the basis of a new experimental procedure. Contact compressing stresses are shown to cause a significant reduction of the crack growth kinetics in the field of pulsating tensile stresses as well as a considerable increase (two-fold) of threshold stress intensity factors ΔK_{th}. The contact stress influence intensity is a function of contact loading, the propagating crack length and roll steel strength. (5 refs.)

109439 **Correlations among growth law of small cracks, low cycle fatigue law and applicability of Miner's rule.** Y.Murakami (Dept. of Mech. & Strength of Solids, Kyushu Univ., Fukuoka, Japan), S.Harada, T.Endo, H.Tani-Ishi, Y.Fukushima.
Eng. Fract. Mech. (GB), vol.18, no.5, p.909-24 (1983).
The initiation and propagation process of a small crack in low-cycle fatigue of a medium carbon steel is observed in detail by the plastic replica method. It is found that the Manson-Coffin relation is virtually the same as the crack growth law of a small crack; more than 90% (almost 100%) of the fatigue life of plain specimens is occupied by the crack propagation process. From this viewpoint, the ambiguity in the definition of the initiation of 'an engineering-size crack' can be removed. The effects of prior fatigue history on the growth rate of a small crack are investigated systematically using special specimens containing an artificial small hole with diameters of 40, 100 and 200 μm. Prior fatigue history which may be accumulated at the region where a crack will later propagate hardly influences the crack growth rate, i.e. prior fatigue history itself should not be regarded as fatigue damage. This is an essential condition for Miner's rule to apply. (31 refs.)

109440 **Model of fatigue crack propagation by damage accumulation at the crack tip.** G.Chalant, L.Remy (Centre des Materiaux, Ecole des Mines de Paris, ERA CNRS, Evry, France).
Eng. Fract. Mech. (GB), vol.18, no.5, p.939-52 (1983).
Modelling fatigue crack propagation by damage accumulation at the crack tip originally proposed by McClintock (1963) is reworked out using metallurgical considerations. On a physical basis it is shown that the validity of such models is actually confined to the low crack growth rate range corresponding to stage I growth such as along crystallographic planes. At higher crack growth rates there is a transition to plastic stretching mechanisms which could be described by crack opening displacement models. An evaluation of two models has been carried out on a ^{33}Co Ni alloy where extensive information was available: both are based on the strain singularity as computed by Tracey (1976) from a finite element analysis of plane strain small scale yielding and as adapted to cyclic loading under Rice's hypothesis (1967) and taking the grain as the critical element below which size continuum mechanics do no longer apply. It is pointed out that the use of this strain singularity which is not able to account to crack closure, renders models unable to predict experimental crack growth rates curves but only intrinsic curves relating the growth rate to the effective stress intensity amplitude as defined by Elber. (36 refs.)

109441 **Fatigue crack propagation in steels.** Xiulin Zheng (Dept. of Material Engng., North-Western Polytech. Univ., Xian, Shaanxi, China), M.A.Hirt.
Eng. Fract. Mech. (GB), vol.18, no.5, p.965-73 (1983).
From previous investigations of the mechanisms of both fracture and fatigue crack propagation, the static fracture model proposed by Lal and Weiss (1978) may be thought as reasonable for describing fatigue crack propagation in metals at both low and intermediate stress intensity factor ranges ΔK. Recent progress in fatigue crack propagation indicates that it is not only possible, but also necessary, to modify this static fracture model. Based on the modified static fracture model, the effective stress intensity factor range ΔK_{eff}, which is defined as the difference between ΔK and the fatigue crack propagation threshold value ΔK_{th}, is taken as the governing parameter for fatigue crack propagation. Utilising the estimates of the theoretical strengths of metals employed in industry, a new expression for fatigue crack propagation, which may be predicted from the tensile properties of the metals, has been derived. The correlation between the fatigue crack propagation rate and the tensile properties is thus revealed. The new expression fits the test results of fatigue crack propagation of steels below 10^{-3} mm/cycle and indicates well the effect of stress ratio on the fatigue crack propagation rate. (33 refs.)

109442 **Quasistatic thermal crack growth in unidirectionally fiber reinforced composite materials.** K.Herrmann (Inst. of Mech., Paderborn Univ., Paderborn, Germany), H.Braun.
Eng. Fract. Mech. (GB), vol.18, no.5, p.975-96 (1983).
Micromechanical investigations concerning the quasistatic thermal crack propagation in self-stressed unidirectionally reinforced composite structure with a low-fiber volume fraction have been performed. Thus, in order to gain certain microstructural informations about the thermal shock resistance of those reinforced composites different cracked unit cells of several two-phase composites as well as ensembles of such composite microcomponents are considered which are subjected to thermal loading. Therein the principal facets of composite material failure theories, emphasizing matrix cracking, fiber breaking and interfacial debonding, respectively, have been studied. The resulting mixed boundary-value problems of the stationary plane thermoelasticity are solved numerically by using standard finite element programs. Further, the influences of the fiber diameters, different shapes of the fiber-matrix interfaces as well as of the external boundaries of the microcomponents on the crack opening displacement $u_y{}^c$ and the opening mode stress intensity factor K_I, respectively, have been investigated. Numerical results are given for an Al_2O_3 matrix/molybdenum fiber composite by consideration of different crack configurations. (34 refs.)

109443 **An engineering interpretation of pop-in arrest and tearing arrest in terms of static crack arrest, K_{Ia}.** F.J.Witt (Nuclear Energy Systems, Westinghouse Electric Corp., Pittsburg, PA, USA).
Eng. Fract. Mech. (GB), vol.18, no.5, p.997-1010 (1983).
When fracture toughness specimens are rested under displacement controlled conditions, they are often observed to exhibit unstable cleavage fracture followed by arrest of the cleavage mode wherein a significant load remains on the specimen (pop-in arrest). This behaviour carries over into the ductile tearing regime wherein tearing may occur rapidly identified by load reduction and then proceeds at a discernible less rate (tearing arrest). Both these behaviours represent an initiation condition followed by an arrest condition. It is demonstrated that from either of the arrest conditions an arrest value may be determined which, for available experimental data, is shown to be an engineering estimate for the static crack arrest toughness K_{Ia}. A general lower bound property for the arrest value is postulated based on reference information. A data analysis procedure is outlined and K_{Ic} and K_{Ia} estimate from sixty-eight 1/2, 1 and 2 in. thick compact specimens from two steels (A 533 Grade C Class 1 and AISI 1018) tested between −40° F and 200° F are summarized. The crack arrest estimates are seen to compare favorably with K_{Ia} results obtained by other investigators using 2 in. thick specimens. Also it is demonstrated that when failure is by fully ductile tearing, the crack arrest toughness is at least equal to the estimate for K_{Ic} for the specimen. (15 refs.)

109444 **Fracture mechanics approach to fatigue crack initiation from deep notches.** K.Tanaka (Dept. of Mech. Engng. & Mech., Lehigh Univ., Bethlehem, PA, USA), Y.Nakai, R.Kawashima.
Eng. Fract. Mech. (GB), vol.18, no.5, p.1011-23 (1983).
Fracture mechanics approach is applied to fatigue crack initiation at the tips of deep, blunt notches including those with very small notch-tip radius. The theoretical relations between the stress intensity range ΔK_ρ and the notch-tip radius ρ for a fixed life for crack initiation were derived based on the models of dislocation-dipole accumulation and blocked slip-band. Those are approximated by a simpler equation: $\Delta K_\rho/\Delta K_0=(1+\rho/\rho_0)^{1/2}$ where ΔK_0 and ρ_0 are material constants which are related to the fatigue strength of smooth specimens of $\Delta\sigma_0$ as $\Delta\sigma_0=2\Delta K_0/(\pi\rho_0)^{1/2}$. The results of experiments done with bluntly notched compact tension specimens of a structural low-carbon steel agree with the above relation between $\Delta K_\rho/\Delta K_0$ and ρ/ρ_0. The method to predict ΔK_0, ρ_0 and $\Delta\sigma_0$ from the fatigue data of cracked and smooth specimens is proposed. (32 refs.)

109445 **Crack opening areas in pressure vessels and pipes.** C.Wuthrich (Brown Boveri Res. Center, Baden, Switzerland).
Eng. Fract. Mech. (GB), vol.18, no.5, p.1049-57 (1983).
Summarizes different methods for the calculation of crack opening areas in pressure vessels and pipes. In the case of constant membrane stresses the

crack opening area is related to the stress intensity factor. This concept is applied to axial and circumferential cracks in pipes and to meridional cracks in spherical pressure vessels. Plasticity effects are taken into account in the framework of Dugdale's model. Lower and upper bound values for the leak areas are discussed and related to the problems of leak detection and jet forces acting on leaking pipes. (8 refs.)

109446 Determination of the ideal strength of metal microcrystals. I.M.Mikhailovskii, P.Ya.Poltinin, L.I.Fedorova.
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.186-91 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
An investigation was made of the strength characteristics of microcrystals of submicron transverse size of some metals with the BCC and FCC lattices. This was done for thin foils of copper, nickel, molybdenum, and chromium and for thin filaments of iridium and tantalum. The study was carried out by loading with ponderomotive forces created by an electric field. In contrast to metal whiskers, the investigated microcrystals showed no scale dependence of the strength or of the variance of the strength. An analysis of the theoretical and experimental data led to the conclusion that ideal crystals with the FCC lattice fractured as a result of homogeneous shear along close-packed planes under the action of stresses in the range (0.026-0.041)G, where G is the shear modulus. In the case of the BCC crystals a lattice instability was the likely fracture mechanism. (21 refs.) *A.T.*

109447 Relationship between the parameters of pit fracture and the characteristics of the structure of heat-improved steel. V.M.Goritskii, I.A.Guseva (Central Sci.-Res. Design Inst. for Building Metal Constructions, Moscow, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.192-4 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
An investigation was made of the influence of the compositon of 10KhSND laboratory steel and of 10KhN1M industrial steel in the thermally improved state (quenching from 920°C in water, annealing at 680°C for 1.5 h. cooling in air) and after ageing at 400 and 450°C on the microstructure of pit fracture surfaces. An electron-microscopic study of foils and carbon replicas revealed a linear relationship between the size of carbide particles, size of micropores, and size of fracture pits. (3 refs.) *A.T.*

109448 The effect of water vapor on fatigue crack tip mechanics in 7075-T651 aluminum alloy. D.L.Davidson, J.Lankford (Dept. of Materials Sci., Southwest Res. Inst., San Antonio, TX, USA).
Fatigue Eng. Mater. & Struct. (GB), vol.6, no.3, p.241-56 (1983).
Strains very near a growing fatigue crack have been computed from measured material displacements, both for a very dry environment and for humid air. Significant differences in crack tip strains and crack tip opening displacements occur in these environments, with crack tip deformation in water vapor evidencing less plasticity than the dry environment. These quantitative results are incorporated into a previously developed mathematical model which is based, in part, on dynamic observations of intermittent crack growth. Fractography is shown to support the concepts of intermittent crack advance and decreased crack tip plasticity due to environmental water vapor. (19 refs.)

109449 On the transition from near-threshold to intermediate growth rates in fatigue. M.R.James, W.L.Morris, A.K.Zurek (Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA).
Fatigue Eng. Mater. & Struct. (GB), vol.6, no.3, p.293-305 (1983).
Evidence is presented that the cyclic stress intensity threshold for fatigue crack growth in Al 2219-T851 is associated with a critical maximum value of stress intensity, K_c. This relationship is discovered by measuring the local value of stress intensity at the crack tip which is less than the applied stress intensity because of fatigue induced compressive residual stresses in the plastic zone. Crack growth rates and values of the crack tip residual stress are measured as functions of load ratio. For local stress intensities greater than K_c, the growth rate follows a power-law relationship, increasing monotonically with ΔK. For local stress intensities below K_c, growth rates are also sensitive to the cyclic stress range, $\Delta\sigma$. If the stress range is small, a threshold to growth, typical of long cracks, is seen. When the cracks are short and $\Delta\sigma$ exceeds a critical value, growth rates are a complex function of both $\Delta\sigma$ and ΔK. This behavior is attributed to the effect of $\Delta\sigma$ on the propagation of the crack front past obstacles such as grain boundaries. (40 refs.)

109450 Fracture of metastable tetragonal zirconia crystals. D.Michel, L.Mazerolles, M.Perez y Jorba (Lab. de Chimie Appliquee de l'Etat Solide, Vitry sur Seine, France).
J. Mater. Sci. (GB), vol.18, no.9, p.2618-28 (Sept. 1983).
Crystals of single-phased metastable tetragonal zirconia (MTZ) were prepared from skull-melting at the composition ZrO_2-3 mol.% M_2O_3 (M=Y, Yb or Gd). The fracture of the tetragonal crystals occurred differently than for the cubic stabilized zirconia ones. The toughness was much higher for the tetragonal specimens and the cleavage planes were not the same as for the fluorite crystals. The results were interpreted by considering the domain microstructure induced by the cubic→tetragonal phase transformation undergone by the crystals. (63 refs.)

109451 The influence of mean stress on fatigue crack propagation in dual phase low carbon steel. T.Ishihara (Ishikawajima-Harima Heavy Industries Co. Ltd., Aero-engine & Space Operations, Tokyo, Japan).
J. Mater. Sci. (GB), vol.18, no.9, p.2629-38 (Sept. 1983).
In a low carbon steel, containing martensite encapsulated islands of ferrite, second-stage fatigue crack growth rate is not influenced by the mean stress. However, in steel with ferrite encapsulated islands of martensite, crack growth rate is influenced by each mean stress because its microfracture mode changes from slipping to static. An acceleration of crack growth is mainly influenced by the number of continuous cleavage facets in each matrix. (9 refs.)

109452 Kinetics of shear-activated indentation crack initiation in soda-lime glass. B.R.Lawn, T.P.Dabbs, C.J.Fairbanks (Center for Materials Sci., NBS, Washington, DC, USA).
J. Mater. Sci. (GB), vol.18, no.9, p.2785-97 (Sept. 1983).
The initiation of radial cracks in Vickers indentation of soda-lime glass is found to be strongly rate dependent. For long contact durations the radial cracks pop in during the indentation event, at a reproducible stage of the unloading half-cycle; for short contacts the pop-in occurs after the event, with considerable scatter in delay time. The phenomenon is interpreted in terms of an incubation time to develop a critical nucleus for the ensuing fracture. Increasing either the water content of the environment or the peak contact load diminishes the incubation time. Scanning electron microscopy of the indentation patterns indicates that the sources of the crack nuclei are constrained shear faults within the deformation zone. A qualitative model is developed in terms of a two-step process, precursor faulting followed by crack growth to pop-in instability. Moisture may influence both these steps, in the first by interfacial decohesion and in the second by slow crack growth. The implications of these results in connection with the basic mechanical properties of brittle solids, particularly strength, are considered. (37 refs.)

109453 Propagation of stress corrosion cracks in aligned glass fibre composite materials. J.N.Price, D.Hull (Dept. of Metall. & Materials Sci., Univ. of Liverpool, Liverpool, England).
J. Mater. Sci. (GB), vol.18, no.9, p.2798-810 (Sept. 1983).
A modified fracture toughness test has been used to measure the growth of cracks in unidirectional glass fibre/polyester resin composite materials in the presence of a dilute hydrochloric acid. Crack growth rates perpendicular to the fibre axis have been measured over a range of stress intensities. Scanning electron microscope studies of the fracture surfaces have shown that the micromechanisms of nucleation and propagation are dependent on stress intensity. The use of crack growth data to predict component lifetimes and the existence of inherent flaws in the material are discussed. (16 refs.)

109454 The effect of heat treatment on plane strain fracture of glassy polymers. M.Ishikawa, I.Narisawa (Dept. of Fiber & Polymer Engng., Yamagata Univ., Yonezawa, Japan).
J. Mater. Sci. (GB), vol.18, no.9, p.2826-34 (Sept. 1983).
The effect of annealing on the plane strain fracture of round-notched polycarbonate and poly(methyl methacrylate) bars has been investigated. Morphological observations of thin sections and fracture surfaces revealed that the fracture initiated from internal crazes which were nucleated at the tip of a local plastic zone. The critical hydrostatic stresses for internal craze nucleation were nearly constant regardless of annealing, while the shear yield stress increased with increasing annealing time. The reduction in toughness by annealing can be ascribed to the decrease of the maximum extent of the plastic zone which gives the critical hydrostatic stress for craze nucleation. (16 refs.)

109455 Slow crack growth behavior in transformation-toughened Al_2O_3-$ZrO_2(Y_2O_3)$ ceramics. P.F.Becher (Metals & Ceramics Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.7, p.485-8 (July 1983).
Significant increases in the critical fracture toughness (K_{IC}) over that of alumina are obtained by the stress-induced phase transformation in partially stabilized ZrO_2 particles which are dispersed in alumina. More importantly, improved slow crack growth resistance is observed in the alumina ceramics containing partially stabilized ZrO_2 particles when the stress-induced phase transformation occurs. Thus, increasing the contribution of the ZrO_2 phase transformation by tailoring the Y_2O_3 stabilizer content not only increases the critical fracture toughness (K_{IC}) but also the K_{Ia} to initiate slow crack growth. For example, crack velocities $(\nu)\geq 10^{-9}$ m/s are obtained only at $K_{Ia}\geq 5$ MPa.m$^{1/2}$ in transformation-toughened ($K_{IC}=8.5$ MPa.m$^{1/2}$) composites vs $K_{Ia}\geq 2.7$ MPa.m$^{1/2}$ for comparable velocities in composites where the transformation does not occur ($K_{IC}=4.5$ MPa.m$^{1/2}$). This behavior is a result of crack-tip shielding by the dissipation of strain energy in the transformation zone surrounding the crack. (16 refs.)

109456 Dynamic fatigue of a machinable glass-ceramic. K.K.Smyth, M.B.Magida (NASA-Goddard Space Flight Center, Greenbelt, MD, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.7, p.500-5 (July 1983).
To assess the stress-corrosion susceptibility of a machinable glass-ceramic, its dynamic fatigue behavior was investigated by measuring its strength as a function of stress rate. Fracture mechanics techniques were used to analyze the results for the purpose of making lifetime predictions for components of this material. This material was concluded to have only moderate resistance ($N=30$) to stress corrosion in ambient conditions. The effects of specimen size on strength were assessed for the material used in this study; it was concluded that the Weibull edge-flaw scaling law adequately describes the observed strength-size relation. (15 refs.)

109457 Relation between multiregion crack growth and dynamic fatigue of glass using indentation flaws. P.Chantikul (Dept. of Appl. Phys., School of Phys., Univ. of New South Wales, Kensington, NSW, Australia), B.R.Lawn, H.Richter, S.W.Freiman.
J. Am. Ceram. Soc. (USA), vol.66, no.7, p.515-18 (July 1983).
The influence of transport-limited kinetic crack growth on the fatigue properties of soda-lime glass was examined. Dynamic fatigue data were taken on specimens with controlled indentation flaws and were compared with the predicted response from measured crack velocity characteristics. Heptane was used as the operational test environment because of its pronounced crack velocity plateau; control tests in water served to establish a baseline reference for comparing the results. Fractographic observations using a stress wave marker technique showed a complex growth history for flaws broken in heptane compared to that for flaws broken in water. The magnitude of the predicted region II influence is too small to be detected in the dynamic fatigue results, even allowing for the relatively high degree of data reproducibility. The implications of this conclusion for lifetime predictions are discussed. (21 refs.)

109458 Fracture mechanics for delamination problems in composite materials. S.S.Wang (Dept. of Theoretical & Appl. Mech., Univ. of Illinois, Urbana, IL, USA).
J. Compos. Mater. (USA), vol.17, no.3, p.210-23 (May 1983).
A fracture mechanics approach to the well-known delamination problem in composite materials is presented. Based on the theory of anisotropic laminate elasticity and interlaminar fracture mechanics concepts, the composite delamination problem is formulated and solved. The exact order of the delamination crack-tip stress singularity is determined. Asymptotic stress and displacement fields for an interlaminar crack are obtained. Fracture mechanics parameters such as mixed-mode stress intensity factors, K_I, K_{II}, K_{III}, and the energy release rate, G, for composite delamination problems are defined. To illustrate the fundamental nature of the delamination crack behavior, solutions for edge-delaminated graphite-epoxy composites under uniform axial extension are presented. Effects of fiber orientation, ply thickness, and delamination length on the interlaminar fracture are examined. (17 refs.)

109459 Fatigue crack propagation in random short-fiber SMC composite. S.S.Wang, E.S.-M.Chim, N.M.Zahlan (Dept. of Theoretical & Appl. Mech., Univ. of Illinois, Urbana, IL, USA).
J. Compos. Mater. (USA), vol.17, no.3, p.25-66 (May 1983).
An investigation of the kinetics of fatigue crack growth in a random short-fiber reinforced SMC composite is presented. Experiments were conducted on notched SMC-R50 composite specimens subjected to cyclic uniaxial tensile and mixed-mode fatigue loading. Fatigue crack propagation rates were studied in terms of fracture mechanics parameters. A power-law relationship between the crack growth rate and the cyclic stress intensity factor range was obtained for the SMC-R50 composite under various fatigue loading modes. The value of the exponent in the power-law equation was found to be much higher for the composite than values reported for metals and some structural polymers. A fractographic study of fatigue fracture surfaces was also conducted. Mechanisms of fatigue crack growth in the SMC-R50 composite were identified. A mechanical model is then proposed for further study of the mechanics of fatigue crack growth in random short-fiber SMC composites. (14 refs.)

109460 Energy absorption of composite materials. G.L.Farley (US Army Res. & Technol. Labs., AVRADCOM, Langley Res. Center, Hampton, VA, USA).
J. Compos. Mater. (USA), vol.17, no.3, p.267-79 (May 1983).
The energy absorption characteristics of selected composite material systems and compares the results with aluminum. Composite compression tube specimens were fabricated with both tape and woven fabric prepreg using graphite/epoxy (Gr/E), Kevlar epoxy (K/E) and glass/epoxy (Gl/E). Chamfering and notching one end of the composite tube specimen reduced the peak load at initial failure without altering the sustained crushing load, and prevented catastrophic failure. Static compression and vertical impact tests were performed on 128 tubes. The results varied significantly as a function of material type and ply orientation. In general, the Gr/E tubes absorbed more energy than the Gl/E or K/E tubes for the same ply orientation. The [0/±15] Gr/E tubes absorbed more energy than the aluminum tubes. Gr/E and Gl/E tubes failed in a brittle mode and had negligible post crushing integrity, whereas the K/E tubes failed in an accordian buckling mode similar to the aluminum tubes. (7 refs.)

109461 Effect of alloying elements on the hydrogen embrittlement of vanadium at moderate temperatures. S.Morozumi (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan), K.Suzuki.
J. Jpn. Inst. Met. (Japan), vol.47, no.8, p.704-10 (Aug. 1983). In Japanese.
In order to investigate the effect of alloying elements on the hydrogen embrittlement of vanadium at moderate temperatures, the metal was alloyed up to about 20 atomic per cent with molybdenum as an endothermic occluder and with titanium as an exothermic occluder, respectively, and then the specimens were hydrogenated up to about 10 atomic per cent of hydrogen. The specimens were tensile tested in the temperature range from room temperature to 573K. Both of molybdenum and titanium increased the solubility limit of hydrogen in vanadium, which was measured by the internal friction method. The alloying elements deteriorated vanadium for hydrogen embrittlement, by increasing the strength and lowering the ductility. Therefore, the ductile-brittle transition temperature (DBTT) of hydrogenated alloys, which was determined as a temperature at which just half of the reduction in area of unhydrogenated specimen was obtained in the hydrogenated specimen, was located in the solid solution region as to hydrogen as well as alloying elements at moderate temperatures in phase diagrams. The brittle fracture mode was different between V-Mo and V-Ti alloys. (10 refs.)

109462 Reloading stress relaxation behavior and rupture for 19Cr-9Ni-1.4Mo-1.4W-Nb bolting steel. C.Tanaka, T.Ohba (Nat. Res. Inst. for Metals, Tokyo, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.357, p.620-4 (June 1983). In Japanese.
A series of studies have been conducted on the effect of retightening, (reloading) on stress relaxation behavior of high temperature bolts used in steam turbines. The results are described of reloading stress relaxation tests made after relaxation to various specific values of residual stress for a 19Cr-9Ni-1.4Mo-1.4W-Nb bolting steel at the test temperature of 650°C. Most of the repeated loadings on the specimens were brought up to rupture. Logarithmic relations between the testing time at each cycle and the number of loadings were analyzed numerically by taking the specific value of residual stress as a parameter. The results confirmed the previous empirical equation. As for rupture behavior, the following three terms, the number of loadings, the accumulated testing time, and the accumulated plastic strain, were expressed by power functions of the specific value of residual stress. From these equations obtained for reloading stress relaxation behavior and rupture, the design curves of retightening characteristics of bolts were presented. (13 refs.)

109463 Study on creep crack growth properties for $2^1/_4$ Cr-1Mo steel. T.Sato, T.Kurumaji, S.Kimura (Kure Res. Lab., Babcock-Hitachi K.K., Kure, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.357, p.630-4 (June 1983). In Japanese.
The effect of heat treatment on the creep crack growth properties of $2^1/_4$Cr-1Mo steel was determined and then compared with the creep crack behaviour of actual weld joints. Creep crack growth properties are remarkably changed by heat treatment. The creep crack growth rate increased with decreasing ductility, in the following order. Simulated HAZ>water quenched->normalized-tempered>annealed. The J-da/dt curve on a high ductility condition is different from that on a low ductility condition even for the same steel. Creep cracks advanced in the coarse grain heat affected zone in actual weld joints of 1Cr-$^1/_2$Mo steel. Creep crack resistance is improved by reduction of hardness due to stress relieving. (11 refs.)

109464 Behavior of crack propagation in a low alloy steel under high-temperature rotating bending fatigue. K.Kanazawa, K.Yamaguchi, N.Suzuki, M.Sato, M.Kanao (Nat. Res. Inst. for Metals, Tokyo, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.357, p.640-4 (June 1983). In Japanese.
Stepwise *S-N* curves have been obtained at 500°C under rotating bending fatigue tests for the notched specimens of a low alloy steel SCM 435. The behavior of crack propagation under such fatigue conditions was examined, and the reason why such stepwise *S-N* curves and the effect of oxide formed at the crack surface on the crack propagation were discussed. On the fracture surface failed at the longer life side in the stepwise *S-N* curve, a certain region from the root of the notch, designated as the A region, was covered with a thick oxide layer. In the A region, a crack propagated with a very slow rate and the propagation rate scarcely depended on the crack length. By examining the change in compliance under rotating bending conditions, it was clarified that the crack opening level was increased by the oxide formed on the crack surface. (12 refs.)

109465 Effect of strain wave shape on low-cycle fatigue crack propagation of type SUS 304 stainless steel at elevated temperatures. M.Okazaki, F.Shiraiwa, I.Hattori (Dept. of Mech. Engng., Technol., Univ. of Nagaoka, Nagaoka, Japan), T.Koizumi.
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.357, p.645-50 (June 1983). In Japanese.
The effect of strain wave shape on the propagation of strain-controlled low cycle fatigue cracks in type SUS 304 stainless steel was investigated at 600 and 700°C. It was found that the rate of crack propagation in the cycle-dependent region was successfully correlated with a range of cyclic J-integral, regardless of strain wave shape, frequency and test temperature. It was also shown that the rate of crack propagation gradually increased from a cycle-dependent type to a time-dependent one as frequency decreased and slow-fast strain wave shape became obvious, and that the ratio of the range of creep J-integral to that of total J-integral was an important factor in such a behavior. Furthermore, the fatigue crack initiation mechanism under strain with slow-fast strain wave shape was studied and it was shown that grain boundary sliding played an important role in it. (16 refs.)

109466 Fatigue life prediction of nickel base superalloy under intermittent strain cycling. T.Okada, T.Horikawa, H.Nakamura, T.Tsunenari, K.Take (Tech. Inst., Kawasaki Heavy Industries Ltd., Akashi, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.357, p.651-6 (June 1983). In Japanese.
In order to establish the fatigue life prediction method for gas turbine blades, the fatigue tests are being conducted under the intermittent strain waveform which is composed of cycling of a large pulsating strain and superposed small strain cycling. The results of fatigue tests on Inconel 713 LC under constant amplitude strain cycling, tension hold strain cycling and intermittent strain cycling at 600°C were given. The fatigue lives observed under the intermittent strain cycling were compared with those predicted by using the linear cumulative damage concept. (6 refs.)

109467 Elevated temperature low cycle fatigue strength of forged Ni-base superalloy IN 718. K.Kuwabara, A.Nitta, T.Kitamura (Central Res. Inst. of Electric Power Industry, Komae, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.357, p.657-61 (June 1983). In Japanese.
In order to investigate the characteristics of low cycle fatigue strength of a forged Ni-base superalloy IN 718 at elevated temperatures, strain-controlled fatigue tests were carried out on the smooth specimens and load-controlled fatigue crack propagation tests on the notched specimens. As a result, the failure life for the smooth specimen was found to be sensitive to the fracture mode and to decrease by changing from transgranular to intergranular fracture. It was also found that the failure life was independent of the type of straining in compression. The crack propagation rate in the intergranular fracture mode as well as in the transgranular fracture mode was correlated well with the stress intensity factor, which implied the creep fracture under a small scale creep condition. (6 refs.)

109468 A fracture criterion of Inconel 617 under cyclic straining at high temperatures. M.Kitagawa, K.Tamura, A.Ohtomo (Res. Inst., Ishikawajima-Harima Heavy Industries, Co. Ltd., Tokyo, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.357, p.662-6 (June 1983). In Japanese.
The materials used in high temperature equipment are often subjected to the cyclic straining at the temperatures where fracture is often controlled by time dependent phenomena. The cyclic fracture at such high temperatures sometimes cannot be evaluated by the conventional creep or creep-fatigue fracture criteria. Therefore, a new fracture criterion utilizing the static and cyclic creep rupture time and static creep rupture ductility is proposed.In the criterion, fracture is considered to occur when the sum of the ductility exhaustion damage (which is proportional to the unidirectionally accumulated strain) and the creep damage (determined by time divided by cyclic creep rupture time) reaches a constant value. The criterion was successfully applied to the life prediction of the inscale fracture model of a high temperature heat exchanger made of Inconel 617 alloy. Furthermore, the strain rate dependency of cyclic life under various saw tooth waves was proved to be explainable by the same criterion if the local strain behaviour was examined. (8 refs.)

109469 Effect of vacuum environment on high temperature low-cycle fatigue properties of Inconel 617. H.Hattori, M.Kitagawa, A.Ohtomo (Res. Inst., Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.357, p.667-71 (June 1983). In Japanese.
A set of strain controlled fatigue tests were carried out at 1000°C in air and vacuum environments. The fatigued specimens were metallographically examined by means of an optical and scanning electron microscopes and electron probe microanalysis.

109470 Effects of frequency and temperature- and strain-waveform on thermal fatigue strength of type 316 stainless steel. T.Tsunenari, T.Horikawa, T.Okada, K.Take, T.Miyashita (Tech. Inst., Kawasaki Heavy Industries Ltd., Akashi, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.357, p.672-7 (June 1983). In Japanese.
The effects of frequency and temperature— and strain-waveform on thermal fatigue strength were examined by conducting out-of-phase and in-phase thermal fatigue tests with three kinds of temperature-waveforms (fast heating and fast cooling, slow heating and slow cooling, slow heating and fast cooling) under temperature cycling between 350-650°C and by isothermal low-cycle fatigue tests at 650°C under cyclic frequencies of 0.5~0.39 cpm. The effect of frequency on fatigue life in out-of-phase thermal fatigue was as small as in isothermal low-cycle fatigue, whereas in in-phase thermal fatigue it was much greater and the fatigue life reduction was more remarkable in low frequency. The effect of temperature-and strain-waveform on thermal fatigue life was still smaller than the effect of frequency on out-of-phase thermal fatigue life. The fracture mode of out-of-phase thermal fatigue was the transgranular type even at the lowest frequency tested. (12 refs.)

109471 Thermal fatigue strength of gray cast iron. S.Iwanaga, Y.Sakakibara, T.Miyoshi, K.Saruki (Toyota Central Res. & Dev. Labs. Inc., Aichi, Japan).
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.357, p.678-82 (June 1983). In Japanese.
Describes the difference between out-of-phase and in-phase thermal fatigue lives of gray cast iron resulting from the difference in maximum tensile stress between two phases, which is caused by the asymmetry in the stress-strain relation of gray cast iron. Thermal fatigue tests were performed in the temperature range 150~500°C, in which the growth of cast iron was negligibly small, under strain controlled conditions. The life of in-phase thermal fatigue, in which tensile stress appears at the high temperature side, was about 30 times longer than the life of out-of-phase thermal fatigue, in which compressive stress appears at the high temperature side. In the hysteresis loop of the first cycle, the maximum tensile stress in in-phase thermal fatigue was smaller than that in out-of-phase thermal fatigue. (7 refs.)

109472 Effect of low temperatures on the low cycle fatigue of low carbon steel. J.Polak, P.Liskutin, J.Helesic (CSAV, Brno, Czechoslovakia).
Kovove Mater. (Czechoslovakia), vol.21, no.4, p.425-38 (1983). In Czech.
The cyclic plastic stress-strain response and fatigue life of low carbon steel at temperatures ranging from room temperature down to 133K were studied. Cyclic straining with constant strain rate and constant plastic strain amplitude was applied. The effective stress component increases considerably while the internal stress component decreases slightly at low temperatures. This is in accord with the increase of the parameter characterising the average size of the dislocation substructure at low temperatures. The fatigue life curve changes with decreasing temperatures both in Manson-Coffin's and Wohler's plots but it was found to be a unique function of the average energy dissipated in one cycle. (11 refs.)

109473 High temperature hardness of tungsten carbide. Minyoung Lee (Corporate Res. & Dev., General Electric Co., Schenectady, NY, USA).
Metall. Trans. A (USA), vol.14A, no.8, p.1625-9 (Aug. 1983).
The effect of crystallographic orientation and test temperature on hardness of WC single crystals was investigated along with the hot hardness of polycrystalline tungsten carbide. Also investigated was the effect of carbide grain size and the amount of binder phase on the hot hardness of some cemented tungsten carbides. The hot hardness of single crystal WC on all major crystallographic orientations evaluated decreases very rapidly for increasing temperature, and the single crystal hardness on its hardest orientation is only about half on the polycrystalline material depending on the test temperature. Because of its polycrystalline character, some cobalt bonded cemented tungsten carbides can be harder than single crystal WC over some intermediate temperature range. (7 refs.)

109474 Effects of load ratio and temperature on the near-threshold fatigue crack propagation behavior in a CrMoV steel. P.K.Liaw, A.Saxena (Dept. of Metall., Westinghouse Res. & Dev. Center, Pittsburgh, PA, USA), V.P.Swaminathan, T.T.Shih.
Metall. Trans. A (USA), vol.14A, no.8, p.1631-40 (Aug. 1983).
The influence of temperature in the range of 24 to 260°C and load ratio on the near-threshold fatigue crack growth rate behavior of a CrMoV steel was characterized. At all temperatures investigated, the threshold stress intensity range, ΔK_{th}, for fatigue crack growth decreased with increasing load ratio. The near-threshold crack growth rates increased significantly at 149°C when compared with the rates at room temperature. However, the crack growth rates at 260°C were comparable to those at 149°C. These observations are rationalized in terms of the concepts of roughness and oxide-induced crack closure. Extensive fracture surface characterization using SEM, oxide thickness measurements by Auger spectroscopy, and roughness measurements by light-section-microscopy were conducted to substantiate the explanations. (36 refs.)

109475 Crack propagation of steels during low cycle thermal-mechanical and isothermal fatigue at elevated temperatures. M.Okazaki (Fculty of Engng., Technol. Univ. of Nagaoka, Nagaoka, Japan), T.Koizumi.
Metall. Trans. A (USA), vol.14A, no.8, p.1641-8 (Aug. 1983).
The surface and through crack propagation of three high temperature steels in low cycle thermal-mechanical and isothermal fatigue at elevated temperatures was investigated. The rate of crack propagation obtained was correlated with the range of cyclic J-integral, ΔJ_f. It was found that there is a linear relationship on a log-log plot regardless of materials, test conditions, and crack configurations. Furthermore, fatigue life predicted by integrating the equation of crack propagation was compared with experimental results. (32 refs.)

109476 Effect of strain wave shape on low-cycle fatigue crack propagation of SUS 304 stainless steel at elevated temperatures. M.Okazaki, I.Hattori, F.Shiraiwa (Dept. of Mech. Engng., Technol. Univ. of Nagaoka, Nagaoka, Japan), T.Koizumi.
Metall. Trans. A (USA), vol.14A, no.8, p.1649-59 (Aug. 1983).
Effect of strain wave shape on strain-controlled low-cycle fatigue crack propagation of SUS 304 stainless steel was investigated at 600 and 700°C. It was found that the rate of crack propagation in a cycle-dependent region was successfuly correlated with the range of cyclic J-integral, ΔJ_f, regardless of the strain wave shape, frequency, and test temperature. It was also shown that the rate of crack propagation gradually increased from cycle dependent curve to time-dependent one with decreasing frequency and slow-fast strain wave shape, and that one of the factors governing the rate of crack propagation in such a region was the ratio of the range of creep J-integral to that of total J-integral, $\triangle J_c/\triangle J_T$. Based on the results thus obtained, an interaction damage rule proposed semi-empirically was interpreted, with regard to crack propagation. Furthermore, fatigue crack initiation mechanism in slow-fast strain wave shape was studied, and it was shown that gain boundary sliding took an important role in it. (29 refs.)

109477 Anisotropic embrittlement in high-hardness ESR 4340 steel forgings. G.B.Olson (MIT, Cambridge, MA, USA), A.A.Anctil, T.S.DeSisto, E.B.Kula.
Metall. Trans. A (USA), vol.14A, no.8, p.1661-9 (Aug. 1983).
ESR 4340 steel forgings tempered to a hardness of HRC 55 exhibit a severe loss of tensile ductility in the short transverse direction which is strain-rate and humidity dependent. The anisotropy is also reflected in blunt-notch Charpy impact energy, but is absent in the sharp-crack fracture toughness. Brittle behavior is associated with regions of smooth intergranular fracture which are aligned with microstructural banding. Scanning Auger microprobe analysis indicates some intergranular segregation of phosphorus and sulfur in these regions. The anisotropic embrittlement is attributed to an interaction of nonequilibrium segregation on solidification with local equilibrium segregation at grain boundaries during austenitizing. This produces defective regions of enhanced intergranular impurity segregation which are oriented during forging. The regions are prone to brittle fracture under impact conditions and abnormal sensitivity to environmental attack during low strain-rate deformation. A relatively sparse distribution of these defects (~ 10 cm^{-3}) accounts for the discrepancy between smooth bar and blunt-notch tests vs. sharp-crack tests. Isotropic properties are restored by homogenization treatment. For application of these steels at extreme hardness levels, homogenization treatment is essential. (20 refs.)

109478 The effect of grain size on fatigue growth of short cracks. A.K.Zurek, M.R.James, W.L.Morris (Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA).
Metall. Trans. A (USA), vol.14A, no.8, p.1697-705 (Aug. 1983).
The influence of alloy grain size on growth rates of surface cracks 20 to 500 μm in length was studied in Al 7075-T6 specimens prepared in 12 and 130 μm grain sizes. Grain boundaries temporarily interrupt the propagation of cracks shorter than several grain diameters in length. Linear elastic fracture mechanics is inadequate to describe resulting average growth rates which must instead be characterized as a function of cyclic stress amplitude, σ_a, and alloy grain size as well as stress intensity range, ΔK. These observations are rationalized using two models, one that relates crack closure stress to alloy grain size. In addition, growth rates were found to be faster in fully reversed loading than in tension-tension loading, especially in the large grained material. Evidence is presented to demonstrate that this is a consequence of the fatigue induced development of a compressive residual surface stress during tension-tension loading. (23 refs.)

109479 Hydrogen pressure dependence of the fracture mode transition in nickel. R.H.Jones, S.M.Bruemmer, M.T.Thomas, D.R.Baer (Battelle-Northwest Lab., Richland, WA, USA).
Metall. Trans. A (USA), vol.14A, no.8, p.1729-36 (Aug. 1983).
A relationship between fracture mode, grain boundary composition, and hydrogen pressure has been determined for nickel straining electrode samples tested at cathodic potentials. This relationship can be expressed as $C_S^* \alpha P_{H2}^{-n}$ where C_S^* is the critical grain boundary sulfur concentration corresponding to 50% transgranular and 50% intergranular fracture and P_{H2} is the hydrogen pressure. The value of n was found to be between 0.34 and 0.9. This expression was derived by relating C_S^* to the hydrogen overpotential with the Nernst equation. At a cathodic test potential of -0.3 V (SCE), C_S^* was equal to 0.20 monolayers of sulfur and at higher cathodic potentials of higher hydrogen pressures, C_S^* decreased such that at -0.72 V (SCE) C_S^* was equal to 0.045 monolayers of sulfur. The inverse hydrogen pressure dependence observed with cathodic hydrogen is similar to that for the hydrogen permeation rate or a critical hydrogen concentration derived by Gerberich et al. (1975) for gaseous hydrogen. (22 refs.)

109480 Effect of stress biaxiality of the fatigue crack growth rate of a mild steel. S.Harada, T.Endo (Dept. of Mech. Engng., Kyushu Inst. of Technol., Kitakyushu, Japan).
Mem. Kyushu Inst. Technol. Eng. (Japan), no.13, p.11-18 (March 1983).
Fatigue crack growth under multiaxial loading is of importance in engineering practice. In order to examine the effect of stress biaxiality on the fatigue crack growth rate, torsional (biaxial) and uniaxial zero-tension fatigue crack propagation tests were carried out on a mild steel. The experimental results showed that the stress bixiality gives a different effect on the crack growth rate depending on the loading condition. Estimation of the stress biaxiality effect was done by focusing attention on the crack tip plastic zone size. (21 refs.)

109481 Structure and properties of low-carbon steel alloyed with boron and copper. Ya.N.Malinochka, G.Z.Koval'chuk, V.N.Yarmosh (Inst. of Ferrous Metall., Dnepropetrovsk, USSR).
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.760-5 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.10-14 (Nov. 1982).
It was found that adding as much as 0.5% Cu to steel microalloyed with boron (as much as 0.003%) increases the solubility of boron in austenite and prevents precipitation of brittle boron-containing phase in austenite grain boundaries. Adding copper to steel with boron increases the stability of supercooled austenite somewhat and has no negative effect on the hardenability of the steel. After heat treatment, steel with boron and copper has higher values of strength and especially fracture toughness as compared with steel and boron but without copper. The ductility of the steel with both additions is fairly high and approaches that of unalloyed steel as the tempering temperature is raised. Adding copper lowers the ductile-brittle transition temperature of steel containing boron. (14 refs.)

109482 Microstructure and mechanical properties of 20GTL steel after heat treatment using various cycles. A.A.Zhukov, F.A.Bekerman, A.N.Kharitonov, A.I.Bondarev, A.N.Platonov (Bryansk Inst. for Transport Machinery Building, Bryansk, USSR).
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.766-71 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.15-19 (Nov. 1982).
It is concluded that steel modified with titanium and having a quite high residual aluminum content is relatively insensitive to overheating. 20GTL steel may be austenitized at 920 and even at 970°C. Overheating at 1050°C does not lead to a significant reduction in its mechanical properties. The impact strength of the normalized steel (including at -60°C) is more sensitive to underheating than to overheating. The negative influence of the pearlite network in the structure of 20GTL steel is revealed in a reduction in impact strength at $+20$ and -60°C. Hardening and tempering of cast steel make it possible to completely homogenize its microstructure and significantly increase the strength properties without a significant reduction in ductility. However, the impact strength at $+20$ and -60°C does not increase. (4 refs.)

109483 Structure and properties of steel for high-pressure vessels. M.B.Balakhovskaya, L.V.Nadtsyna, L.N.Davlyatova (All-Union Sci.-Res. Inst. for Heat Engng., USSR).
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.772-4 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.19-21 (Nov. 1982).
It was found that the structure of 16GNMA steel in the normalized condition consists of ferrite and bainite or of upper bainite. The steel with the bainitic structure is characterized by a higher thermal fatigue resistance than that with a ferritic-bainitic structure. When together with thermal fatigue the metal is subjected to the action of shut-down (acid) corrosion, the steel with the bainitic structure is less reliable. Both in the original (after normalizing and tempering) and the aged conditions 16GNMA steel has sufficiently high resistance to brittle fracture. (no refs.)

109484 Influence of carbon vacuum deoxidation on the properties of 34KhN1M steel. P.V.Sklyuev, V.S.Gulyakov, O.A.Polzunov, V.E.Sokolov (Ural Heavy Machinery Plant Production Union, USSR).
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.774-7 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.21-2 (Nov. 1982).
In carbon vacuum deoxidation by the method of pouring from ladle to ladle and subsequent teeming in air there was an increase in impact strength and ductility, a decrease in the tendency toward temper embrittlement, and a reduction in the brittle-ductile transformation temperature. (11 refs.)

109485 Effect of structure on the type of fracture of titanium alloy VT3-1. N.Z.Pertsovksii, M.Ya.Brun, N.M.Semenova.
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.853-9 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.12, p.45-7 (Dec. 1982).
The effect of the structural parameters on the fracture mode of alloy VT3-1 (6.3% Al, 2.3% Mo, 1.6% Cr, 0.4% Fe) was studied with different types of tests. The samples were prepared from a rolled bar 20 mm in diameter in which final deformation occurred in the $\alpha+\beta$ range. For samples intended for fracture toughness tests forged disks 400 mm in diameter were used after deformation under various conditions with heating in the β and $\alpha+\beta$ ranges. The mechanical properties were tested with standard samples for tensile tests, bending tests, and off-centered tensile tests in samples with a thickness of 20 mm. The samples with an equiaxed structure had the highest ductility and lowest values of α_T and K_{Ic}. For samples with a lamellar structure the ductility decreased with increasing diameter of the original β grains and decreasing size of the α colonies. Thinning of α platelets caused the tensile strength to increase, but the ductility and fracture toughness to decrease. (8 refs.)

109486 Size and mechanical properties of craze zones at propagating crack tips in poly(methyl methacrylate) during fatigue loading. W.Doll, L.Konczol, M.G.Schinker (Fraunhofer-Inst. fur Werkstoffmech., Freiburg, Germany).
Polymer (GB), vol.24, no.9, p.1213-19 (Sept. 1983).
In specimens of high molecular weight poly(methyl methacrylate) the microregion at the crack tip has been investigated during fatigue crack propagation by applying the optical interference method in a specially constructed experimental set-up. Thus, in the frequency range of 0.4 to 50 Hz the size and contour of the craze zone were directly measured at upper and

lower load of the cycles. In contrast to previous assumptions it is established that the maximum craze width at the crack tip and hence the maximum length of stretched fibrils increases strongly with crack propagation rate. The directly measured craze data and also the material parameters indirectly derived by the aid of the Dugdale model are related to those data which have been measured during continuous crack propagation under quasi-static tensile load. The spacings of the fatigue striations on the fracture surfaces are compared with the lengths of the craze zones. (28 refs.)

109487 Quantitative morphology analysis for establishing correlations between morphology and properties of impact resistant PVC. G.Leps, J.Sachse, J.Bohse, R.Stephan (Tech. Hochschule 'Carl Schorlemmer', Leuna-Merseburg, Merseburg, Germany).
Prakt. Metallogr. (Germany), vol.20, no.6, p.297-305 (June 1983). In German, English.
In order to establish quantitative correlations between morphology and properties of notch impact resistant P(EVA-g-VC) systems, the following morphological parameters were determined from TEM and SEM micrographs, respectively: volume ratio of phases; content of PVC primary particles; continuity of EVA phase; coefficient of variation of continuity of EVA phase; and elongation and deformation of PVC primary particles. (12 refs.)

109488 Fracture of ceramics under multiaxial stresses. A statistical approach applied to bending tests. J.Lamon (Centre des Materiaux, Ecole Nat. Superieure des Mines de Paris, Evry, France).
Rev. Int. Hautes Temp. & Refract. (France), vol.19, no.3, p.171-83 (1982). In French.
A general approach for the statistical analysis of fracture under multiaxial stress states has been evaluated for a fracture criterion based upon recent concepts of non-coplanar crack extension. The resultant failure expressions have been applied to bend tests and used to interpret experimental results obtained with porcelain cylinders. Implications for the interpretation of bending tests and some important trends in the failure strength with specimen size are discussed. (12 refs.)

109489 Acoustic emission study of microcracking damage in polycrystalline $(V,Cr)_2O_3$ during thermal cycling of the near-room-temperature phase transition. V.Boutinard Rouelle-Rossier, C.Carry (Lab. de Ceramique EPF-Lausanne, Switzerland).
Rev. Int. Hautes Temp. & Refract. (France), vol.19, no.3, p.255-6 (1982). In French. (no refs.)

109490 Porosity effects on thermal shock resistance of ceramics. J.C.Glandus, P.Boch (ENS CI-CNRS, Limoges, France).
Rev. Int. Hautes Temp. & Refract. (France), vol.19, no.3, p.257-65 (1982). In French.
The porosity dependence of thermal shock resistance of two nitride ceramic materials is studied. It is shown, that although the use of thermoelastic analysis leads to an expected decrease of fracture resistance, this parameter is not systematically lowered by an increase in porosity. On the contrary, one observes that increasing porosity gives rise to an improvement of damage resistance. The good agreement between these observations and many bibliographical data allows the generalisation of the present results. (21 refs.)

109491 Cold brittleness of constructional low-carbons steel produced from metallised raw material. L.V.Samoylenko, A.I.Ivanov, G.K.Volkova, P.Ya.Dovzhuk.
Russ. Metall. (GB), no.1, p.106-8 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.120-3 (1982).
Reduction of the coloured impurities, formation of a more finely-dispersed structure, and refining of the subgrain structure in low-carbon constructional steel from heavy metallised charges cause a lowering of the critical embrittlement temperature to −100°C. (12 refs.)

109492 Effect of deformation and heat treatment on phase transitions and properties of titanium alloys. L.K.Dolinskaya, A.F.Matveyenko, Yu.V.Rodionov.
Russ. Metall. (GB), no.1, p.111-14 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.126-30 (1982).
The dependence of the phase transformations and mechanical properties of the VT22 and VT22M titanium alloys on deformation and heat treatment was examined. The high strength of both alloys was found to be associated with the quantitative ratio of the α and β phases but was determined mainly by the structural condition of the alloys. (4 refs.)

109493 Use of the parameters of fracture microrelief for evaluation of the performance of structural materials. L.I.Maslov, O.G.Zamolodchikov, S.A.Kunavin.
Russ. Metall. (GB), no.1, p.168-71 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.196-201 (1982).
Attention is given to one of the possible parameters in the evaluation of local fracture based on an analysis of the energy of local plastic deformation in the fracture of materials by the separation mechanism (microvoid coalescence). (11 refs.)

109494 Examination of the temper brittleness of quenched and tempered low-alloy steels. V.M.Goritskiy, L.I.Gladshteyn, G.R.Shneyderov.
Russ. Metall. (GB), no.2, p.135-40 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.150-6 (1982).
Investigations were conducted into the effect of alloying with molybdenum, phosphorus and vanadium with nitrogen on the structure and susceptibility to thermal embrittlement of low-alloy quenched and tempered steel 10KhSND. Examination by the methods of quantitative fractography shows that in thermal embrittlement conditions, the propagation of cracks in 10KhSND steel takes place mainly along the boundaries of large subgrains and prior martensite packets. In the given compositions of 10KhSND steel, the development of thermal embrittlement is accompanied by a marked increase in the size of intersubgrain fracture facets d_f on the fracture surface; the degree of increase of d_f depends on the composition of the steel and increases to the largest extent for steel alloyed with vanadium and nitrogen. The thermal embrittlement of the quenched and tempered steels is closely linked with the critical density of large ($\sim$0.1 μ) cementite-type particles at the subgrain boundaries. (9 refs.)

109495 Fracture in cryogenic steel (9% Ni) under low-temperature low-cycle fatigue. V.A.Duryagin, A.B.Kuslitskiy, I.V.Kokotaylo, K.B.Katsov.
Russ. Metall. (GB), no.2, p.141-3 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.157-9 (1982).
The features of deformation and fracture of 9% nickel steel (0.03 C, 0.56 Mn, 0.33 Si, 9.52 Ni, 0.05 Al, 0.28 Mo, 0.03 Cr, 0.008 S) were examined under conditions of low-temperature small-cycle fatigue in pure (nonzero) bending. The zone of fatigue crack propagation was found to decrease, whilst the rate of growth of the cracks increased, as the test temperature is reduced. Whilst at room temperature the low-cycle fatigue strength of cryogenic steel is limited by the duration of this stage of crack propagation, at low temperatures the predominant factor is the duration of the stage of crack formation. (3 refs.)

109496 Regularities in the formation of the shape of scratches on tungsten monocrystals. V.V.Dorokhov, A.Ya.Shvartser.
Russ. Metall. (GB), no.2, p.143-7 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.159-64 (1982).
An effort was made to elucidate some specific features of interaction of a single abrasive (indentor) with a BCC metal by studying the influence of the crystallographic orientation on the processes of formation of the shape of the scratches. The process is characterised by the presence of directions of a predominant flow of the metal in front of moving indentor. On the (001) face the metal is squeezed out along the <110>, on the (011) face along the <100>, on the face (111)−along the <11$\bar{2}$> direction. The displacement of the metal upwards in front of the moving indentor occurs along the 112 slip planes. The anisotropy during scratching of tungsten crystals is associated with the orientation of active slip planes {112} and with the positioning of twinning directions in these planes. (9 refs.)

109497 Dependence of the hardness of α'-uranium alloys on the factor of dimensional non-correspondence. L.M.Gomozov.
Russ. Metall. (GB), no.2, p.148-50 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.165-7 (1982).
The value of dHV/dc (c-concentration) for α'-alloys of uranium with Cr, V, Mo, Zr and Nb was experimentally determined. A comparison of the increase in hardness (ΔHV) as a measure of dissolution hardening and of the factor of dimensional non-correspondence of atoms of uranium and alloying elements (η) yields the relationship $\Delta HV \sim \eta^{1.46}$. The dissolution hardening of binary α'-solid solutions of uranium is more intensive than hardening of metals with more symmetrical crystal structures. Apparently, this is due to the fact that, together with dimensional distortions, the distortions of symmetry of the lattice of α-uranium appear, which possess special fd-electron bonds. (8 refs.)

109498 Load frequency dependence in fatigue life of nitrided steel. K.Ishizaki, L.H.Corredor, G.O.Fior (Dept. of Materials Sci., Univ. Simon Bolivar, Caracas, Venezuela).
Scr. Metall. (USA), vol.17, no.8, p.979-81 (Aug. 1983).
At frequencies lower than about 5 Hz, the fatigue life of nitrided steel is greatly decreased with respect to fatigue life at frequencies higher than 5 Hz. The shortening fatigue life at low frequencies may be due to enhanced nitrogen diffusion caused by the Snoek effect. (11 refs.)

109499 Fatigue crack initiation from a notch tip under a cyclic compressive load. Wu-Yang Chu, Chin-Mei Hsiao, Lian-Jiang Jin (Dept. of Metal Phys., Beijing Univ. of Iron & Steel Technol., Beijing, China), Tian-Hua Liu.
Scr. Metall. (USA), vol.17, no.8, p.993-6 (Aug. 1983).
It was found that a fatigue crack could initiate from a notch under a cyclic compressive load but the threshold value was four times as large as that under a cyclic tensile load. The fatigue crack would not propagate under a cyclic compressive load after it grew to a certain size. If the minimum cyclic load was near zero, the threshold value of crack initiation under cyclic compressive stress decreased greatly and the fatigue crack continued to propagate. (1 ref.)

109500 Low-cycle fatigue of titanium alloys promising for cryogenic generator construction. V.A.Strizhalo, A.I.Zinchenko, A.A.Chernyi, N.A.Grekov, G.I.Arkovenko (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.8, p.1006-11 (Aug. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.8, p.10-15 (Aug. 1982).
The results of low-cycle fatigue studies of the Ti alloys PT3V and 19 are presented. The loading conditions and temperatures for the tests were chosen with allowance for possible service conditions of cryogenic generator rotors: a change in load according to a pulsating cycle at low frequency ($\sim$1.5-2 cycles/min) and constant temperature. The tests were conducted at three temperatures: 293, 77, and 4.2K (the tests at 293 K were conducted under room conditions in air, while the tests at 77 and 4.2K were performed in liquid nitrogen or helium). (3 refs.)

109501 Evaluation methods of residual fatigue life of metallic materials. V.I.Kovpak (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian, SSR).
Strength Mater. (USA), vol.14, no.8, p.1030-4 (Aug. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.8, p.31-4 (Aug. 1982).
Discusses the problems involved in the prediction of the residual life of metallic materials, which is the margin by which the structural elements can be extended after their calculated life has been spent. (13 refs.)

109502 Constructional thermal-fatigue strength of R2M rotor steel. M.G.Kabelevskii, L.I.Stolyarova, G.G.Medekshas, P.T.Krasauskas (Central Heavy Machinery Res. Inst., Moscow, USSR).
Strength Mater. (USA), vol.14, no.8, p.1048-54 (Aug. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.8, p.47-52 (Aug. 1982).
The authors examined the production and growth of thermal fatigue cracks and determined the thermal fatigue strength characteristics of R2M rotor steel. These characteristics include the following: the relationship between the deformation and the number of cycles to the production of a crack, the parameter representing the sensitivity to stress concentrations, and the dependence of the crack propagation speed on the magnitude of the stress-intensity coefficient. The experiments were performed with model disks of diameter 300 mm and thickness 40 mm with eight axial slots of depth 10 mm on the circumference. Each pair of slots had a radius of curvature of 0.25, 1, 2.5, or 7 mm. The differences in sharpness of the notches meant that the material could be tested at theoretical stress-concentration coefficients ranging from 3.4 to 14 simultaneously. (17 refs.)

109503 Effect of the dimensions of specimens on the crack resistance of creep-resisting hull steels. V.T.Troshchenko, V.V.Pokrovskii, V.G.Kaplunenko, P.V.Yasnii, G.P.Karzov, B.T.Timofeev, V.P.Leonov (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.10, p.1289-98 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.3-11 (Oct. 1982). [received: Sept. 1983]
The authors investigated the effect of the scale factor on the crack resistance of the hull steels 15Kh2MFA, 15Kh2NMFA (I), and 15Kb2NMFA (II). Increased thickness of specimens was found to lead to reduced rate of fatigue crack growth on the first section of the diagram of fatigue failure and to increased value of K_{th} of the investigated steels at 293K. Increased thickness of the specimen practically did not cause a change of the rate of fatigue crack growth on the Paris section, but it increased the characteristics K_{fc} and K_Q of the investigated steels under cyclic and static loading, respectively. It is concluded that the effect of the scale on the characteristics of fracture toughness of structural steels is apparently connected with the proneness of the material to strain-hardening. (34 refs.)

109504 Fatigue damage to pseudo-α-titanium alloy in the 10-33-Hz frequency range. A.Ya.Krasovskii, Yu.N.Petrov, G.N.Nadezhdin, L.E.Matokhnyuk, V.L.Svechnikov, T.Ya.Yakovleva (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).

Strength Mater. (USA), vol.14, no.10, p.1320-3 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.30-4 (Oct. 1982). [received: Sept. 1983]

The results of tests of a pseudo-α-titanium alloy VT18U at frequencies of 30 and 300 Hz and 10 kHz are used to study the evolution of its dislocation structure during fatigue damage accumulation. The fatigue tests were conducted on smooth specimens with a working diameter of 7 mm. The test results provide evidence of an increase in endurance and endurance limit with an increase in loading frequency. This effect is connected with the fact that given identical stress amplitudes the level of inelastic strain on which fatigue damage accumulation depends will be greater in the case of low-frequency loading. At high frequencies the process of plastic strain cannot be completed to the same degree as at low frequencies and damage to the material is less. (17 refs.)

109505 Effect of the form and size of a fatigue crack on the fatigue fracture toughness of titanium alloy VT9. N.D.Bega (Inst. of Problems of Materials Sci., Acad. of Sci., Kiev, Ukrainian SSR).

Strength Mater. (USA), vol.14, no.10, p.1324-6 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.34-7 (Oct. 1982). [received: Sept. 1983]

The material studied was titanium alloy VT9 in the $\alpha+\beta$ state, heat-treated as follows: annealing at 1223K for 60 min, subsequent cooling in air to 803K, holding for 6 h. The yield point was 1020 MPa, while the ultimate strength was 1120 MPa. The smooth cylindrical specimens had a working length of 30 mm and diameter of 10 mm. From results it is concluded that in the region σ_{max} near the yield point, the plastic strain accumulated to fracture during cyclic loading creates conditions for structural changes in alloy VT9 and is the main reason for the sharp reduction in its fatigue fracture toughness. Further studies will be required to obtain a consistent physical model of this effect. (5 refs.)

109506 Zones of elastic deformation under the surface of impact fracture of steel 45. L.R.Botvina, G.V.Klevtsov, Yu.S.Gladilov (A.A. Baikov Inst. of Metall., Acad. of Sci., Moscow, USSR).

Strength Mater. (USA), vol.14, no.10, p.1348-52 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.55-9 (Oct. 1982). [received: Sept. 1983]

The presence of two zones of plastic deformation under the fracture surface in impact loading was revealed. The temperature relationship of the depth and degree of plastic deformation of the material in these zones in the brittle-ductile transformation area was investigated. It is concluded that the appearance of the weakly deformed macrozone is related to reaching the critical degree of plastic deformation on the fracture surface ϵ_c at which the fibrous constituent appears in the fracture. The temperature of occurrence of this zone corresponds to the lower brittle-ductile transition temperature; the temperature of reaching the critical degree of plastic deformation in this zone ϵ_y^{max} corresponds to the upper brittle-ductile transition temperature. (12 refs.)

109507 Evaluating the crack resistance of tungsten at high temperatures. A.V.Babak (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).

Strength Mater. (USA), vol.14, no.10, p.1389-91 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.89-91 (Oct. 1982). [received: Sept. 1983]

The influence of temperature on the crack resistance of tungsten was studied. The investigation was made on standard 6-mm-thick type VR samples. The samples were tested in off-center tension in the 20-2000°C temperature range. During the crack resistance tests of the samples, tensile curves were drawn to load P vs. displacement V_t coordinates, by treatment of which, using the standard scant method, the value of the critical load for start of crack advance P_Q was determined. The stress intensity factor K_Q was used as the crack resistance parameter. (9 refs.)

109508 Behavior of shells of various types in internal explosive loading. A.I.Belov, V.E.Klapovskii, V.N.Mineev, A.I.Nazarov, V.I.Nelin, M.N.Niklonskii (Central Sci.-Res. Inst. of Sci. & Tech. Information, Moscow, USSR).

Strength Mater. (USA), vol.14, no.10, p.1417-19 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.113-15 (Oct. 1982). [received: Sept. 1983]

Comparative experimental investigations were carried out into the dynamic strains and fracture of solid and multilayer shells subjected to internal loading with a pressure pulse. The shells were made of steel Kh18N9T. The multilayer shell was assembled from two coaxial cylinders with the gap between them filled with water. The total thickness of the shells was selected similar to the thickness of the solid shell. Pulsed loading was generated by means of an axisymmetric explosion of a condensed substance (ES) in air. (3 refs.)

109509 Fractographic study on fatigue fracture of some heat-treated steels for lower da/dN values. C.Masuda, S.Nishijima.

Trans. Natl. Res. Inst. Met. (Japan), vol.25, no.2, p.79-86 (June 1983).

Microfractographic aspects of fatigue fracture were examined in relation to the strength level of material and the macrocrack propagation rate, da/dN, with a particular emphasis on the low da/dN range. The materials investigated were heat-treated carbon and low alloy steels characterized by different levels of Vickers hardness (HV=140, 330, 480, and 780). Fatigue tests were conducted under repeated tensile loads. For low da/dN values (<100 nm/cycle), the fatigue fracture surface exhibited a certain amount of intergranular facets, except for the material of HV330. The coverage of intergranular facet was variable depending upon the da/dN level, but was found to take a maximum value when the size of cyclic plastic zone at the crack tip was nearly equal to the size of ferritic grains (steel of HV 140), or prior austenitic grains (steel of HV 480). (6 refs.)

109510 Possible mechanism for embrittlement of Zircaloy by molybdenum and tungsten. R.Kohli (Nuclear Technol. Div., Battelle Columbus Labs., Columbus, OH, USA).

Z. Metallkd. (Germany), vol.74, no.8, p.494-5 (Aug. 1983). In German.

The tensile properties of Zircaloy have been measured after long-term annealing at 623 and 973K in the presence of molybdenum and tungsten powders. The specimens were severely embrittled with total elongation values in the range of 0.2 to 6%. Embrittlement is attributed to the presence of intermetallic phases with corresponding microstructural changes in the specimens. (8 refs.)

109511 Development of the minima in elongation in time-to-rupture creep tests of low alloy steels. G.Hofer (Kraftwerk Union Erlangen, Erlangen, Germany).

Z. Metallkd. (Germany), vol.74, no.8, p.513-20 (Aug. 1983). In German.

A number of low alloy fine grained structural steels show temperature-dependent minima of elongation in time-to-rupture creep tests. The creep behaviour of the superheated and quenched coarse-grained steel 20 MnMoNi 55 (ASTM A 508 Cl.3) was investigated in the temperature range between 550 and 650°C. Tempering in this region improves the elongation at fracture and with that the toughness of the material. With an analysis of the creep behaviour and with instrumented Charpy impact tests it was shown that the minima in the elongation versus time-to-rupture curves are caused by creep processes and not by temper embrittlement. (18 refs.)

109512 Joint exercise to compare fatigue crack growth data obtained on type 304/316 stainless steel. K.Krompholz, G.J.Lloyd, P.Petrequin.

Report EUR 8502 EN, Comm. European Communities, Luxembourg (1983), 37 pp. Contract RAP-013(80) D.

The Activity Group 3 'Materials' of the Working Group on Codes and Standards of the Fast Reactor Co-ordinating Committee has set itself the task of comparing fatigue crack growth data obtained on type 304/316 ss, which are used as structural materials in fast reactor applications in the European Community. The objectives therefore were to compile the available data which reflect the influence of parameters like, for example, frequency, stress ratio, environmental impact etc. in a unified correlation of fatigue crack growth vs. stress intensity factor amplitude; to quantify, if possible, the effect of these parameters on fatigue crack growth and to identify whether the two kinds of steels show differences in fatigue crack growth under comparable conditions.

109513 Study of low-cycle fatigue behaviour of steels at high temperature. A.Origoni, V.Mandorini.

Report EUR 6497 EN, Comm. European Communities, Luxembourg (1982), 84 pp. Contract 6210.KD/4/401.

Creep and low-cycle fatigue tests have been carried out on 2 1/4 Cr 1 Mo steel normalized and tempered, at the temperature of 550°C. Creep rupture times found are very close to those determined, on the same material, in another ECSC research. Low-cycle fatigue tests have shown that elastic and plastic terms of imposed deformation are very well represented by straight lines on a double-log plot versus a parameter N_{of} relative to the useful specimen life. Moreover it was found that the frequency effect on the number of cycles to rupture becomes appreciable near 0.1 c/m and it is the more evident the less is the amplitude. All the specimens have shown a transgranular fracture. Finally a series of combined creep low-cycle fatigue tests interpreted in accordance with the summation of damage fractions attributable to creep and fatigue has shown that, in the experimental conditions, a strengthening mechanism exists for 2 1/4 Cr 1 Mo steel, resulting from the interaction of creep and fatigue phenomena.

109514 Fatigue crack growth and fracture resistance of steels in high-pressure hydrogen environments. A.H.Priest.

Report EUR 8191 EN, Comm. European Communities, Luxembourg (1983), 47 pp. Contract EHC-(1)42-012-81 UK(H).

Presents a review of information and data available from the past British Steel Corporation (BSC) research programmes concerned with the influence of high pressure hydrogen on the properties of steels used for gas containment. An evaluation has been made of the effects of hydrogen pressure and cyclic frequency on the fatigue properties of eight steels, most of which are currently used in the manufacture of gas cylinders. The evaluation has included CrMo and CMn types of steels and material with strength levels close to the bottom and top of the currently specified range. The results indicate a marked influence of hydrogen pressure on the fatigue behaviour of all eight steels. At hydrogen pressures of 150 bar and above even the most 'resistant' steel shows a sixteen-fold increase in fatigue crack growth rate when compared with data obtained in nitrogen gas at a similar pressure. The cyclic frequency has also been observed to influence the fatigue behaviour in a smaller, but still significant, manner. In general the fatigue crack growth rates increase as the frequency is reduced, with the most marked acceleration produced as the frequency drops from 10 to 1 Hz. In CrMo steels the greatest resistance to hydrogen accelerated fatigue crack growth was exhibited by material with a tempered martensite microstructure containing a uniform distribution of fine carbide precipitates. (13 refs.)

109515 Comportement en fatigue d'aciers a haute limite d'elasticite (Fatigue behaviour of steels with high elastic limit). C.Maillard-Salin, H.P.Lieurade.

Report EUR 8060 FR, Comm. European Communities, Luxembourg (1983), 83 pp. In French. Contract 7210.KD/303.

Low-cycle fatigue tests are carried out on different types of butt joints in structural steels. The used joints are welded with manual welding, with MAG welding or with submerged arc welding. Different surface conditions (as rolled or ground) are tested. From the results of tests conducted under total strain amplitude control, strain amplitude versus life curves are plotted. Several experimental parameters characterizing the notch acuity of the different specimens tested are derived using the test data. For this derivation characteristics of the tested specimens are compared with reference characteristics determined on ground specimens. The used reference characteristics correspond to a metal having the same hardness as the crack initiation location. The influence of different parameters is discussed particularly the dimensions effect, notch effect (surface conditions, bead geometry) and the role of microstructure (heat treatment). (10 refs.)

109516 The influence of critical manufacturing variables upon fatigue life of springs. L.Stankowski, J.Warner (Allen-Bradley Co., Milwaukee, WI, USA).

Proceedings of the 31st Relay Conference, Stillwater, OK, USA, 26-27 April 1983 (Elkhart, IN, USA: Nat. Assoc. Relay Manuf. 1983), p.1/1-7

Allen-Bradley Company manufactures numerous devices for use in a corrosive environment that incorporate springs of various shapes and sizes. These springs, with their expected reliability, are often made of stainless steel. This report discusses the relationship of surface texture of stainless steel springs to fatigue life and shows that rough surface texture is a deciding factor in premature fatigue failures. (3 refs.)

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The dependence of the high temperature mechanical properties of austenitic stainless steels on implanted helium .... See Entry 106164

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Thermomechanical treatment of a commercial purity Al-Mg-Si alloy .... See Entry 109343

On the microstructure of quenched, normalized and full-annealed, copper-modified 4340 steel .... See Entry 109344

An electron-microscopic examination of low-alloy steel fine structure after controlled rolling and direct quenching .... See Entry 109346

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81.40P Friction, lubrication, and wear

(see also 62.20P Tribology)

109517 The amorphous phase and surface mechanical properties of 304 stainless steel implanted with Ti and C. D.M.Follstaedt, F.G.Yost, L.E.Pope, S.T.Picraux, J.A.Knapp (Sandia Nat Labs., Albuquerque, NM, USA).
Appl. Phys. Lett. (USA), vol.43, no.4, p.358-60 (15 Aug. 1983).
The wear tracks resulting from unlubricated pin-on-disc tests of 304 stainless steel which was ion implanted with Ti and C have been examined with transmission electron microscopy, scanning electron microscopy, and energy dispersive X-ray spectroscopy. At light pin loads, where the maximum wear depths were reduced by the implantation from ~1.5 to ~0.15 μm, nearly continuous amorphous layers containing Ti were found to exist across the wear tracks. However, the amorphous phase was not observed in deeper wear tracks (≳1 μm) produced by higher loads. This correlation of the presence of the amorphous layer with reduced wear demonstrates that this layer is reponsible for the reduction in wear produced by implantation of Ti and C. (13 refs.)

109518 Plastic deformation and wear process at a surface during unlubricated sliding. T.Yamamoto, D.H.Buckley (Lewis Res. Center, NASA, Cleveland, OH, USA).
ASLE Trans. (USA), vol.26, no.3, p.277-87 (July 1983).
The plastic deformation and wear of a 304 stainless steel surface sliding against an aluminium oxide rider with a spherical surface (the radius of curvature: 1.3 cm) were observed by using scanning electron and optical microscopes. Experiments were conducted in a vacuum of 10^{-6} Pa and in an environment of 5×10^{-4} Pa of chlorine gas at 25°C. The load was 500 grams and the sliding velocity was 0.5 centimeter per second. The deformed surface layer which accumulates and develops successively is left behind the rider, and step-shaped protruberances are developed even after single-pass sliding under both environmental conditions. A fully developed surface layer is gradually torn off leaving a characteristic pattern. The mechanism for tearing away of the surface layer from the contact area and sliding track contour is explained assuming the simplified process of material removal based on the adhesion theory for the wear of materials. (15 refs.)

109519 Tribological characteristics of nitrogen (N^+) implanted iron. W.R.Jones,Jr., J.Ferrante (Lewis Res. Center, NASA, Cleveland, OH, USA).
ASLE Trans. (USA), vol.26, no.3, p.351-9 (July 1983).
The effect of implantation of nitrogen ions (1.5 MeV) on the friction and wear characteristics of pure iron sliding against M-50 steel (unimplanted) was studied in a pin-on-disk sliding friction apparatus. Test conditions included room temperature (~25°C), a dry air atmosphere, a load of $^1/_2$ kg (4.9 N), sliding velocities of 0.043 to 0.078 m/s (~15 to 25 rpm), a pure hydrocarbon lubricant (n-hexadecane), or a USP mineral oil and nitrogen ion implantation doses of 5×10^{15} and 5×10^{17} ions/cm^2. No differences in wear rates were observed in the low-dose (5×10^{15} ions/m^2) experiments. In the high-dose experiments (5×10^{17} ions/cm^2), small reductions in initial (~40 percent) and steady-state (~20 percent) wear rates were observed for nitrogen-implanted iron riders as compared with unimplanted controls. No differences in average friction coefficients were noted for either dose. Auger electron spectroscopy combined with argon ion bombardment revealed a subsurface Gaussian nitrogen distribution with a maximum concentration of 6 atomic percent at a depth of 8×10^{-7} m (0.8 μm). Similar analysis within the wear scar (~2.0×10^{-5} m subsurface) of an implanted rider after 20 μm of wear yielded only background nitrogen concentration. No inward migration of nitrogen ions was observed. (25 refs.)

109520 Fabrication and wear test of a continuous fiber/particulate composite total surface hip replacement. J.C.Roberts, F.F.Ling, W.R.Jones,Jr. (Lewis Res. Center, NASA, Cleveland, OH, USA).
ASLE Trans. (USA), vol.26, no.3, p.367-75 (July 1983).
Continuous fiber woven E-glass/epoxy composite femoral shells having the same elastic properties as bone have been fabricated. These shells were coated with filled epoxy wear-resistant coatings consisting of 1 to 64 micron particles of: Al_2O_3, Al_2O_3+Cu, and 18-8 stainless steel+Al_2O_3 in an epoxy matrix. The resulting femoral shells were wear tested dry against ultrahigh-molecular-weight polyethylene (UHMWPE) acetabular cups for up to 250000 cycles on a total hip simulator. The best femoral shell tested was the one containing particles of 18-8 stainless steel+Al_2O_3 in an epoxy base. Articulation of this shell dry against UHMWPE for 250000 cycles resulted in a friction force that was about 10 percent lower than that of the current total hip prosthesis; that is, a vitallium ball articulating dry with an UHMWPE cup. Addition of graphite fibers to the UHMWPE acetabular cup and articulation with the 18-8 stainless steel+Al_2O_3 epoxy shell increased the friction force but reduced the surface damage to the UHMWPE. When femoral shells containing Al_2O_3+Cu particles in an epoxy matrix were run dry against UHMWPE for 42000 cycles the friction force was continually increasing and there was evidence of more surface damage to the UHMWPE cup than when the shell contained particles of 18-8 stainless steel+Al_2O_3. (28 refs.)

109521 Tribochemical processes and wear resistance of polymeric materials. V.V.Korshak, I.A.Gribova, A.P.Krasnov, V.N.Aderikha (Inst. of Organo-Element Compounds, Acad. of Sci., Moscow, USSR).
ASLE Trans. (USA), vol.26, no.3, p.401-4 (July 1983).
Tribochemical transformations of polyphenylquinoxaline (PPQ) and a composite material on its basis containing graphite are investigated. A mass-spectrometric analysis shows that in the polymer surface layers the destructive-structurizing processes occur on friction that changes the structure and properties of the surface layer. It is shown that, in the presence of a graphite

filler, the tribochemical transformation character also changes. Based on the investigation data, a general scheme of tribochemical changes of PPQ is proposed and their relation to wear is suggested. (8 refs.)

109522 The role of copper-base alloys in tribological experiments and applications. A.D.Sarkar (Dept. of Mech. Engng., Univ. of Petroleum & Minerals, Dhahran, Saudi Arabia).
Arabian J. Sci. & Eng. (GB), vol.8, no.2, p.113-21 (April 1983).
The effect of geometry on the wear rates of brass is examined by carrying out experiments using laboratory machines. It is shown that an empirical relationship between the volume, V, lost due to wear and the contact stress σ can be obtained, but V is not directly proportional to σ. Some results of wear studies using binary Cu-Zn and Cu-Sn alloys are reported. It is noted from a review of the literature that the wear resistance of copper-base alloys can be improved by increasing the tin and lead content. It is recommended that further laboratory studies on the wear of copper-base alloys will be of value. (13 refs.)

109523 Abrasive wear in uni-directional friction and reciprocating friction. N.Yahata (Dept. of Mech. Engng., Tokyo Univ. of Agriculture & Technol., Koganei, Japan).
J. Jpn. Inst. Met. (Japan), vol.47, no.8, p.692-8 (Aug. 1983). In Japanese.
A comparison of abrasive wear between uni-directional friction and reciprocating friction was made on annealed plain carbon steels sliding against fresh Al_2O_3 abrasive cloths and repeatedly used ones. Wear tests of the two sliding modes were carried out with a testing machine, remodeled from a lathe under similar conditions in air. The experiments indicated that in case of fresh abrasive cloths, a heavier wear always resulted from uni-directional friction, and the wear differences between the two sliding modes increased with increasing normal forces and abrasive grain sizes; in case of repeatedly used ones, a heavier wear resulted from reciprocating friction in steady conditions. The wear differences between the two sliding modes can be explained in terms of the differences in the degree of work-hardening of the rubbed surfaces and the amount of the abrasive grains being blunted, fractured, eroded out of the resin base, clogged and capped with metal chips etc. (13 refs.)

109524 Structure and wear properties of Al-Sn alloy produced by electroslag remelting. Hoon Yung Young (Coll. of Engng., Yon Sei Univ., Seoul, Korea), Jin Il Choi, Ki Young Kim.
J. Korean Inst. Met., vol.21, no.5, p.469-81 (May 1983). In Korean.
Experiments were carried out to investigate the effect of various casting processes such as sand casting, chill casting and ESR, and also of nickel addition on the structure and sliding wear properties of Al-Sn alloy containing up to 20% tin. The results obtained are as follows: (1) Addition of nickel to the Al-Sn alloy produced by sand casting and ESR was effective to refine tin particles, while there was no structural change in chill cast alloy. (2) The wear resistance of the alloy produced by ESR was superior to that by sand casting and chill casting. The wear resistance varied with sliding conditions, but better wear resistance was achieved with a continuously networked tin structure. (3) In the sliding wear of Al-Sn alloy, abrasive and adhesive wear, occured, while oxidizing wear was not recognized. (4) In the wear test of Al-Sn alloy, the average size of wear debris and the wear amount increased with increasing sliding speed, and both of them were also found to be in proportion. (24 refs.)

109525 Metastable austenitic Cr-Mn steels. M.A.Filippov (S.M. Kirov Ural Polytech. Inst., Sverdlovsk, USSR).
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.751-5 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.2-7 (Nov. 1982).
It is concluded that the contact strength of machine parts operating under various conditions of contact dynamic loading (cavitation-erosion, gas erosion, friction, and impact-abrasive wear) can be improved substantially by using Cr-Mn MAS steels. The resistance of Cr-Mn MAS depends on the conditions of CDL, the rate of the martensitic transformation, and the properties of the phases formed. For applications involving cavitation steels containing 0.1-0.3% (C+N) of the 10Kh14AG12-30Kh10G10 type are recommended, in which the $\gamma \rightarrow \epsilon$ and $\gamma \rightarrow \alpha$ martensitic transformations occur at a high rate; steels with a high carbon content (0.6-0.8%) in which the $\gamma \rightarrow \alpha$ transformation is the primary transformation under load (steels of the 60Kh5G10L-70Kh4G8L type) are promising for impact-abrasive wear conditions. (22 refs.)

109526 Modification of Kh12M steel. A.E.Pavaras, A.N.Popandopulo, P.I.Ambrosa, A.F.Vishkarev, V.V.Savinov (Kaunas Polytech. Inst., Kaunas, USSR).
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.793-7 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.36-8 (Nov. 1982).
It was found advisable to modify steels of the Kh12M type with aluminum, yttrium, and boron, since this helps to achieve more uniform distribution of eutectic carbides, to decrease segregation of alloying elements, and to decrease sensitivity of the steel to overheating. Carbide inclusions in forged and annealed modified steel Kh12M are small in size and of characteristic shape. Modification of steel Kh12M promotes transformation of austenite during tempering, promotes precipitation hardening, improves mechanical properties, and increases by 1.5-2 times the wear resistance of tools. (2 refs.)

109527 Lubrication of high temperature ceramic materials. B.Longson (Nat. Centre of Tribology, Risley, England).
Tribology Int. (GB), vol.16, no.4, p.221-5 (Aug. 1983).
A composite of $CaF_2/BaF_2/Ni$ was shown to be an effective lubricant for a silicon carbide ceramic and a titanium carbide/nickel cermet when tested as like pairs in crossed cylinders geometry at room temperature and at 600°C. (18 refs.)

109528 The effect of particle shape and size on erosion of aluminum alloy 1100 at 90° impact angles. R.Brown (Dept. of Chem. Engng., Univ. of Rhode Island, Kingston, RI, USA), S.Kosco, E.J.Jun.
Wear (Switzerland), vol.88, no.2, p.181-93 (1 July 1983).
Aluminum alloy 1100 was eroded by 70 μm and 210 μm silica spheres and by 210 μm angular quartz particles at a velocity of 122 m s^{-1} and at an impact angle of 90°. Extensive scanning electron microscopy examination of eroded surfaces, erosion debris and metallographic sections, together with transmission electron microscopy examination of debris and eroded surfaces, was conducted. Hills and valleys were formed during the incubation period of erosion for all types of erodent. During steady state erosion small nonfragmenting erodent removed material by a flaking mechanism in valleys. For larger fragmenting erodent four additional mechanisms aiding erosion were identified. Furthermore, a threshold particle size for hill and valley formation is proposed. The implication of this on the magnitude of the erosion rate is discussed. (27 refs.)

109529 Effect of aqueous cations on friction between rubber and glass. L.Sokoloff, S.L.Lee (Dept. of Pathology & Mech. Engng., State Univ. of New York, Stony Brook, NY, USA).
Wear (Switzerland), vol.88, no.2, p.207-19 (1 July 1983).
The coefficient of friction μ between plate glass and natural rubber subjected to boundary lubrication by various isotonic salt solutions was measured. All the monovalent chloride solutions tested (Na^+, K^+, Li^+, $NH_4{}^+$, $(CH_3)_3NH^+$ and $(CH_3)_4N^+$) reduced the value of μ below that obtained using distilled water as the lubricant. The divalent cations test (Ca^{2+}, Ba^{2+} and Mg^{2+}) and La^{3+} increased μ. The effects of Fe^{3+} and Al^{3+} were anomalous. Little increase in friction was observed in the presence of these cations, but large increases in μ were obtained after they had been rinsed away with NaCl. Immersion in water increased the extensibility of the rubber relative to that obtained in air. The addition of monovalent cations had no measurable effect on the elastic properties on the elastic properties of the rubber. The friction increased progressively when the pH of the NaCl solutions was reduced below 4 by adding HCl solution. Desorption experiments showed that the rubber adsorbed $^{45}Ca^{2+}$. The effect was competitively inhibited by the addition of 0.1 and 1 M non-isotopic $CaCl_2$. (29 refs.)

109530 Study of rolling friction—behaviour of the small displacement of starting rolling friction. T.Koizumi (Dept. of Mech. Engng. for Production, Tokyo Inst. of Technol., Tokyo, Japan), H.Shibazaki, T.Nishio, N.Nishiwaki.
Wear (Switzerland), vol.88, no.3, p.285-96 (15 July 1983).
In this study the detailed behaviour of the starting rolling displacement at the contact of a flat steel surface with a steel roller is investigated. In addition, the behaviour of the hysteresis loop formed in the region of the starting rolling distance is experimentally examined by varying the hardness of the rolling contact surface and the radius of the roller. From the results it is found that the contact width is closely related to the rolling friction force, that the area of the hysteresis loop increases proportionally to the second power of the starting rolling distance and that the maximum width of the hysteresis loop shows almost the same value as the half-contact width calculated by Hertz' theory. (11 refs.)

109531 A critical study of the erosion of an aluminium alloy by solid spherical particles at normal impingement. A.K.Cousens, I.M.Hutchings (Dept. of Metall. & Materials Sci., Univ. of Cambridge, Cambridge, England).
Wear (Switzerland), vol.88, no.3, p.335-48 (15 July 1983).
Detailed observations of the mechanism of material removal in aluminium alloys eroded at normal incidence by spherical particles are reported. Eroded specimens were examined by scanning electron microscopy and were sectioned for metallographic examination. Important features observed included surface ripples of uniform wavelength and the formation of platelets on the surface. Beneath each surface examined was a layer, clearly delineated from the bulk material, with approximately four times the hardness of the bulk. This layer had a laminar structure and contained numerous embedded fragments of erodent particles. The layer was of relatively uniform thickness and was perforated in places by bulk material penetrating to the surface. In the early stages of erosion, before a linear erosion rate is established, the subsurface microstructure is developed. Then, by a process akin to backward extrusion, bulk material is forced to the surface through fissures in the hard layer. (18 refs.)

109532 Deformation by scratches and frictional properties of MgO crystals. Y.Enomoto (Mech. Engng. Lab., Ibaraki, Japan).
Wear (Switzerland), vol.89, no.1, p.19-28 (1 Aug. 1983).
The subsurface structure of MgO crystals frictionally damaged on their (001) faces by scratching with a diamond stylus in the $\langle 100 \rangle$ direction was investigated using a scanning electron microscope in both the cathodoluminescence and the secondary electron modes. The friction is independent of the load below a critical value, and above this value it depends on the load W according to $\mu \propto W^n$ where μ is the coefficient of friction. The subsurface beneath the sliding contact consists of four characteristic material zones: zone I is severely deformed with a high defect density which causes quenching of the luminescence; zone II is a plastically deformed intermediate zone showing enhanced luminescence; zone III is a slipped zone which on etching shows a dislocation pit pattern; zone IV consists of non-deformed crystalline material. The normalized depth d/a, where d is the depth of each deformed zone and a is the track half-width, is independent of the load. The frictional behaviour was examined by using empirical relations for the damage to estimate the plastic work done during the scratching process. (19 refs.)

109533 Antiwear property of lubricant additives for high silicon aluminium alloy under boundary lubricating conditions. M.Kawamura, K.Fujita (Toyota Central Res. & Dev. Labs., Aichi-ken, Japan).
Wear (Switzerland), vol.89, no.1, p.99-105 (1 Aug. 1983).
The antiwear effects of phosphates, phosphites and zinc dialkyldithiophosphates (ZnDTPs) were examined by the use of a cross-pin-type lubricant tester for a high silicon aluminium alloy boundary lubrication conditions. The reactivity of the additives with metals was studied by differential thermal analysis. Phosphates and phosphites containing straight chain alkyl groups showed smaller wear scar diameters than those containing branched or aryl groups. The reactivity of the additives did not correlate with the antiwear property. The results suggest that the oiliness effect is a dominant factor. ZnDTPs showed good antiwear properties, which may be attributed to the adsorption of the additives or the formation of a friction polymer. (7 refs.)

109534 Observation of wear damage of a hot isostatically pressed alumina cutting tool by cathodoluminescence. Y.Enomoto (Mech. Engng. Lab., Ibaraki, Japan), K.Fujise.
Wear (Switzerland), vol.89, no.1, p.107-11 (1 Aug. 1983).
Recent work has shown that the observation of cathodoluminescence (CL) from the wear damage of brittle materials provides one with fruitful information about plastically deformed zones and subsurface microcracks. This technique is applied to study the wear behaviour of a hot isostatically pressed (HIP) α-alumina cutting tool. Wear damage of the tool tip was observed using a JEOL JL-35C scanning electron microscope in both the CL mode (emission at all wavelengths) and the secondary electron (SE) mode at an accelerating voltage of 25 kV. It can be observed that, in the CL micrograph, three large dark zones exist at the flank face, i.e. about the outside zones of primary grooves and secondary grooves and about the central zone. These dark zones primarily correspond to the deposited area of steel material transferred from the workpiece. (6 refs.)

On prediction of wear coefficients in sliding wear ....See Entry 107821

Effect of lubricants on frictional polymerization of palladium electrical contacts ....See Entry 108525

On the mechanism of self-lubrication in metal-polymer electrical contacts ....See Entry 108548

Heat treatment and diamond burnishing of gray cast iron .....See Entry 109356

A proposed diamond polishing process ....See Entry 109550

Friction oxidation characteristics ....See Entry 109553

Cavitation erosion of cast iron in 3% salt water ....See Entry 109599

81.40R Electrical and magnetic properties (related to treatment conditions)

(see also 72.80 Conductivity of specific semiconductors and insulators, 74.70 Superconducting materials, 75.50 Studies of specific magnetic materials)

109535 Magnetic properties of alloy 40KhNYu-VI. V.A.Petrov, L.I.Vershinina, R.D.Strokatov, V.F.Sukhovarov (Inst. of Atmospheric Optics, Acad. of Sci., Tomsk, USSR).
Fiz. Met. & Metalloved. (USSR), vol.56, no.1, p.72-6 (July 1983). In Russian. English translation in: *Phys. Met. & Metallogr. (GB)*
Magnetic properties and structure of a dispersion-hardening industrial alloy 40KhNYu-VI were investigated. X-ray structure analysis and electron microscopy showed that nickel particles precipitated within primary particles of the α-phase. The Kondorskii theory was used to discuss the magnetic properties of alloys and to determine the volume fraction of ferromagnetic particles. The range of existence of the ferromagnetic state was established experimentally. (8 refs.) *A.T.*

109536 Mossbauer investigations on magnetically ordered precipitates in Cu-Ni-Fe. F.Richter, W.Pepperhoff (Forschungsinst., Mannesmann AG, Duisburg, Germany).
Z. Metallkd. (Germany), vol.74, no.8, p.500-3 (Aug. 1983). In German.
During slow cooling of Cu-Ni-Fe alloys with a similar composition as the technically important alloys CuNi10Fe and CuNi30Fe nickel rich Fe-Ni particles are formed. For these particles a nickel content of 60 to 70% could be determined from the ferromagnetic behaviour of $(Cu_{0.9}Ni_{0.1})_{0.98}Fe_{0.02}$ and the superparamagnetic behaviour of $(Cu_{0.7}Ni_{0.3})_{0.98}Fe_{0.02}$. The decrease of iron in the matrix may cause a deterioration in corrosion resistance. (18 refs.)

Low-temperature investigations of the system α-R(H, D)$_x$ with R=Er, Tm, Lu after quench and/or electron irradiation ....See Entry 108390

Galvanomagnetic effects in quenched aluminium ....See Entry 108391

Dependence of the thermal electromotive force of aluminum alloys on the grain size ....See Entry 108393

Changes in the magnetic properties of alloy YuNDKT (35% Co, 15% Ni, 7% Al, 4% Cu, 5% Ti, 1% Nb, rest Fe) during heating ....See Entry 108733

On the high energy product of Fe-Pt permanent magnet alloys ....See Entry 108735

Variation of the magnetic properties of $SmCo_5$ powders by water milling ....See Entry 108740

Influence of plastic deformation on magnetic interaction in $FePt_3$ alloy ....See Entry 108754

Effect of heat treatment on dielectric strength of polyethylene terephthalate under compressive stress ....See Entry 108877

Cementite decomposition in steel under plastic deformation .. See Entry 109212

Change in structure and properties in stepped aging of V95 aluminum alloy plates .... See Entry 109357

Examination of the structure, magnetic and elastic properties of single crystals of alloy Fe-25% Co-30% Cr-3.4% Mo ....See Entry 109380

Checking the metallurgical condition of ferrous alloy parts by electromagnetic measurements ....See Entry 109645

81.40T Optical properties (related to treatment conditions)

(see also 78.20 Optical properties and materials)

Photoluminescence associated with thermally induced microdefects in Czochralski-grown silicon crystals ....See Entry 108987

81.60 CORROSION, OXIDATION AND SURFACE TREATMENTS

109537 Polishing hard materials. A.P.Smith (Div. of Manufacturing Technol., CSIRO, Melbourne, Australia).
Am. Ceram. Soc. Bull. (USA), vol.62, no.8, p.886-8 (Aug. 1983).
The development of a polishing technique for polishing hard materials (DPH>800) is described. A grooved and etched tin lap was found to produce excellent polishes on a range of hard materials such as carbides, ceramics, refractories, and minerals. The results show improved flatness together with significantly increased polishing rates when compared with existing techniques. Details of lap construction are described, including an etching technique which enables rapid and reliable refurbishing of the lap surface. (9 refs.)

109538 XPS and XAES studies of transient enhancement of Cu^I at CuO surfaces during vacuum outgassing. J.P.Tobin, W.Hirschwald, J.Cunningham (Inst. of Phys. Chem., Free Univ. Berlin, Berlin, Germany).
Appl. Surf. Sci. (Netherlands), vol.16, no.3-4, p.441-52 (July-Aug. 1983).
Vacuum outgassing of CuO powder at 473K gives rise to Cu^I formation at the surface. This process is reversed by heating to 673K in vacuo. From the changes in relative surface concentration of the components as measured by XPS and AES and from mass spectrometric observations it is concluded that surface reduction by impurity carbon is responsible for the formation of Cu^I from Cu^{II} and that charge transfer between bulk and surface layer causes the retransition. (12 refs.)

109539 The oxidation behaviour of silicon-infiltrated silicon carbide. U.Ernstberger, H.Cohrt, F.Porz, F.Thummler (Inst. fur Werkstoffkunde II, Univ. Karlsruhe, Karlsruhe, Germany).
CFI-Ceram. Forum Int. Ber. Dtsch. Keram. Ges. (Germany), vol.60, no.5-6, p.167-73 (30 July 1983). In German, English.
The oxidation behaviour of silicon-infiltrated silicon carbide was investigated for the 1150...1350°C temperature range. A passivating protective coating was found to form in the presence of a high oxygen partial pressure (air under atmospheric pressure). Oxidation progresses according to a parabolic function in which the velocity constants are located between those of silicon and those of pressureless-sintered silicon carbide. The protective coating does not develop smoothly across the composite SiSiC, as would be the case for polycrystalline or monocrystalline silicon or silicon carbide, but instead remains extensively rugged on top of the silicon phase. This is attributable to the presence of impurities in the material. At considerably low oxygen partial pressures ($p_{O2}=4\times10^{-6}$ bar), there occurs a temperature-and gas-flow-velocity-dependent reduction in mass (active oxidation), which gradually vanishes due to the emergence of an SiO(g) equilibrium partial pressure in the pores formed through the heavy attack of the silicon phase. (19 refs.)

109540 Knurl roll design for stable rotogravure coating. W.W.Pulkrabek (Dept. of Mech. Engng., Univ. of Wisconsin-Platteville, Platteville, WI, USA), J.D.Munter.
Chem. Eng. Sci. (GB), vol.38, no.8, p.1309-14 (1983).
When a thin film of fluid is coated on a web by any type roll or spreader coater such that the fluid splits while in a divergent channel the resulting fluid surface is not smooth but is made up of ridges, running in the direction of coating. At production speeds (50 m/min and higher) there is a natural frequency of this fluid ribbing effect which is independent of the type of coater and fluid rheology, and depends only on the depth of the wet coat of transferred liquid. A study has been made to determine how this natural ribbing frequency is related to coating stability on a rotogravure coater with a ruling mill knurled coating roll. It has been observed that many knurl rolls deposit a metastable fluid pattern on the web when the resulting fluid surface matches the knurl pattern of the roll. Under some coating conditions this resulting surface becomes unstable and the fluid is transferred to a condition of fewer ridges per cm, resulting in a nonuniform coated surface. (11 refs.)

109541 Titanium oxycarbide on TiC (100) surface. C.Oshima, S.Otani, M.Aono (Nat. Inst. for Res. in Inorganic Materials, Ibaraki, Japan), S.Zaima, Y.Shibata.
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.6, p.930-3 (June 1983).
Experimental data on chemical composition, atomic structure and electronic structure strongly suggests that titanium oxycarbide, TiO_xC_{1-x}, a mixed phase of TiO and TiC, is formed on the surface when a TiC (100) surface is exposed to oxygen and is then heated at ~1000°C in an ultra-high vacuum. (14 refs.)

109542 A Monte Carlo study of Si(111) surface oxidation. S.E.Goodnick, W.Porod, R.O.Grondin, S.M.Goodnick, C.W.Wilmsen, D.K.Ferry (Dept. of Electrical Engng., Colorado State Univ., Fort Collins, CO, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.767-72 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
A theoretical study of the initial oxidation stages of Si(111) surfaces is undertaken. A Monte Carlo simulation is used to study the individual surface processes that have been suggested in the literature. The relative importance of these mechanisms for the chemical composition of the oxide layer as well as for the initial stages of the formation of SiO_x is investigated. (21 refs.)

109543 Elevated temperature low energy ion cleaning of GaAs. P.Oelhafen, J.L.Freeouf, G.D.Pettit, J.M.Woodall (IBM Res., Yorktown Heights, NY, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.787-90 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The authors have studied various cleaning procedures for obtaining atomically clean, well-ordered surfaces of GaAs(100) and (110). They have evaluated the resulting surfaces by angle resolved ultraviolet photoelectron spectroscopy (ARUPS), X-ray photoelectron spectroscopy (XPS), and low energy electron diffraction (LEED). They report results for thermally cleaned, ion bombarded and annealed, and ion bombardment at elevated temperature cleaning procedures. The most reproducible results, giving the best, lowest background LEED patterns and the sharpest ARUPS results, were obtained from the elevated temperature ion bombardment cleaned samples. The thermally cleaned samples, while showing low impurity concentrations to XPS studies, had a relatively high background LEED pattern. The ARUPS results were not indicative of a high degree of surface order; the normal emission spectra more resemble angle integrated UPS results. The room temperature ion bombarded samples, followed by anneals of 30 min at temperatures up to 520°C, yielded a high quality 1×1 pattern on a GaAs(100) surface, but no higher order reconstruction could be obtained. The ion bombardment typically used in this work was 200 eV Ar ions. Substrate temperature during bombardment were varied from 300 to 800K. Post anneals were also examined. Temperatures of 300°C were quite adequate to obtain a high quality 1×1 LEED pattern on both (100) and (110) surfaces. Post anneals at 520°C yielded a low background (8×2)Ga surface. (8 refs.)

109544 Cleaning chemistry of GaAs(100) and InSb(100) substrates for molecular beam epitaxy. R.P.Vasquez, B.F.Lewis, F.J.Grunthaner (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.791-4 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
The widely accepted sample-cleaning procedure for MBE substrates, involving the thermal desorption of native oxide-passivation layers in UHV, is examined using high resolution X-ray photoelectron spectroscopy. Oxide composition, carbon contamination, and substrate surface stoichiometry are followed for a variety of temperatures, for GaAs, $In_xGa_{1-x}As$, and InSb substrates. The oxide desorption mechanism observed involves thermal reduction of As^{+5} to As^{+3} resulting in the further oxidation of the GaAs substrate surface and the additional formation of Ga_2O_3 and As^0. At higher temperatures, first the As_2O_3 desorbs followed by the loss of Ga_2O_3. Carbon-contamination levels were minimized (<0.5% of a monolayer) by the etch removal of the chemical passivating layer by a HCl/EtOH strip immediately prior to vacuum introduction of the sample. The etch is done in inert-atmosphere conditions and gives total removal of both arsenic and gallium oxides, yet leaves the substrate stoichiometry unmodified. The method was quite effective for the $In_xGa_{1-x}As$ (x=0-1) system; however, halide-passivation films gave better results on InSb. (19 refs.)

109545 Photoelectrochemical passivation of GaAs surfaces. J.M.Woodall, P.Oelhafen, T.N.Jackson, J.L.Freeouf, G.D.Pettit (IBM Res. Yorktown Heights, NY, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.795-8 (July-Sept. 1983). (10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces, Santa Fe, NM, USA, 25-27 Jan. 1983).
A wet chemical technique is described for passivating air-exposed GaAs surfaces. The passivating layer is elemental arsenic which forms as a result of illuminating an n-type GaAs wafer immersed in a mixture of HCl acid and deionized 18 MΩ water with light from a mercury vapor lamp at intensities of 0.01-0.05 W-cm^{-2}. Studies using XPS, LEED, and UPS show that the passivated surfaces have the following properties: (1) there is little or no Ga or Ga and As oxide species in the As film or at the film/GaAs interface; (2) a strong GaAs LEED pattern is observed after a 290°C anneal following low energy ion beam bombardment. This suggests that the As/GaAs interface formed by photoetching is free of contaminates and the the GaAs surface is wellordered prior to ion bombardment at heat treatment. Thus, clean, well ordered surface of GaAs which have been previously air exposed can now be

obtained at lower temperatures than previously. This creates new possibilities for surface studies, epitaxy, and metallization. (15 refs.)

109546 Some investigations on anodic oxide films on gallium arsenide. C.Ghosh, W.Polhamus (ITT Electro-Optical Products Div., Roanoke, VA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.837-9 (July-Sept. 1983).
The anodic oxides on metal-organically grown GaAs have been investigated by Auger and secondary ion mass spectroscopy (SIMS). The surface of the oxide was found to contain carbon contamination amounting to ~7 at.%. The carbon contamination was no longer detectable after Auger sputter profiling for 0.6 min (at a rate of 40 Å/min for Ta_2O_5). Carbon contamination to similar depth on the surface was also observed on freshly etched GaAs. Auger analysis results show a Ga to As atomic ratio of 6:1 for the oxide. As the oxide/GaAs interface is approached, the As concentration increases sharply. The SIMS spectra of the surface and the bulk of the oxide does not show the presence of Ga_2O_3 and As_2O_3, believed to be the main constituents of anodic oxides, but peaks corresponding to GaO and AsO and elemental Ga and As are observed. This is probably due to decomposition of Ga_2O_3 and As_2O_3 because of argon ion bombardment. (15 refs.)

109547 Radio frequency reactive sputter etching—control of etch rates. C.M.Horwitz (Res. Lab. of Electronics, MIT, Cambridge, MA, USA).
J. Vac. Sci. & Technol. B (USA), vol.1, no.3, p.840-3 (July-Sept. 1983).
Etch rate variability in a reactive sputter-etching process can come from many factors, and here the etching of SiO_2 in CHF_3 is used in a study of the effects of various parameters on the etch rate, although other materials are also considered. It is found that this SiO_2/CHF_3 combination is remarkably insensitive to chamber pump-out time and the initial chamber condition, at least at high applied RF voltages (1.5 kV peak to peak). However, the gas pressure, flow rate, applied RF voltage, and the target electrode configuration do have a strong effect on rates. This latter result is shown to agree with presently available data on the capacitance of sputtering glow discharges. An etch rate reproducibility of ±2% over a period of four months has been demonstrated. (15 refs.)

109548 Numerical simulation of the long-term performance and corrosion of photoelectrochemical cells. H.Flaisher, R.Tenne (Dept. of Plastics Res., Weizmann Inst. of Sci., Rehovot, Israel).
J. Phys. Chem. (USA), vol.87, no.16, p.3061-8 (4 Aug. 1983).
A computer progam which simulates the long-term operation of a photoelectrochemical cell (PEC) has been devised by using the basic chemical reactions which are supposed to occur at the surface of the semiconductor electrode. The model takes into account the buildup of a top passivating layer. The rate constants for these reactions were derived implicitly by varying them until the results of the model were comparable to those obtained experimentally for the CdSe/polysulfide photoelectrochemical cell. Once these constants were found, the program was used to simulate experimental curves of efficiency as a function of the cell parameters and time. The ratio of peak photocurrent and steady-state photocurrent was evaluated as well. Effects of solution concentration, incident light intensity, and surface roughness (e.g. by photoetching) were all observed by using the model. These results are in qualitative agreement with many independent experimental observations. For a given electrode, when the rate of hole transfer into the electrolyte is increased (i.e. increased quantum yield), the rate of the electrode deactivation decreases in accordance with experimental observations. (20 refs.)

109549 Ion sputtering and its application to biomaterials [reviews]. W.Kowalski (Tech. Univ. of Wroclaw, Wroclaw, Poland).
J. Mater. Sci. (GB), vol.18, no.9, p.2531-43 (Sept. 1983).
The mechanisms of surface morphology and chemistry changes induced by ion sputtering of solids are reviewed and the influence of ion processing on surface morphology and chemical composition of biological implant materials is discussed. The influence of the ion bombardment induced morphological and chemical changes of biomaterials on mechanical properties and tissue response is also presented. (59 refs.)

109550 A proposed diamond polishing process. C.Jeynes (H.H. Wills Phys. Lab., Univ. of Bristol, Bristol, England).
Philos. Mag. A (GB), vol.48, no.2, p.169-97 (Aug. 1983).
A two-stage, predominantly brittle wear-chip mechanism is developed which may describe fine polishing with diamond grit having sizes in the range 2-10 μm. (Coarser grits do not give a fine polished surface). In the first stage, the size of the wear chips is determined by cracking in the elastic stress field behind the polishing grains. This field is pseudo-Hertzian: it is supposed not to be qualitatively changed by the presence of some plastic deformation. In the second stage, wear chips may be released by various other mechanisms not discussed in detail; their release will be encouraged by plastic deformation. The model predicts that Auerbach's constant will be increased by a factor of 2 for micrometre-sized indenters. The discussion draws attention to the effects of different ranges of grain size in the diamond polishing process; the mechanism described cannot be valid, either for submicrometre-sized grits, where plastic deformation is thought to predominate, or for heavily loaded stones, where part of the load is borne by the cast-iron polishing wheel. (71 refs.)

109551 Observation of oxidation of germanium in the column of an electron microscope. N.V.Rozhanskii, V.A.Arslambekov (Inst. of Phys. Chem., Acad. of Sci., USSR).
Sov. Phys.-Crystallogr. (USA), vol.28, no.1, p.78-9 (Jan.-Feb. 1983). Translation of: *Kristallografiya (USSR)*, vol.28, no.1, p.143-5 (Jan.-Feb. 1983). [received: Sept. 1983]
The authors have studied the oxidation of the (111) surfaces of small Ge crystals in the column of an electron microscope at $T=550°C$ under a pressure of oxygen of about 1 torr. The crystals were thinned owing to the formation of the voltatile germanium monoxide GeO. In parallel with the formation and evaporation of GeO, crystals of the hexagonal modification of GeO_2 grew on the surface in the epitaxial orientations $(0001)GeO_2 \| (111)Ge$, $\langle 10\bar{1}0 \rangle GeO_2 \| (112)Ge$. (7 refs.)

109552 Production and properties of low electrical resistance molybdenum silicide layers. G.Beddies, K.Hofmann, W.Bretschneider, H.-D.Zscheile, P.Bogdanowa, H.Helms, K.-H.Wickleder (Sektion Phys., Tech. Hochschule Karl-Marx-Stadt, Karl-Marx-Stadt, Germany).
Wiss. Z. Tech. Hochsch. Karl-Marx-Stadt (Germany), vol.25, no.2, p.188-96 (1983). In German.
Until recently poly-silicides were used for the production of protective layers on some materials, but their relatively high resistance, i.e. about 3 ohm, prompted a search for a more suitable material. This is a crystalline phase of $MoSi_2$. The silicide is precipitated on the surface of the material to be coated in two forms as a double layer or as a mixed layer. The technique of coating involves spraying in a high vacuum environment. The layers are then tested for electrical resistance, mechanical durabiity and microscopic structure. The equipment used in the process of coating is illustrated and the technique of spraying is described. Tests have shown that increasing the silica content in the coating compound results in a small increase in the specific resistance. Photometer curves show a bending diagram of a Mo/Si layer at various temperatures. (5 refs.) *G.R.S.*

10th Annual Conference on the Physics and Chemistry of Semiconductor Interfaces .... See Entry 105017

Chemographic images of silicon surfaces .... See Entry 105389

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Thermal chamber for physicochemical experiments in the electron microscope .... See Entry 105423

Application of ion implantation and backscattering techniques to the analysis of nuclear waste glass corrosion .... See Entry 105959

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Corrosion experience with a slurry-fed ceramic melter .... See Entry 105995

Role of electrochemistry in causes and measurement of corrosion in PWR steam generators .... See Entry 106110

Search for improved surface treatment procedures in fabrication of HgI_2 X-ray spectrometers .... See Entry 106222

Scaling up the neutral solution antireflection process .... See Entry 106906

Kinetics of interstitial supersaturation during oxidation of silicon .... See Entry 107668

Transverse banding in single crystals of $FeGe_2$ and $Fe_{0.99}Co_{0.01}Ge_2$ .... See Entry 107706

Dislocation etching of $KClO_4$ single crystals .... See Entry 107707

Effect of beam energy and anneal history on trivalently bonded silicon defect centers induced by ion beam etching .... See Entry 107780

Investigation of the initial stages of oxidation of microcrystalline silicon by means of X-ray photoelectron spectroscopy .... See Entry 108185

MBE growth and characterization of single crystal silicon oxides on (111) and (100) silicon .... See Entry 108221

Nature of group Ib metal films deposited on polymer surfaces photooxidised with far-ultraviolet (185 nm) radiation .... See Entry 108234

Determination of stresses in $Si-SiO_2$ and mechanically affected Si by EPR .... See Entry 108244

The effect of surface oxygen on the intermixing and Schottky barrier at GaAs(110)-Au interfaces .... See Entry 108493

Study of the GaAs-Au and $Si-SiO_2$ interface formation by the Kelvin method .... See Entry 108510

Native oxide formation and electrical instabilities at the insulator/InP interface .... See Entry 108559

The effect of low pressure plasma on $Si-SiO_2$ structures and GaAs substrates .... See Entry 108561

Electrophysical properties of MIS (MOSFET) structures based on indium arsenide .... See Entry 108566

GaAs surface oxidation-related photoluminescence transients .... See Entry 109016

A new method for the fabrication of submicron thick gallium arsenide membranes .... See Entry 109145

Predicting conditions for sputtering gas-thermal coatings with given thickness and waviness .... See Entry 109149

Adhesion of graphite fibres to epoxy matrices. I. The role of fibre surface treatment .... See Entry 109210

Fabrication and wear test of a continuous fiber/particulate composite total surface hip replacement .... See Entry 109520

Application of the four-point bending technique on single edge notched specimens to the fracture behavior of ceramics .... See Entry 109651

Formation of surface states on strontium oxide powders. [Photoluminescence observations] .... See Entry 109804

Estimation of depth profiles of boron in silicon on ion beam etched sloping cuts by means of neutron induced autoradiography .... See Entry 109831

81.60B Metals and alloys

(inc. stress corrosion cracking; anticorrosion)

109553 Friction oxidation characteristics. F.Arezzo (Kearfott, Little Falls, NJ, USA).
ASLE Trans. (USA), vol.26, no.3, p.288-92 (July 1983).
A mechanism is proposed to account for the friction oxidation that occurs in steel bearings subjected to small amplitude oscillations. It was developed from analysis of data obtained from an apparatus used to rate the lubricity of greases. The heat generated in poorly lubricated bearings increases the rate at which iron oxide forms. The oxide builds up until it can no longer sustain the resulting load; then the oxide layer collapses, contributing abrasive particles that cause additional wear. (8 refs.)

109554 Experience with titanium-tubed condensers and coolers in Swedish nuclear power stations. I.Multer (Swedish State Power Board, Vallingby, Sweden).
VGB Kraftwerkstech. (German Ed.) (Germany), vol.63, no.6, p.487-90 (June 1983). In German.
The subject of the paper is the experience of Swedish nuclear power stations with special brass-tubed condensers and the application of an $FeSO_4$ protective layer which is an extremely problematical operation caused by Swedish relationships with very low cooling water temperatures. The paper demonstrates to what extent effective life is attained using these special brass-tubed condensers and the requirements which have led to almost all condensers being retro-fitted with titanium in the meantime. Economic comparison shows that over the foreseen life titanium condensers are about US $14 million less expensive than special brass-tubed condensers. (no refs.)

109555 Aluminium distribution in the coating developed by hot dip galvanizing of silicon semi-killed steel samples. M.Seraoui, C.Reille, N.Tabet, B.Schmitt (Univ. de Constantine, Constantine, Algeria).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.20, p.1587-9 (6 June 1983). In French.
Aluminium localization with regard to Fe-Zn compounds of the galvanizing coating developed on a silicon semi-killed steel, is in relationship with immersion time. Aluminium, at first concentrated in the steel/η phase interface, is distributed after, in the δ_1/ζ and ζ/η interfaces. The ζ phase formation takes place before the decomposition of the iron-aluminium metastable phases which gives rise to the δ_1 compound. (7 refs.)

109556 Oxidation of $2^1/_4$ Cr-1 Mo steel in oxygen, oxygen-water vapour mixture at high temperature. A.S.Khanna (Materials Dev. Lab., Reactor Res. Centre, Kalpakkam, India), K.P.Singh.

Trans. Indian Inst. Met., vol.35, no.5, p.494-6 (Oct. 1982). [received: Aug. 1983]

Oxidation experiments were carried out on 1 mm thick strips of Cr-Mo steel. From the results it is clear that as the temperature increases, the behaviour becomes less parabolic. Oxidation in oxygen-water vapour mixture is higher than in pure oxygen at all temperatures. (9 refs.)

109557 Oxidation of thin Cd, Cu and Te films under continuous laser irradiation. M.Wautelet (Faculte des Sci., Univ. de l'Etat, Mons, Belgium).

Mater. Lett. (Netherlands), vol.2, no.1, p.20-2 (July 1983).

Thin films of Cd, Cu and Te are irradiated in air by means of a continuous, unfocused laser beam. The diameter of the oxidised zone varies empirically with time like: $d=d_0 \exp[-(t-t_1)/t_2]$, where t_1 and t_2 depend on the power of the laser beam. Temperature calculations indicate that melting of the elemental constituents is probably involved in the transformation. (8 refs.)

109558 A method for calculating the extent of galvanic corrosion and cathodic protection in metal tubes assuming unidirectional current flow. D.J.Astley (IMI plc, Birmingham, England).

Corros. Sci. (GB), vol.23, no.8, p.801-32 (1983).

A simple procedure for calculating how galvanic corrosion and cathodic protection effects are distributed within metallic tubular systems carrying electrolytes is described. The procedure involves the use of equations which are analytical solutions and, in some instances, equations which require numerical solutions which can easily be effected using microcomputers. The equations are based on an assumption of unidirectional flow of electric current which is shown to be valid for appreciably conducting electrolytes, such as seawater. Various combinations of linear polarisation kinetics, Tafel law polarisation kinetics and totally diffusion-controlled kinetics can be used. Experimental verification of the procedure has been obtained using synthetic seawater for titanium and Cu-30Ni tubes in galvanic contact and for cathodically protected Cu-30Ni tube. It is proposed that the procedure could find useful application at the design stage of plant involving two or three different metals, or of cathodically protected pipework, when any necessary preventative measures indicated by an analysis could be adopted. (35 refs.)

109559 The solution composition and electrode potential in pits, crevices and cracks. A.Turnbull (NPL, Teddington, England).

Corros. Sci. (GB), vol.23, no.8, p.833-70 (1983).

The extent of information on the solution composition and electrode potential in pits, crevices and cracks has been reviewed. A brief description of the experimental techniques is followed by a detail summary of the experimental measurements on various metal/environment systems. For each system the potential in the cavity is compared with the external potential and the magnitude of the potential drop is discussed in terms of the polarization characteristics of the metal, the ease of mass transport, etc. The pH values in the cavities are interpreted on the basis of the nature of the electrode reactions in the cavity and the hydrolysis of dissolved metal cations. (83 refs.)

109560 Current distribution during the electrochemical corrosion protection of pipes. W.Schwenk (Mannesmann Forschungsinst. GmbH, Duisburg, Germany).

Corros. Sci. (GB), vol.23, no.8, p.871-86 (1983).

Summarizes some theoretical considerations about the current and potential distribution with cathodically protected pipes with respect to practical questions: (a) external protection and questions on the extent of the protection length, (b) internal current distribution behind an insulating unit due to d.c. voltage across this unit caused by external cathodic protection or by galvanic effects, and (c) current and potential distribution within a crevice due to external polarization. (6 refs.)

109561 The role of wedging stresses in the exfoliation corrosion of high strength aluminium alloys. M.J.Robinson (School of Industrial Sci., Cranfield, England).

Corros. Sci. (GB), vol.23, no.8, p.887-99 (1983).

The wedging stresses generated by the formation of insoluble corrosion products have been measured during the exfoliation corrosion of the high strength aluminium alloy L95. Stress intensity values obtained from double cantilever beam experiments, mathematical modelling and from observations of crack opening displacements are discussed with reference to the corrosion process. Exfoliation has effectively been prevented by applying compressive loading and it has been concluded that the degradation occurs by a stress corrosion mechanism. (11 refs.)

109562 The microstructure of the scale forming on dilute iron-silicon alloys in carbon dioxide. P.T.Moseley, G.Tappin, J.A.A.Crossley, J.C.Riviere (Materials Dev. Div., AERE, Harwell, England).

Corros. Sci. (GB), vol.23, no.8, p.901-20 (1983).

The information available relating to the microstructure of scale forming on dilute iron-silicon alloys ([Si]=0-1 $^w/_o$) in CO_2 (99%)/CO(1%) at 500°C has been supplemented by new analytical investigations involving X-ray diffraction, electron microscopy and X-ray photo-electron spectroscopy (XPS). X-ray diffraction from the underside of the scale has provided lattice parameter, strain and grain size measurements of the magnetite in the inner part of the duplex scale. Of these different sets of information the grain size shows by far the most dramatic dependence on alloy composition. The presence of 1.0 $^w/_o$ of silicon in the alloy brings a reduction in the grain size of the inner scale of more than an order of magnitude when compared with the scale on pure iron. A dry stripping technique has been developed which allows a thorough examination of the boundaries marking the inner and outer limits of the inner part of the scale. For the case of scales on Fe-1.0 Si it is found that the midscale interface, like that at the base of the scale, is marked by a local accumulation of silicon. (18 refs.)

109563 Conversion electron Mossbauer spectroscopy on the oxidation of a (110) Fe-57 single crystal 100 Å thick. M.Domke, B.Kyvelos (Inst. fur Atom- und Festkorperphys., Freie Univ. Berlin, Berlin, Germany).

Corros. Sci. (GB), vol.23, no.8, p.921-30 (1983).

Conversion electron Mossbauer spectroscopy (CEMS) has been used to measure the initial stages of oxidation on an 100 Å thick (110) Fe-57 single crystal face at 275°C in the pressure range from 2×10^{-4} to 8×10^{-3} torr. Only magnetite is formed at 2×10^{-4} and 8×10^{-3} torr, a magnetite/haematite conversion occurs at 2×10^{-3} torr. The various oxide phases have been investigated according to their growth behaviour and kinetics. Complicated changes in the kinetic behaviour are found with the magnetite/haematite conversion. Depth selective CEMS has been used to measure qualitatively the depth distribution of the oxide phases and the iron ion sites. (43 refs.)

109564 Blistering phenomena on lacquered mild steel. K.R.Gowers, J.D.Scantlebury (Corrosion & Protection Centre, Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).

Corros. Sci. (GB), vol.23, no.9, p.935-42 (1983).

Concentrically divided mild steel panels were used as substrates underneath artificial paint blisters, and electrical current flow was measured between the concentric regions during immersion in sea water, using a zero resistance ammeter. It was demonstrated that currents do flow between different regions of steel substrate underneath a paint film, whilst it is corroding. Contamination of the blisters with sodium chloride was found to promote the corrosion processes and the current flow. Different types of corrosion processes were observed in the contaminated blisters, often with frequent movement of anodic and cathodic regions. In one instance, one of the contaminated artificial blisters grew to resemble a standard dome-shaped natural blister, and this was found to have a central anodic region surrounded by an outer cathodic region. (15 refs.)

109565 Constant strain-rate testing of AISI type 304 stainless steel in 0.5 M H_2SO_4+0.1 M NaCl solution at room temperature with controlled potential. R.J.L.Meyburg, J.M.Krougman, F.P.Ijsseling (Corrosion Lab., Royal Netherlands Naval Coll., Den Helder, Netherlands).

Corros. Sci. (GB), vol.23, no.9, p.943-57 (1983).

The constant strain-rate (CSR) test method has been applied to investigate the stress corrosion cracking (SCC) susceptibility of AISI type 304 stainless steel in 0.5 M H_2SO_4+0.1 M NaCl at 25°C within a range of controlled potentials. Cracks were found to form in two distinct potential regions: in the cathodic range, and in the passive potential region. A clear differentiation between the two observed types of cracks was attempted. Crack morphology, the measured current during straining and the reduction of area were used as criteria. SCC was found to occur essentially in the passive potential region; in the cathodic range the cracks were due to hydrogen embrittlement. (22 refs.)

109566 Strain-induced anodic dissolution of Cu single crystals—effects of specimen geometry and slip morphology. H.Niwa, S.Asawa, S.Haruyama, T.Mori (Tokyo Inst. of Technol., Yokohama, Japan).

Corros. Sci. (GB), vol.23, no.9, p.959-68 (1983).

Specimen geometry with respect to slip deformation and slip morphology have been examined in a study of strain-induced anodic dissolution of Cu single crystals. It has been found that a sample, whose geometry leads to the largest exposure of fresh (111) slip planes onto the original surfaces, shows the largest anodic dissolution on straining. However, the amount and rate of dissolution are unaffected by slip morphology or dislocation density. It has been calculated that approximately seven layers of Cu atoms dissolve from the freshly formed active (111) planes until the planes become inactive. (9 refs.)

109567 An electrochemical study of phase-transitions in rust layers. M.Stratmann, K.Bohnenkamp, H.-J.Engell (Max-Planck-Inst. fur Eisenforschung GmbH, Dusseldorf, Germany).

Corros. Sci. (GB), vol.23, no.9, p.969-85 (1983).

Isolated rust layers have been investigated by electrochemical methods to find out whether their reduction and re-oxidation can affect the atmospheric corrosion of iron. At potentials below 0 mV, first a thin Fe^{2+}-containing surface layer is formed on top of the γ-FeOOH. This reduced surface layer can dissolve into the cell electrolyte at acid pH, or at lower potentials the Fe^{2+}-ions can react with γ-FeOOH to Fe_3O_4. The formation of magnetite could be followed by in-situ magnetic measurements. The reduced surface layer can easily be oxidized back to γ-FeOOH, magnetite can partly be oxidized to γ-Fe_2O_3. (39 refs.)

109568 Low temperature stress corrosion cracking of Inconel 600 under two different conditions of sensitization. R.Bandy, R.Roberge, R.C.Newman (Corrosion Sci. Group, Brookhaven Nat. Lab., Upton, NY, USA).

Corros. Sci. (GB), vol.23, no.9, p.995-1006 (1983).

The low temperature stress corrosion cracking (SCC) of Inconel 600 under two different conditions of sensitization was studied in sulfur-bearing environments. In one case the material was sensitized directly from the mill annealed condition (MAS) and in the other solution annealing followed by water quenching was used prior to sensitization (SAS). The propensity to SCC increased significantly by the SAS treatment, as revealed by dynamic tests in very dilute sodium thiosulfate or sodium tetrathionate solutions, and U-bend tests in a concentrated thiosulfate solution which failed to crack the MAS material. The implications of these observations are discussed in terms of the microstructures of the materials. (18 refs.)

109569 A computer analysis of electrochemical impedance data. M.W.Kendig, E.M.Meyer, G.Lindberg, F.Mansfeld (Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA).

Corros. Sci. (GB), vol.23, no.9, p.1007-15 (1983).

CIRFIT, a computer analysis of electrochemical impedance data, minimizes the sum of squares of the radial difference between observed and calculated impedance data presented in either the complex impedance or admittance plane. CIRFIT requires no assumptions of ideal capacitive frequency response for the double layer in order to extract the values of solution resistance and polarization resistance that are important to corrosion rate analysis. Examples are presented of the use of CIRFIT for the analysis of corroding iron in tapwater and for model pit electrodes that have twotime constants in 0.5 M NaCl. (15 refs.)

109570 The oxidation behaviour of heat resisting metallic fibres. S.R.J.Saunders, I.Lefever (NPL, Teddington, England).

Corros. Sci. (GB), vol.23, no.9, p.1025-43 (1983).

The behaviour of 22 μm diameter alloy fibres of Type 310 stainless steel, Hastelloy X, Inconel 601, and Fecralloy has been studied at 600°C in combustion gases with and without HCl addition. Chromia-forming alloys exhibited higher rates of attack than would have been expected from a consideration of the properties of the bulk material whereas normal rates of attack were observed for alumina-forming alloys. The addition of HCl to the combustion gases increased rates of attack for all alloys and generally this was associated with increased sulphur in the oxide layer. The results are discussed with reference to the unusual geometry of the samples, and it is suggested that the direction of motion of the ions in the growing oxide layer is an important factor governing its protective nature. Alloy depletion effects were also noted, particularly for some Fecralloy samples which were pre-oxidized before exposure, and this may cause eventual failure of the protective oxide. (8 refs.)

109571 Protection potentials for pitting of stainless steel in neutral chloride solutions. R.C.Newman (Corrosion Sci. Group, Brookhaven Nat. Lab., Upton, NY, USA).

Corros. Sci. (GB), vol.23, no.9, p.1045-6 (1983).

Azzerri et al. (see ibid., vol.22, p.675, 1982) have recently measured protection potentials for pitting of Type 304 stainless steel in neutral sodium chloride solutions. They suggest that the protection potential E_p is given by: $E_p \simeq A - B\log c$ where c is the molar concentration of sodium chloride and B is about 0.12 V/decade at 22°C. However, the data show that E_p tends to approach a constant value for $c \lesssim 0.15$ M. The correlation with the equation is therefore poor. The assumption is explored that protection corresponds to passivation at a critical interfacial concentration of dissolution products M^{n+}. This is equivalent to a critical pH, and roughly equivalent to a critical current density for a given pit geometry. (2 refs.)

109572 Some preliminary experiments regarding the corrosion inhibition of a carbon steel by oleylamino-propylene amine with tri (methyl-phosphonic) acid. M.Duprat, F.Moran, F.Dabosi (Lab. de Metall. Phys., ERA, CNRS, Toulouse, France).
Corros. Sci. (GB), vol.23, no.9, p.1047-50 (1983).
It has been reported (see Corrosion, vol.36, p.262, 1981) that the association of oleylamino-propylene amine and amino-tri [methyl-phosphonic] acid (FA+TMPA) exhibits good inhibitive properties against the corrosion of a carbon steel in an aerated 3% sodium chloride solution. It has been shown that this selective composition appears to be one of the best of its type for avoiding both problems of scaling and/or corrosion. The authors report preliminary results of rotating disc electrode experiments using both steady-state and transient electrochemical techniques to study the protection mechanism. (5 refs.)

109573 Long-term corrosion tests of materials for thermal decomposition of sulphuric acid. F.Coen-Porisini (Comm. of the European Communities Joint Res. Centre, Ispra, Italy).
Int. J. Hydrogen Energy (GB), vol.8, no.10, p.819-28 (1983).
The corrosion resistance of tubes of Incoloy 800 and AISI 310 SS has been studied in a mixture of air and H_2SO_4 vapours at 1 bar pressured. The duration of the test was one year (8500 h). The temperatures of the tubes ranged from 400 to 700°C for SS AISI 310 and from 400 to 900°C for Incoloy 800. The extent of the attack was determined by measuring the scale thickness and the penetration depth on cross-sections of samples taken from several zones of the tubes. X-ray diffraction and SEM X-ray microanalysis techniques were used. (18 refs.)

109574 Effect of cold work on anodic polarization of low carbon steel. A.M.Shamseldin, J.M.Abd Elkader, F.M.Abd El Wahab, H.S.Hegazy (Lab. of Electrochem. & Corrosion, Nat. Res. Centre, Cairo, Egypt).
J. Mater. Sci. (GB), vol.18, no.9, p.2732-42 (Sept. 1983).
Carbon steel nails prepared by deep drawing exhibit grains elongated in the direction of swaging. They are also characterized by high corrosion rates, as measured potentiodynamically in 0.1 M H_2SO_4. Normalization of grain dimensions and reduction in the corrosion rate are achieved through annealing. Treatment at 750°C for 2 h is effective in producing strain-free specimens with rounded grains. Extended heat treatment at this temperature causes the development of larger grains and the improvement in the corrosion behaviour of the alloy. 'As-received' and strain-free specimens are subjected to controlled tensile or torsional cold work. In all cases deformation results in an increase in the susceptibility of the alloy to undergo attack. The rate of corrosion increases greatly when the deformed steel corrodes in Cl^- ion containing media. Both general and pitting corrosion are operative. (21 refs.)

109575 High-performance Ni-Cr-Mo-W alloys. H.M.Tawancy, R.B.Herchenroeder, A.I.Asphahani (Technol. Dept., Cabot Corp., Kokomo, IN, USA).
J. Met. (USA), vol.35, no.6, p.37-43 (June 1983).
The Ni-Cr-Mo-W system is re-examined in view of its importance to industrial applications involving aqueous corrosion. Historical development of the system is presented, and its physical metallurgy is examined in terms of secondary precipitates and long-range ordering. The role of alloying elements is explained in terms of thermal stability and environmental resistance. Finally, the future of the Ni-Cr-Mo-W system is explored. (29 refs.)

109576 Stress generation behaviour in Cu_2O scales during thermal oxidation. Yung-ju Pyun, T.Homma (Inst. of Industrial Sci., Univ. of Tokyo, Tokyo, Japan), K.Takakuwa.
J. Jpn. Inst. Met. (Japan), vol.47, no.8, p.663-70 (Aug. 1983). In Japanese.
The stress generation behavior in Cu_2O grown on Cu has been studied using an X-ray diffraction apparatus, which is provided with a newly designed hot stage unit. The oxidation run has been carried out at temperatures between 573 and 923K and at oxygen pressures ranging from 24 to 110 Pa for (100) and (111) faces of single crystalline copper discs and surfaces of polycrystalline ones. The stress generation behavior varied depending on temperature and crystalline state of the specimen. At temperatures below the half of the melting point of Cu_2O a compressive strain (7×10^{-3} at 573K) larger than the fracture strain of the bulk oxide (2×10^{-3}) was observed. This elastic strain diminished at higher temperatures. The oxide scale exhibited a pseudo brittle-ductile transformation between 573-673K. A quantitative evaluation of the stress generated in the epitaxial oxide grown on Cu (100) showed values between 1.3 and $3.0 \pm 0.5 \times 10^8$ Nem^{-2}, which were 30% larger than the elastic strain generated in the oxide grown on Cu (111). (29 refs.)

109577 Growth and distribution of microcracks at the surface of smooth specimen of 304 stainless steel in creep and effect of high temperature oxidation. R.Ohtani (Faculty of Engng., Kyoto Univ., Kyoto, Japan), S.Nakayama.
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.357, p.635-9 (June 1983). In Japanese.
A continuous observation was made of intergranular microcrack growth at the surface of smooth specimens of 304 stainless steel during creep tests at 650°C in air and in vacuum. It was found that the effect of environment was different depending upon the stress value. That is, at high stress, the rupture time was shortened by intergranular oxidation, and on the contrary at low stress, it was lengthened by the formed oxide film which has protective and restorative actions. It was shown that the microcrack growth behavior in creep was explainable on the basis of the Weibull distribution of crack length. (5 refs.)

109578 Titanium α-nitrogen solid solution formed by high temperature nitriding: diffusion of nitrogen, hardness, and crystallographic parameters. J.-P.Bars (Inst. Nat. des Sci. Appliquees de Rennes, Rennes, France), D.David, E.Etchessahar, J.Debuigne.
Metall. Trans. A (USA), vol.14A, no.8, p.1537-43 (Aug. 1983).
The nitriding of titanium by nitrogen has been carried out at 1350°C and 1450°C, and the nitrogen concentrations at different levels in the α-phase layer determined by direct analysis, using the $^{14}N(d,\alpha)^{12}C$ nuclear reaction. The concentrations at the α/ϵ interface agree with the published phase diagram, but a significant deviation is observed at the α/β interface. The diffusion coefficients were calculated from the experimentally obtained profiles and were found to agree well with those calculated using a simple model describing the nitriding reaction. The crystallographic parameters of the HCP titanium α-nitrogen solid solutions were determined and showed evidence of a cooperative effect in the deformation of the crystallographic interstices. Vickers microhardness was measured with a 100 g load for nitrogen concentrations above 10 at. pct. (17 refs.)

109579 Sensitization of 12 wt pct chromium, titanium-stabilized ferritic stainless steel. T.M.Devine, A.m.Ritter (Corporate Res. & Dev. Center, General Electric Co., Schenectady, NY, USA).
Metall. Trans. A (USA), vol.14A, no.8, p.1721-8 (Aug. 1983).
The sensitization behaviours of 19 heats of titanium stabilized, 12 wt.% chromium, ferrite stainless steel were evaluated by measuring the intergranular corrosion resistance of samples given a two-step heat treatment. The latter consisted of a one-hour high temperature exposure followed by a water quench and one of 19 different low temperature treatments. The results indicate that heat treating at temperatures $\gtrsim$1000°C produces a microstructure which can be sensitized by subsequent aging at temperatures $\lesssim$600°C. The amount of carbon and not the amount of nitrogen nor the amount of carbon plus nitrogen dictated the sensitization resistant of the titanium-stabilized, 12 wt.% chromium alloy. The proposed mechanism of sensitization in these alloys suggests that during the high temperature exposure, the titanium carbonitrides decompose, freeing carbon or carbon and nitrogen into interstitial solid solution. During subsequent heat treating at temperatures $\lesssim$600°C, chromium-containing carbides, precipitate intergranularly, and a chromium-depleted zone is formed along the grain boundaries. (20 refs.)

109580 On the corrosion fatigue behavior of a modified SAE 4135 type steel in a H_2S environment. K.Tsukada, K.Minakawa, A.J.McEvily (Univ. of Connecticut, Storrs, CT, USA).
Metall. Trans. A (USA), vol.14A, no.8, p.1737-42 (Aug. 1983).
The corrosion fatigue behaviour of a modified SAE 4135 steel in a H_2S environment is compared to that of a standard SAE 4135 steel of the same strength level. The modification consists of an increase in molybdenum content from 0.20 to 0.75% and the addition of 0.036% columbium. It was found that the high cycle fatigue strength of the modified steel was 66% higher than that of the standard steel. The improvement is attributed to an increase in resistance to hydrogen embrittlement brought about by a higher tempering temperature which reduces the amount of phosphorous on grain boundaries, as well as the beneficial scavenging effects associated with the increase in molybdenum content and the presence of columbium. (13 refs.)

109581 Study of the possibility of liquid boriding of high-speed steels. E.A.Smol'nikov, L.M.Sarmanova (All-Union Sci.-Res. Tool Inst., VNII, USSR).
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.785-8 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.30-2 (Nov. 1982).
A study was made of low and high-temperature boriding of steels R6M5 (standard composition), 11R3AM3F2 (1.05% C; 2.9% Mo; 3.9% Cr; 2.5% V), and 9M3F2S (0.9% C; 5.5% Cr; 3.3% Mo; 2.2% V; 1.2% Si). It is concluded that a beneficial effect of boriding may be expected only on a tool which is made of steel having a hardening temperature not above 1080°C and the technical specifications of which do not have a ground shape. For high-speed steels it is apparently only possible to subject those tools to boriding for which red hardness is not obligatory (e.g. certain components of special bearings) and for which fusion of the cutting edge is acceptable (e.g. certain types of cutters). For the rest of the objects made of high-speed steels boriding is unsuitable. (2 refs.)

109582 Effect of ultrasonics on the properties of hardened high-speed steel R6M5. V.A.Sushchikh, K.M.Pogodina-Alekseeva, V.S.Biront (Krasnoyarsk Inst. of Nonferrous Metals, Krasnoyarsk, USSR).
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.789-93 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.11, p.32-5 (Nov. 1982).
Prismatic specimens $2.5 \times 6 \times 60$ mm in size, drills 7 and 20.5 mm in diameter, and end mills 20.54 mm in diameter made of steel R6M5 were subjected to UST. The action of ultrasonic treatment for hardened high-speed steel R6M5 with optimum treatment schedules ($\sigma_p = 164$ MPa, $\tau = 10$ min) lead to a reduction in first order residual stresses by $\sim$20%. Subsequent single and two-stage tempering of steel R6M5 at 555 ± 5°C made it possible to increase hardness by HRC 1.5-2.0 and the ultimate bending strength by 400-600 MPa. (7 refs.)

109583 Failure of stainless steels in contact with tin-phosphorus bronze. E.V.Vasil'eva, M.I.Trekina, N.S.Artemenko, I.I.Yurkov.
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.859-62 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.12, p.47-9 (Dec. 1982).
It was found that sintering of bronze filters is accompanied by complex interactions of the mold material (steel 12Kh18N9T) with the filter material (bronze Br0F10-1), the most important of which are oxidation of the surface of the mold and interdiffusion of the components. Oxidation of steel 12Kh18N9T under these sintering conditions is accompanied by oxidation of chromium, which leads to impoverishment of the surface in chromium and the development of a zone of internal oxidation. The diffusional penetration of the filter components—copper, tin, and phosphorus—into the mold in the process of sintering is accompanied by alloying of these elements with the basic mold material (iron) and leads to further reduction of its oxidation resistance. Especially harmful is simultaneous alloying with copper and phosphorus. (1 ref.)

109584 Surface composition of stainless steel at active corrosion. T.Hakkarainen, I.Olefjord (Chalmers Univ. of Technol., Goteborg, Sweden).
Phys. Scr. (Sweden), vol.T4, p.189-93 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).
X-ray photo-electron spectroscopy was used to study the surface compositions of stainless steel (AISI 304) after active corrosion in 2.5 M H_2SO_4 or 2.5 M H_2SO_4+0.5 M NaCl solutions under electrochemically controlled conditions. Using two models with different assumptions about the element distributions, possible concentration profiles for Fe, Cr, Ni, Mo and Cu in their metallic and oxidized states were evaluated. It was concluded that Ni, Cu and Mo are enriched in their metallic states on the surface, possibly mainly on separate surface regions not containing Fe and Cr. (4 refs.)

109585 Examination of solid-phase transformations in the surface layers of titanium. A.P.Brovko, I.N.Bekman.
Russ. Metall. (GB), no.1, p.82-5 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.95-8 (1982).
Solid-phase processes in thin oxide surface layers on titanium have been studied by the radioactive gas-tracer method in the 20-1000°C temperature range with a linear heating regime. The main mechanism responsible for radon release on heating is bulk undisturbed diffusion associated with metal-iron self-diffusion. Solid-phase processes occurring in the oxide layer of the metal during heating (dehydration, phase changes, oxidation, nitriding, etc.) are reflected in the thermodesorption spectrum as additional peaks. Depending on the experimental conditions, various types of oxide layers can exist on the titanium surface. (8 refs.)

109586 Examination of the high-temperature oxidation of Ni-Re alloys. E.M.Lazarev, N.A.Korotkov, E.P.Arskaya, R.A.Miliyevskiy.
Russ. Metall. (GB), no.1, p.93-6 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.105-9 (1982).
Small additions of rhenium (up to 10 wt.%) have virtually no effect on the rate of oxidation of nickel at 1000-1200°C. Oxidation in the Ni alloy with 25% Re is about half that of plain nickel. In all these alloys the scale consisted of two layers: a top layer of NiO and underneath it a layer of mixture of NiO and ReO_2, which is due to the low permeability of rhenium through the nickel oxide. There is two-sided diffusion in the oxidation of Ni-Re alloys: diffusion of nickel to the outside of the scale and of oxygen into the alloy, which cause a lower layer of scale and a zone of internal oxidation to appear. (10 refs.)

109587 Influence of lanthanum, titanium and niobium on the heat resistance of a chromium nickel alloy in air and combustion products of fuel oil. M.V.Pridantsev, A.M.Samarina, M.P.Matveyeva.
Russ. Metall. (GB), no.1, p.97-100 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.110-14 (1982).
Alloying of the alloy 40Ni-60Cr with small additions ($\leq 2\%$) of lanthanum, titanium or niobium noticeably decreases the velocity of its oxidation in air at high temperatures (1000-1100°C), thus there are optimum concentrations of alloying elements securing the maximum heat resistance of the alloys. Scale forming on the oxidation of low-alloyed alloys in air consists of Cr_2O_3. With an increasing concentration of lanthanum, titanium or niobium, their simple or complex oxides are formed in the scale and the protective properties of the scale deteriorate. The corrosion resistance of chromium-nickel alloys with a high chromium content in the products of combustion of a high sulphur fuel oil is higher than that of industrial heat resistant alloys. (12 refs.)

109588 Growth of a system of interacting pores when a metal is saturated by hydrogen (hydrogen corrosion). K.A.Guriyev, B.Ya.Lyubov.
Russ. Metall. (GB), no.2, p.155-8 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.172-5 (1982).
The growth of a system of pores in the case of hydrogen corrosion is considered when the flow of diffusing substance into the pores cannot be considered as a small correction to the diffusion. (2 refs.)

109589 Numerical calculation of the decarburisation of medium and high carbon steels at temperatures below the A_1 point. E.L.Gyulikhandanov, S.N.Provotorov.
Russ. Metall. (GB), no.2, p.158-61 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.175-7 (1982).
Numerical simulation was used to analyse the kinetics of decarburisation in medium and high carbon steels below the A_1 point in the presence of carbide segregations. The number and size of the carbide segregations, and the rate of the chemical reaction between the gas medium and the surface have a substantial effect on the kinetics of carbon diffusion in the ferrite. (6 refs.)

109590 Oxidation resistance of high-nitrogen CrMn steels with silicon. O.A.Bannykh, V.M.Blinov, I.L.Poymenov, Ts.V.Rashev, Ch.A.Andreev, M.D.Manchev.
Russ. Metall. (GB), no.2, p.162-6 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.178-83 (1982).
The relationship governing the oxidation and formation of scale on high-nitrogen Cr-Mn steels with silicon have been examined. The oxidation resistance of these steels at temperatures up to 900°C is determined mainly by the protective properties of the thin layer of silicon oxide, whereas at higher temperatures it is controlled by chromium- and iron-base spinel phases. High-strength nonmagnetic Cr-Mn steels of the Kh18AG14S2 type with a higher nitrogen (0.3-1.65%) and silicon (2-3%) content can be classified on the basis of their resistance to oxidation in air as oxidation-resistant materials for service at temperatures from 700 to 1000°C. (8 refs.)

109591 Features of growth of interference-coloured oxide films in air on titanium alloy VT5. O.L.Kirillova, E.S.Vorontsov, Yu.V.Spichkin.
Russ. Metall. (GB), no.2, p.166-9 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.183-6 (1982).
The growth of oxide films on the titanium alloy VT5 was investigated using the interference patterns supplemented by ellipsometric measurements, metallographic, electronographic and micro-X-ray analyses. Using the differential method of analysis, a substantial change was detected in the activation energy during the oxidation: the value of E increases with increasing thickness of the oxide film. The existence of a special anisotropy of growth of oxide film, caused by the direction of deformation of the metal (rolling) was established. (5 refs.)

109592 Corrosion resistance of alloys based on titanium in solutions of hydrochloric acid, sodium chloride and hydroxide. S.N.Mandzhagaladze, M.P.Mikaberidze, T.T.Nartova, I.N.Lordkipanidze, D.N.Pirtskhalava.
Russ. Metall. (GB), no.2, p.169-72 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.2, p.186-9 (1982).
The influence of copper and nickel on the corrosion resistance and electrochemical properties of titanium in solutions of hydrochloric acid, sodium chloride and hydroxide was studied. Additions of copper in amounts of 0.35-5% lowers the corrosion resistance of titanium in solutions of hydrochloric acid, sodium chloride and hydroxide. In all the solutions investigated, copper has no practical influence on the development of the cathode process and increases the anodic currents. Introduction of nickel into titanium increases its resistance to corrosion in hydrochloric acid sodium chloride and hydroxide solutions. The minimum velocities of solution are observed for the titanium alloy with 8% Ni. (6 refs.)

109593 Surface films and rate of dissolution. I.A.Kakovskiy, L.D.Sheveleva.
Russ. Metall. (GB), no.3, p.40-2 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.3, p.43-7 (1982).
The deleterious influence of surface films on the rate of heterogeneous processes has been demonstrated. Formation of surface films is often linked with the occurrence of parallel-series or side reactions. The criterion for assessing the influence of films chosen is the ratio of the experimental and theoretical rate constants. The harmful influence of films can be eliminated in various ways that depend on the composition and character of the film. (18 refs.)

109594 Effect of lanthanum, yttrium, titanium, zirconium and boron on the high-temperature properties of chromium-nickel alloys in various environments. M.V.Pridantsev, M.P.Matveyeva, E.M.Lazarev, V.A.Morozov, A.M.Samarina.
Russ. Metall. (GB), no.3, p.57-63 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.3, p.60-8 (1982).
Alloying of alloy 40Ni-60Cr with small amounts of boron, lanthanum, yttrium, titanium and zirconium markedly reduce its oxidation rate in air, particularly at high temperatures. Alloying with the rare-earth elements is the most effective. The heat-resistance of chromium-nickel alloys in natural gas combustion products is higher than in air. Scale formed on oxidation of alloys in air or on reaction of the alloys with natural gas combustion products consists of chromium oxide Cr_2O_3. The corrosion resistance of chromium-nickel alloys with high chromium content in the combustion products from high-sulphur fuel oil is higher than that of commercial heat-resistant alloys. Alloying of alloy 40Ni-60Cr with small amounts of lanthanum or titanium increases its corrosion resistance by 5-15%. Small additions of boron, lanthanum, yttrium, titanium and zirconium markedly increase the ductility of alloy 40Ni-60Cr without substantially reducing its heat-resistance. (27 refs.)

109595 Reconsideration of the superposition model for environmentally assisted fatigue crack growth. R.P.Wei, Ming Gao (Lehigh Univ., Bethlehem, PA, USA).
Scr. Metall. (USA), vol.17, no.7, p.959-62 (July 1983).
A modification of the superposition model for environmentally assisted fatigue crack growth (corrosion fatigue) is proposed. The modification gives explicit recognition to the fact that mechanical (or 'pure') fatigue and corrosion fatigue can proceed by different micromechanisms and in parallel. The modified model provides a rational basis for considering the role of microstructure in corrosion fatigue. Preliminary fractographic evidence provides support for this modification. (10 refs.)

109596 Effect of palladium additions to AISI 4130 steel on its sulfide cracking susceptibility. J.B.Lumsden (Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA), B.E.Wilde, P.J.Stocker.
Scr. Metall. (USA), vol.17, no.8, p.971-4 (Aug. 1983).
Describes work on high strength steels aimed at decreasing the penetration of hydrogen or rendering the adsorbed hydrogen innocuous. Palladium metal markedly enhances the recombination kinetics of adsorbed hydrogen and also has the ability of absorbing large quantities of hydrogen. An investigation was undertaken to determine the effects of palladium additions to AISI 4130 steel on its sulfide stress cracking susceptibility and to correlate these effects to changes in the composition and morphology of sulfide inclusions. (14 refs.)

109597 Creep and stress rupture strength of 5VMTs alloy clad with VN7 alloy. I.S.Tsvilyuk, V.I.Pyl'nikov (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.10, p.1385-8 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.85-9 (Oct. 1982). [received: Sept. 1983]
Presents the results of investigations of the creep and short-term and stress-rupture strengths of VN7-5VMTs-VN7 clad sheet and also data on comparison of the characteristics considered for this sheet and for 5VMTs niobium base alloy. It was found that 5VMTs alloy clad with VN7 alloy possessed an advantage in short-term properties over 5VMTs alloy up to 1300°C, but was substantially inferior to the latter in stress rupture strength characteristics in the 1000-1400°C test-temperature range. (4 refs.)

109598 Morphological study of porous PbO_2 formed in aqueous H_2SO_4 on Pb-Sb and Ca-Sn-Pb alloys. J.A.Bialacki, N.A.Hampson (Chem. Dept., Univ. of Technol., Loughborough, England), K.Julian.
Surf. Technol. (Switzerland), vol.19, no.4, p.347-53 (Aug. 1983).
A morphological study of the PbO_2 matrix formed by the oxidation of pasted Pb-Sb and Ca-Sn-Pb electrodes in 0.3M H_2SO_4 and then subjected to microcomputer-controlled potentiostatic pulse experiments in 5 M H_2SO_4 is presented. After a reductive pulse into the $PbSO_4$ region, a complete discharge and a re-step back into the PbO_2 region, it was found that with the Pb-Sb 'positive' a considerable amount of α-PbO_2 was produced. This was very different from the case of the Ca-Sn-Pb-supported PbO_2 matrix where β-PbO_2 was predominantly formed. (6 refs.)

109599 Cavitation erosion of cast iron in 3% salt water. T.Okada, Y.Iwai (Dept. of Mech. Engng., Fukui Univ., Fukui, Japan), A.Yamamoto.
Wear (Switzerland), vol.88, no.2, p.167-79 (1 July 1983).
Vibratory cavitation erosion tests were performed on cast irons and steels in 3% salt water, and the results were compared with previous finding in ion-exchanged water. The ratio of the mass loss rate in 3% salt water to that in ion-exchanged water is greater for pearlitic than ferritic cast irons. It is also greater for spheroidal graphite than for gray cast iron. These results are explained by the increased number and/or average length of erosion cracks in 3% salt water. The erosion resistances of cast irons and steels in 3% salt water do not improve with increasing values of $H_v^2/E\beta_g$ (where β_g is the fatigue strength reduction factor for cast iron) as expected from those in ion-exchanged water. In 3% salt water, cast irons show only one-half the erosion resistance of steels with the same value of $H_v^2/E\beta_g$. The relation that the mass loss rate is proportional to the *n*th power of the horn amplitude was observed. However, the exponent *n* is smallest for the pearlitic materials in corrosive liquid. (6 refs.)

109600 Can you weld to avoid corrosion?. R.Brosilow.
Weld. Des. & Fabr. (USA), vol.55, no.9, p.67-74 (Sept. 1982). [received: July 1983]
Presents a survey of the causes of corrosion with particular emphasis on corrosion in welds. (no refs.)

109601 Investigation and analysis of corrosion phenomena in coated precious metal contact materials. H.Graichen, G.Oertel, H.Sommer, R.Voigtmann, C.Weissmantel (Tech. Hochschule Karl-Marx-Stadt, Sektion Phys./Elektronische Bauelemente, Karl-Marx-Stadt, Germany).
Z. Phys. Chem., Leipzig (Germany), vol.264, no.4, p.645-63 (1983). In German.
In order to investigate the corrosion resistance, samples of galvanically coated contact materials of the composition CuSn6/Au/Pd/Au were subjected in corrosion chambers to a test atmosphere containing H_2S, SO_2 and H_2O. Morphological changes were examined by scanning electron microscopy (SEM), and the corrosion products were analyzed—including depth profiling—by means of Auger electron spectroscopy, electron spectroscopy (ESCA) and secondary ion mass spectroscopy. From the results it can be concluded that the transport of copper (Cu) through the noble metal layers are rate-determining. (28 refs.)

109602 The inhibition of the intergranular corrosion of a sensitized stainless steel in hot acidic solutions. G.Trabanelli, A.Frignani, F.Zucchi, M.Zucchini (Corrosion Study Center 'A. Dacco', Univ. of Ferrara, Ferrara, Italy).
Z. Phys. Chem., Leipzig (Germany), vol.264, no.4, p.813-26 (1983). In German.
Some different types of organic substances (an acetylenic derivative, and sulphur- or nitrogen-containing additives) were tested as inhibitors for the intergranular corrosion of sensitized AISI 304 stainless steel in diluted sulphuric or sulphamic acid solutions at 70°C. Among the different organic substances examined, the sole compounds able to stop the intergranular attack are those containing a sulphur atom with its electronic lone pair free. These inhibitors perform their action by reducing the differences of the corrosion rate between the chromium depleted grain-boundaries and the matrix. As some of the tested inhibitors could decompose with the formation of HS^-(or H_2S), the influence exerted by HS^- ion on the corrosion process is evaluated. (23 refs.)

109603 Mesure continue de l'epaisseur des revetements sur les toles (Continuous measurement of the thickness of coatings on metal sheets). J.Lebailly, R.Pirlet.
Report EUR 8122 FR, Comm. European Communities, Luxembourg (1983), 40 pp. In French. Contract 7210.GA/205.
Following a study of the literature relating to methods and devices for measuring the thickness of coatings, the research was devoted to the development of a suitable equipment for on-line measurements on coated metal sheets. Firstly, a method based on the infrared spectral reflectivity of the materials proved to be unsuitable. Work was then focused on designing a measuring device based on the variations in reluctance of a magnetic circuit including the coated sheet. The air gap between the measuring head and the coating is kept constant by a pneumatic device. The sensitivity of the equipment is 0.001 mm. The maximum accuracy is 0.003 mm in the range from 0.001 to 0.010 mm. The range of measurements can be extended up to 0.200 mm. A prototype unit was also constructed in order to apply this technology to an industrial production line. The system is applicable to non-magnetic solid coatings on magnetic substrates. (44 refs.)

109604 Submicron conductor array fabricated from a recrystallized eutectic thin film. H.E.Cline (General Electric Corporate Res. & Dev., Schenectady, NY, USA).
Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA, USA, 1-4 Nov. 1982 (New York, USA: Elsevier 1983), p.727-31
A submicron conductor array was fabricated without using lithography by selectively etching a recrystallized Al-Al_2Cu eutectic alloy thin film. The 2 micron thick eutectic films were deposited on glass substrates and directionally solidified with both a quartz-iodine lamp and a scanning laser at rates between 0.0016 and 0.14 cm/sec. The resulting structure consisted of alternate parallel stripes of the two eutectic phases with a spacing between 0.5 and 4 microns that was controlled by the solidification rate. An array of submicron Al-rich conductors was fabricated by selectively etching away the Al_2Cu phase. At solidification rates greater than 0.004 cm/sec using the lamp heater the solid-liquid interface became non-planar while with the laser the structure was well aligned at the highest rates used, 0.14 cm/sec. At the maximum theoretical solidification rate that produces a two phase aligned eutectic structure the width of the Al wires would be 100 Å. (4 refs.)

Investigation of phosphate-sludge interactions .... See Entry 106109

Q-switched frequency-doubled Nd:YAG laser surface finishing of metals .... See Entry 106904

The influence of ion implantation on the thermal oxidation of copper .... See Entry 107727

Features of structural changes accompanying the metal-semiconductor phase transition in an oxidized vanadium foil .... See Entry 107908

A TEM study of activated FeTi surface .... See Entry 108132

Effect of lubricants on frictional polymerization of palladium electrical contacts .... See Entry 108525

Interatomic Auger analysis of the oxidation of thin Ba films. I. Characterization of the low energy Auger spectrum .... See Entry 109060

Interatomic Auger analysis of the oxidation of thin Ba films. II. Applications to impregnated cathodes .... See Entry 109061

Surface preparation for quantitative Auger electron spectroscopy: mechanical polishing and inert gas ion sputtering .... See Entry 109067

Secondary emission properties of impregnated tungsten cathodes .... See Entry 109069

Energy loss spectroscopy of oxygen chemisorption on tin .... See Entry 109070

Dependence of surface composition of Zr-Ni intermetallic compounds on bulk composition and treatment .... See Entry 109092

Silver coatings obtained using a wire spraying technique .... See Entry 109146

Ion beam sputter deposition of optical coatings .... See Entry 109150

Preparation and oxidation of a thin Ba film .... See Entry 109167

Transformation behaviour of laser processed Fe-5%Cr, Fe-5%Ni and Fe-6%Cr-2%Ni alloys .... See Entry 109282

Transformation structures and strengthening mechanisms of laser processes Fe-Cr alloys .... See Entry 109283

Precipitation hardening in surface layers of an aluminium-zinc-magnesium alloy .... See Entry 109313

Formation and thermal stability of an oxide dispersion in a rapidly solidified Ti-Er alloy .... See Entry 109320

Properties of structural aluminium alloys in the recrystallised and polygonised states .... See Entry 109334

Heat treatment and diamond burnishing of gray cast iron .... See Entry 109356

Change in structure and properties in stepped aging of V95 aluminum alloy plates .... See Entry 109357

An investigation into the kinetics of migration of ferrite grain boundaries in a low-carbon steel during decarburisation .... See Entry 109361

Thermodynamics and kinetics of steel decarburisation in annealing .... See Entry 109362

Propagation of stress corrosion cracks in aligned glass fibre composite materials .... See Entry 109453

Dynamic fatigue of a machinable glass-ceramic .... See Entry 109456

Behavior of crack propagation in a low alloy steel under high-temperature rotating bending fatigue .... See Entry 109464

Effect of vacuum environment on high temperature low-cycle fatigue properties of Inconel 617 .... See Entry 109469

Structure and properties of steel for high-pressure vessels .... See Entry 109483

Load frequency dependence in fatigue life of nitrided steel .... See Entry 109498

Possible mechanism for embrittlement of Zircaloy by molybdenum and tungsten .... See Entry 109510

A critical study of the erosion of an aluminium alloy by solid spherical particles at normal impingement .... See Entry 109531

Comparative tests of some electrochemical methods for evaluation of the susceptibility to intergranular corrosion .... See Entry 109638

Metallographic methods of preparation and analysis of enameled layers .... See Entry 109648

Corrosion and polarisation characteristics of zinc in battery electrolyte analogues and the effect of amalgamation .... See Entry 109866

The delayed action of magnesium anodes in primary batteries. I. Experimental studies .... See Entry 109868

The delayed action of magnesium anodes in primary batteries. II. Theoretical studies .... See Entry 109869

The effect of current density and thickness of the active mass upon the corrosion rate of the spines of lead-acid battery plates .... See Entry 109877

81.70 MATERIALS TESTING

(inc. sample preparation for examination, metallographic techniques, ion and electron microprobe techniques, Auger and photoelectron techniques, defectoscopy; for measurement in the mechanics of solids and rheology, see 46.30R)

109605 Thermal wave remote and nondestructive inspection of polymers. G.Busse (Inst. fur Phys., Fachbereich Elektrotech., Hochschule der Bundeswehr Munchen, Neubiberg, Germany), P.Eyerer.
Appl. Phys. Lett. (USA), vol.43, no.4, p.355-7 (15 Aug. 1983).
Optically generated thermal waves propagating in various kinds of polymers (adhesives, coatings, fiber reinforced polybutyleneterephthalate, oriented polyethylene) are analyzed by photothermal detection. Some results from this remote technique are difficult to obtain by conventional methods. (17 refs.)

109606 Automatic monitoring of calculated life expiration of pressure parts. R.Pich, K.Erlmann (EVT Energie- und Verfahrenstech. GmbH, Stuttgart, Germany).
VGB Kraftwerkstech. (German Ed.) (Germany), vol.63, no.6, p.537-45 (June 1983). In German.
Introduces the computer-aided system 'FACOS' (fatigue control system) by means of which the calculated life expiration of critical components can be automatically monitored. Creep stress as well as alternating stress are thereby measured. For each component basis operating data in extremely condensed form are recorded and the accumulated life expiration and speed of life expiration are calculated. (43 refs.)

109607 High strain fatigue testing at elevated temperature. R.P.Skelton (Materials Branch, Central Electricity Res. Labs., Leatherhead, England).
Trans. Indian Inst. Met., vol.35, no.6, p.519-34 (Dec. 1982). [received: Aug. 1983]
Focuses upon the elevated temperature, high strain fatigue test. It explains the service cycle which the smooth specimen models and how the test stands in relation to other types of experiments. Push-pull, reverse bend and torsion deformation modes are considered and methods of strain measurement and control are compared, especially with regard to stress relaxation in creep/fatigue. After a discussion of cyclic hardening or softening in the initial stages (with attendant microstructural changes) leading to a steady-state hysteresis loop, the review moves on to total endurances and the various criteria for failure. It is shown how crack growth studies can provide an earlier indication of failure and several methods for crack growth measurement are examined. Much of the discussion concerns the low alloy ferritic and austenitic steels in the temperature range 500-700°C and some recent data on creep and environmental effects are presented. Finally it is shown how the newer asymmetrical cycling modes have permitted damage to be assessed from metallographic observation which in turn leads to the possibility of lifetime prediction. (98 refs.)

109608 Isolation, identification and determination of carbides in 11% chromium creep resistant steel. R.Kannan, S.R.Rajagopalan (Materials Sci. Div., Nat. Aeronautical Lab., Bangalore, India).
Trans. Indian Inst. Met., vol.35, no.6, p.568-71 (Dec. 1982). [received: Aug. 1983]
A composite scheme of chemical phase analysis for the isolation, identification and determination of the carbides (M_7 and M_{23} carbides) present in 11% chromium creep resistant steel is presented. Potentiostatic electrolytic technique in a non-aqueous solvent mixture was employed for the isolation of carbides. The isolated carbides were identified with scanning electron microscope in conjunction with an energy dispersive analyser. A composite scheme of spectrophotometric procedure was evolved for the chemical analysis of the isolated carbides of chromium, molybdenum and vanadium. (6 refs.)

109609 Interpretation of grain size descriptors. A.M.Gokhale (R&D Centre, Hindustan Brown Boveri Ltd., Baroda, India).
Trans. Indian Inst. Met., vol.35, no.6, p.595-600 (Dec. 1982). [received: Aug. 1983]
A rigorous geometrical interpretation of some important grain size descriptors is given. It is shown that the ASTM grain size number is related to the total grain edge length per unit volume. Thus the mean grain intercept (which is related to the total grain boundary surface area per unit volume) and the ASTM grain size number report different independent properties of the grain structure. (16 refs.)

109610 A tensile test apparatus for measurement of strain effect in high current compound superconductors. M.Umeda, H.Yamasaki, M.Watanabe (Electrotech. Lab., Ibaraki, Japan).
Bull. Electrotech. Lab. (Japan), vol.47, no.4, p.276-83 (1983). In Japanese.
A tensile test apparatus has been constructed for measurement of stress-strain diagrams and critical current degradation with strain in superconductors at the liquid helium temperature. The apparatus is designed to test high current Nb_3Sn multifilamentary superconductors, where load $L \leq 500$ kg, current $I \leq 1$ kA and magnetic field $B \leq 10T$. A bronze-processed superconductor including 38720 Nb_3Sn filaments, whose critical current density is 623 A/mm^2 at 9.5 T (without the Cu stabilizer) and critical current Ic is 880 A at 9.5 T, has been tested with the apparatus. Stress-strain relations and Ic degradation with strain have been precisely measured. (11 refs.)

109611 Synchrotron X-ray fractography: a novel technique for fracture-surface analysis. A.B.Hmelo, J.C.Bilello (Dept. of Materials Sci. & Engng., State Univ. of New York, Stony Brook, NY, USA), S.T.Davies, D.K.Bowen.
Mater. Lett. (Netherlands), vol.2, no.1, p.6-11 (July 1983).
Synchrotron X-ray fractography (SXRF), a new non-destructive technique for studying the subsurface microstructure of cleaved samples which allows correlation with the associated surface morphology is described. (11 refs.)

109612 Infrared imaging techniques for flaw detection in composite materials. R.Paulson, A.Aquino, H.Decker, T.Schapp (Lockheed Missiles & Space Co. Inc., Sunnyvale, CA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.366, p.88-95 (1983). (Modern Utilization of Infrared Technology VIII, San Diego, CA, USA, 26-27 Aug. 1982).
With the development of the new super strength lightweight composite materials, flaw and void detection in the various layers have become of major importance. Special infrared imaging techniques have been developed to show these voids. Included in these nondestructive methods are active steady state, active pulsed, and fast recording with slow playback of infrared images. Emissivity correction techniques have also been considered. Considerable time can be saved by using an imaging system since the size and shape of a defect or

void is known at a glance. With video recording, documentation is achieved and further analysis is also possible without tieing up the part. Growth or changes of marginal flaws or voids can be traced during the manufacturing process, noting if they increase to the point of nonacceptance. An 8-13 μ infrared scanner compatible with a video recorder and a line integrator proved most effective. Colorizing the image also made the flaw visualization easier. (no refs.)

109613 A constant-velocity impact tester for brittle material. R.M.Frederiks (IBM Data Systems Div., Hopewell Junction, NY, USA).
Exp. Tech. (USA), vol.7, no.7, p.21 (July 1983).
A quality-control method was needed to determine the cracking susceptibility of different lots of glass. The constant velocity impact tester developed to perform this task consists of: an aluminum block with a precision hole; a pressure and vacuum hat; a mass housed and held in place by the vacuum hat; four vents in the block; and a photodiode light source and electronic-counter measuring setup. A structural bridge and stand hold and align the tester and specimen. The associated control and regulating equipment is illustrated. (no refs.)

109614 Computer controlled decreasing ΔK fatigue threshold test. R.S.Williams, P.K.Liaw, G.Peck (Westinghouse R&D Center, Pittsburg, PA, USA).
Eng. Fract. Mech. (GB), vol.18, no.5, p.953-64 (1983).
An automated fatigue threshold test was developed which decreases testing time, eliminates need for constant operator attention, and produces a plot of fatigue crack growth rate (FCGR) data as the test proceeds. A minicomputer interfaced to a servo-hydraulic test stand adjusts loads during the FCGR test to achieve a specified stress intensity range (ΔK). The value of ΔK is decreased exponentially with crack growth to get the fastest load shedding without crack arrest. The procedure is as follows: apply load levels to obtain desired ΔK for the crack length, a; using the specimen compliance, compute a new value for a; adjust loads to obtain corresponding ΔK for that a; record a, ΔK, and cycle count (N); repeat. Plots of a vs. N, and $\mathrm{d}a/\mathrm{d}N$ vs ΔK are made by a separate program. The optimized load shedding and 24 hr/day operation result in a considerable reduction in test time. The program was written in BASIC on a MTS Automated Test System. Visual crack growth measurements showed good agreement with computer acquired data for a test of ETP Cu. (7 refs.)

109615 An investigation of the blunting line. S.-W.Yin (Zhejiang Inst. of Technol., Hangzhou, China), R.A.Gerbrands, M.Hartevelt.
Eng. Fract. Mech. (GB), vol.18, no.5, p.1025-36 (1983).
Experimental evidence obtained on 3-point SENB specimens of carbon steel (St52-3) is used to compare ways of determining the slope of the 'blunting line' in J_{Ic} testing. The results demonstrate that the slope of the blunting line obtained by the stretched zone width (SZW) method is steeper than the blunting line predicted by the ASTM method. This results in lower values for both J_{Ic} and $(\Delta a)_c$ as determined with the SZW method, compared with those obtained by the ASTM method. The increased conservatism compared to the ASTM approach and the experimental evidence underlying it recommend the SZW method for further study. The subsequent widespread use expected for any recognized J_{Ic} determination seems to justify the additional effort and expenses associated with the SZW method. (15 refs.)

109616 Radiowave inspection of substances by the method of differential modulation of probe radiation. V.D.Iskin, L.F.Kuchin.
Elektron. Obrab. Mater. (USSR), no.3, p.73-5 (1983). In Russian. English translation in: *Electrochem. Ind. Process. & Biol. (GB)*
The device described permits broadening of the range of application of the method of differential modulation of a superhigh-frequency signal, and the use of this method for investigating the composition of substances and materials over a wide range of their physico-chemical properties. The principal component of the device is a differential cell consisting of a set of rigidly-fixed and eccentrically-arranged cylindrical sleeves. (4 refs.) *A.J.B.*

109617 Checking the breaking loads of silicate glass by recording the electromagnetic signal. V.A.Smirnov, V.P.Dmitriev, A.A.Vorob'ev, Yu.P.Malyshkov, V.F.Gordeev.
Glass & Ceram. (USA), vol.39, no.9-10, p.484-7 (Sept.-Oct. 1982). Translation of: *Steklo & Keram. (USSR)*, vol.39, no.10, p.10-11 (Oct. 1982).
Tests were conducted on three-layer specimens (triplex) that simulate the structural work under load. Continuous rolled silicate glass was used to manufacture the triplex. The specimens were a three-layer sheet measuring 100×100 mm, consisting of two layers of glass 6 mm thick each and a polymer gluing spacer between them 3-4 mm thick. Square plates of tempered silicate plate glass measuring 600×600×6 mm were used as models of large articles. The pulsed electromagnetic signal generated by the specimen was received by an electric antenna 3-5 mm from the surface of the specimen. The signal was amplified in the frequency band from 100 Hz to 1 MHz by a differential amplifier, was converted to DC voltage proportional to the number of pulses, and was recorded on photosensitive paper by a Neva MT loop oscillograph. It is concluded that the breaking load of articles of tempered and untempered silicate glass, including multilayer articles of large geometric dimensions and complex shape, can be tested by recording the pulsed electromagnetic signal generated by the articles during loading. (1 ref.)

109618 Detection of SiO_2 cracks with capacitance measurements. G.S.Hopper, D.W.Rich, W.B.Roush (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.2, p.634 (July 1983).
Describes a method to detect quartz defects between levels of metallisation via capacitance measurements. (no refs.)

109619 Test-site design for monitoring cracked SiO_2. G.S.Hopper, W.B.Roush (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.2, p.635-6 (July 1983).
A simple test structure, consisting of many contact pads connected to a silicon substrate and one contact pad connected to a large aluminum-copper plate which is isolated from the silicon substrate by standard SiO_2 underlay, provides a test site for monitoring cracked SiO_2 handling damage. (no refs.)

109620 Acoustic-emission study of crack formation in alloy steels under surfacing metal. S.N.Navolokin, E.G.Starchenko, A.A.Yudin (Sci.-Industrial Union for Machine-Construction Technol., Moscow, USSR).
Ind. Lab. (USA), vol.48, no.11, p.1127-31 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.62-5 (Nov. 1982).
The results are given of an acoustic-emission (AE) study of the nucleation of subsurfacing cracks (SSC) in alloy steels of the pearlite class in high-temperature annealing (550-650°C). The investigated grades of steel were 15Kh2NMFA, 10GN2MFA, and 15Kh2MFA. (4 refs.)

109621 Some problems in industrial ultrasonic weld inspection. V.E.Belyi, V.G.Shcherbinskii (Sci.-Inst. Union for Machine-Construction Technol., Moscow, USSR).
Ind. Lab. (USA), vol.48, no.11, p.1131-3 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.66-8 (Nov. 1982).
Some technical problems in the industrial ultrasonic inspection of welded joints and seams are discussed. The primary objective is to ensure adequately reliable flaw detection. (6 refs.)

109622 Acoustic flaw detector for inspecting multilayer structures. V.V.Murashov, N.N.Detinov.
Ind. Lab. (USA), vol.48, no.11, p.1134-7 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.68-70 (Nov. 1982).
A flaw-detector circuit is proposed is for inspecting multilayer structures in which the system composed of the radiator-product-receiver-amplifier operates in an oscillatory mode. A transducer containing radiating and receiving vibrators is placed on the surface of a product that is being inspected. Elastic vibrations of the product's surface that are excited by the radiator are converted by a piezoelectric receiver into electrical oscillations which enter the input of the amplifier. Then the voltage is supplied to the radiating vibrator which converts the electrical oscillations into mechanical vibrations. The elastic vibrations in the product are registered by a pointer-type indicator. (6 refs.)

109623 Nondestructive capacitive method of quality inspection for a cemented joint in a composite material. T.E.Shatksaya, V.I.Natrusov, N.V.Ivanova, R.A.Kamaletdinov.
Ind. Lab. (USA), vol.48, no.11, p.1137-8 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.70-1 (Nov. 1982).
A nondestructive capacitive method of inspection has been developed to estimate the strength of a cemented joint of fibreglass and a metal ceramic (mark S-2 silicon carbide) which are bonded with type 88N rubber cement. It is based on the property of a capacitor by which its capacity changes according to vibrations in the dielectric constant of a material under inspection that are due to flaws. (no refs.)

109624 Method for measuring the yielding of the testing system machine-specimen. L.T.Timoshuk, N.I.Nistratov (Bardon Central Sci. Res. Inst. of Ferrous Metall., USSR).
Ind. Lab. (USA), vol.48, no.11, p.1139-43 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.71-4 (Nov. 1982).
Experiments have shown that for metals having a physical yield point σ_T the value of this characteristic depends on the rate of tensile strain $\dot{\epsilon}_C$ in the yield stage. The comparability of σ_T values obtained for different metals is achieved in testing at the same speed $\dot{\epsilon}_C$ in the yield section. Speed $\dot{\epsilon}_C$ is linked with stress rate increase σ_A in the elastic stage and parameter K by the relation $\sigma_A=\dot{\epsilon}_C/(1/E+KF/L)$. If this condition is not satisfied an error in determining the physical yield point σ_T is introduced which can reach 10% of its nominal value. (5 refs.)

109625 Evaluation of residual stresses in welded joints of thin plate by a holographic method. A.A.Rassokha, N.N.Talalaev (Khar'kov Red Banner Airforce Engng. Acad., Khar'kov, Ukrainian SSR).
Ind. Lab. (USA), vol.48, no.11, p.1143-6 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.74-7 (Nov. 1982).
It is concluded that the holographic method can be used in the investigation of residual stresses in welded joints of thin plates produced by laser and argon-arc welding. Sufficiently simple calculation equations are developed for determining by a holographic method the residual stresses in plates with a two-dimensional residual stress system. The error in determining residual stresses by a holographic method decreases with increasing plate thickness if the stress system remains plane. The residual stress level in welded joints of plates made from 08Kh15N5D2T steel is close to the yield point both after argon-arc as well as after laser welding. (3 refs.)

109626 Photolithographic method for producing originals of small-base grids. V.A.Strizhak, A.A.Vainshtein, G.V.Khrenov.
Ind. Lab. (USA), vol.48, no.11, p.1147-8 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.77-8 (Nov. 1982).
Investigations of strain fields in the microstructure of high-tensile alloy steels (usually fine-grain steels) are carried out by means of small-base grids. The grid is applied to the specimen of the material being investigated by exposure from the original photo-template with grid image. The authors describe the method of making originals with a grid base of 10, 25, 50, and 100 μm. (3 refs.)

109627 Determination of mechanical characteristics of high-melting-point materials in bending. S.M.Barinov (Bardin Inst. of Metall., Acad. of Sci., USSR).
Ind. Lab. (USA), vol.48, no.11, p.1148-50 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.78-80 (Nov. 1982).
A simple method is described for the determination of strength and strain characteristics of high-melting-point materials in bending which requires no previous determination of μ or n in tension where N is the strain hardening coefficient, and n the exponent in the equation of creep rate as a function of stress. (2 refs.)

109628 Use of parabolic indentors for testing brittle materials by microimpression. T.S.Mikhailovskaya (Zhukov Khar'kov Aviation Inst., Khar'kov, Ukrainian SSR).
Ind. Lab. (USA), vol.48, no.11, p.1151-2 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.80-1 (Nov. 1982).
Analyzes the possibility of the use of a parabolic indentor for determining mechanical characteristics by microimpression. The indentors were made by electrochemical etching in an alternating current of plate tungsten blanks in a layer of 1 N NaOH solution electrolyte located on the surface of a bath with carbon tetrachloride. The tests were made on a PMT-3 tester equipped with specially prepared holders for conical and paraboloid indentors. The object of the investigation was zinc selenide, which is characterized by an increased tendency toward brittle fracture in connection with the presence of directed rigid covalent bonds. For comparison tests were made by microimpression with the use of standard pyramidal (angle at the tip 90°) and conical indentors. (4 refs.)

109629 A unit for creep testing with a capacitive strain sensor. A.P.Khinskii, L.A.Chernyshev.
Ind. Lab. (USA), vol.48, no.11, p.1153-5 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.81-3 (Nov. 1982).
A capacitive sensor, which is a flat differential condenser with a constant gap and a variable ratio of the areas of the plates, is used for continuous measurement of the deformation of a ring sample with high accuracy. Under otherwise equal conditions such as device makes it possible to double the sensitivity and area of linearity of the measured characteristic. It is possible to correct the form of the relationship of this characteristic by changing the configuration of the plates. The rotary plate of the capacitive sensor is

fastened to the loading lever, and the stationary plates are located on a stand. (4 refs.)

109630 Machine for investigating materials in tension in a magnetic field in the 4.2-300K temperature range. L.M.Volikova, V.K.Chernetskii, V.Ya.Il'ichev (Physicotech. Inst. for Low Temperatures, Acad. of Sci., Khar'kov, Ukrainian SSR).
Ind. Lab. (USA), vol.48, no.11, p.1156-8 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.83-4 (Nov. 1982).
A simple machine is described for investigating the mechanical properties of materials in tension in a magnetic field in the 4.2-300K temperature range with the following parameters: maximum load at room temperature 10 kN; strength of the magnetic field 2.387×10^6 A/m; solenoid inside diameter 35 mm; rate of deformation 0.005-50 mm/min. One of the significant disadvantages of the base machine is the axial play in the screw pair, creating at the moment of failure of the sample a marked distortion of the strain curve record. In order to eliminate this disadvantage the nut is fixed relative to the screw with a certain amount of axial interference with the use of special compensators. (10 refs.)

109631 Device for measuring axial and circumferential deformation in tubular specimens. A.G.Moiseev, O.L.Tolokonnikov (Tula Polytech. Inst., Tula, USSR).
Ind. Lab. (USA), vol.48, no.11, p.1158-60 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.85-6 (Nov. 1982).
A device is described for measuring the axial and circumferential deformation in the working zone of tubular specimens which are subjected to the simultaneous action of external pressures up to 1000 MPa (in a high-pressure chamber), axial tensile forces, and positive pressure differential within the specimen. The working principle of the device is the deformation of elastic elements with bonded resistance strain gages and the use of a slide-wire (rheochord-type) gauge. (no refs.)

109632 Rig for testing the mechanical and structural characteristics of paper. V.S.Simonov, V.N.Nepein, R.F.Valeev, V.P.Butyrin, I.A.Plotnikov (All Union Sci.-Res. Inst. for Cellulose Paper Industry, Perm', USSR).
Ind. Lab. (USA), vol.48, no.11, p.1160-3 (Nov. 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.11, p.86-8 (Nov. 1982).
The test consists of a device (type OSFP-1), amplifier, a power unit, a teraohmmeter (type E6-13), and two twin-coordinated recording potentiometers (type PDP4-02). The main feature of the rig is the specially designed OSFP-1 device which enables cyclic or continuous loading of the paper specimen and measurement of the force P, strain Δl, and electric resistance r in the test zone. (3 refs.)

109633 Recent developments in quantitative fractography. M.Coster, J.L.Chermant (Lab. de Cristallographie, Chimie, et Phys. des Solides, Univ. de Caen, Caen, France).
Int. Met. Rev. (GB), vol.28, no.4, p.228-50 (1983).
Following recent developments, quantitative image analysis of fracture surfaces has become an important feature in the process of obtaining a better knowledge of the microstructural processes involved during the deformation and rupture of materials. The authors illustrate and discuss (i) how a fracture surface can be reconstituted from stereographic views and profilometric methods of fracture analysis, and (ii) how to characterize morphologically a fracture surface and the relevant stereometric relationships that can be used. Finally, some examples from the literature of the use of these different methods are presented. (67 refs.)

109634 A TEM method for analyzing local strain fields in irradiated materials. J.I.Bennetch, W.A.Jesser (Dept. of Materials Sci., Univ. of Virginia, Charlottesville, VA, USA).
J. Nucl. Mater. (Netherlands), vol.117, p.303-7 (July 1983). (Proceedings of the Symposium on Radiation Damage Analysis for Fusion Reactors, St. Louis, MO, USA, 25-28 Oct. 1982).
Of great interest to the field of fracture mechanics is the strain field in front of a crack tip. In irradiated materials, cavities which naturally form as a result of radiation provide convenient internal markers. If a miniaturized irradiated tensile sample is pulled in situ in a transmission electron microscope (TEM), both the relative displacement of these cavities and their distortion in shape provide information on localized strain on a microscopic level. In addition, the TEM method allows direct correlation of active slip systems with crack propagation characteristics. To illustrate this method a strain field map was constructed about a crack propagating in a helium irradiated type 316 stainless steel sample containing large cavities. (16 refs.)

109635 Estimation of fatigue curves for steel specimens subjected to bending, axial and torsion loads. S.Subramanyan (Aveen's Univ., Montreal, Canada).
J. Inst. Eng. (India) Mech. Eng. Div., vol.63, pt.ME1, p.12-14 (July 1982). [received: Aug. 1983]
While empirical relationship for estimating fatigue curves in terms of tensile strength is available for unity stress ratio, no such simple method is available for other stress ratios. A method is proposed by approximating the curves in the Goodman diagram as straight lines. Equations are proposed to describe the fatigue curve in terms of stress ratio as well as mean stress values for bending, axial and torsion types of load. Equations have also been proposed for estimating the fatigue limit. These equations are verified for their validity with experimental data drawn from the literature and are found to be satisfactory. (2 refs.)

109636 A radioactive tracer method for measuring the relative surface areas of small samples. S.D.Brown, Tran Bao Van, G.P.Wirtz (Dept. of Ceramic Engng., Univ. of Illinois, Urbana, IL, USA).
J. Am. Ceram. Soc. (USA), vol.66, no.7, p.C115-16 (July 1983).
A new method for measuring the relative surface area of small samples is described. The method is based on liquid-sorption theory and uses stearic acid tagged with ^{14}C. Relative surface area data on alumina samples deposited under various conditions by the anodic spark process are reported. The method was validated successfully using BET data taken on alumina samples. (12 refs.)

109637 Experimental study on accuracy of notch root strain evaluation equation of ASME B & PV C C N-47. Y.Ikemoto, S.Shimizu (Nuclear System Div., Kawasaki Heavy Industries, Ltd., Kawasaki, Japan), T.Kano, T.Udoguchi.
J. Soc. Mater. Sci. Jpn. (Japan), vol.32, no.357, p.615-19 (June 1983). In Japanese.
Describes the test results on strain concentration behaviour of type 304 stainless steel and $2^1/_4$Cr-1Mo steel. Type 304 stainless steel was tested at 600°C under cyclic displacement control and cyclic load control conditions, and $2^1/_4$Cr-1Mo steel was tested at 500°C under static creep condition. An improved fine grating method was developed utilizing photo spots in the indentations made by Vicker's hardness tester. The results of stain measurements were compared with the predictions by the equation given in ASME Code Case N-47 and the structural design guide for the Japanese fast breeder reactor. The equation was proved to give a conservative prediction. (4 refs.)

109638 Comparative tests of some electrochemical methods for evaluation of the susceptibility to intergranular corrosion. P.Novak, V.Cihal.
Kovove Mater. (Czechoslovakia), vol.21, no.4, p.461-6 (1983). In Russian.
The three electrochemical methods, chronopotentiometric, polarization potentiostatic and potentiokinetic in $HClO_4+Cl^-$ and H_2SO_4+KSCN solutions, are compared in relation to standardisation possibilities for testing of the resistance of stainless steels to intergranular corrosion. (3 refs.)

109639 Polar-Scan, a nondestructive test method for the inspection of layer orientation and stacking order in advanced fiber composites. W.H.M.van Dreumel, J.L.Speijer (Dept. of Aerospace Engng., Delft Univ. of Technol., Delft, Netherlands).
Mater. Eval. (USA), vol.41, no.9, p.1060-2 (Aug. 1983).
The ultrasonic scanning method, Polar-Scan is described. Its application to the nondestructive inspection of C fiber reinforced composite laminates used in the aerospace industry is discussed. Polar-Scan generates an image that can be considered a unique fingerprint of a specific laminate. (1 ref.)

109640 A critical commentary on magnetic particle inspection. D.J.Hagemaier (Douglas Aircraft Co., Long Beach, CA, USA).
Mater. Eval. (USA), vol.41, no.9, p.1063-8 (Aug. 1983).
During the past few years a number of steel parts have either failed or have been found cracked on in-service aircraft. Metallurgical evaluations of these parts revealed that, in all cases, the cracks initiated during fabrication, and some of them grew in service. A review of inspection records indicated that all the parts had received at least one magnetic particle inspection subsequent to the manufacturing operation that caused the cracks. An assessment of the situation indicated that the inspections were performed by inspectors, certified to national standards, at approved and qualified laboratories, using standard techniques and procedures. Hence, changes were needed in one or more of these areas to avoid this condition in the future. The author illustrates the cracked parts and describes the changes made to the conditions that allowed cracked parts to go undetected during the fabrication inspection. (1 ref.)

109641 The potential of real-time radiography for API 1104. S.A.Wenk (Southwest Res. Inst., San Antonio, TX, USA), R.A.Brokaw, R.G.Schonberg.
Mater. Eval. (USA), vol.41, no.9, p.1069-73 (Aug. 1983).
Discusses current and potential use of real-time radiography for examining piping welds governed by American Petroleum Institute (API) Standard 1104. A dissertation on the subjectivity of radiographic interpretation is included to compare real-time and film radiography. Also described is a video technique for sizing the through-wall dimension of weld defects for fitness-of-purpose as now permitted by Appendix A of API 1104. Illustrations of potential field applications are given. (4 refs.)

109642 Characterization of metals and alloys by electrical resistivity measurements. R.L.Cohen, K.W.West (Bell Labs., Holmdel, NJ, USA).
Mater. Eval. (USA), vol.41, no.9, p.1074-7 (Aug. 1983).
The authors have developed a four-point probe and measuring package that allow accurate measurements of the resistivity of metals in sheet or bulk form despite surface corrosion and other interfering effects. Measurements in a number of ferrous and nonferrous alloys are described. Several possible applications are suggested, especially in studying ferrous alloys. (9 refs.)

109643 Determination of Luders strains and flow properties in steels from hardness/microhardness tests. F.M.Haggag (Nuclear Safety Methods Div., EG&G Idaho Inc., Idaho Falls, ID, USA), G.E.Lucas.
Metall. Trans. A (USA), vol.14A, no.8, p.1607-13 (Aug. 1983).
Development of radiation tolerant materials for use in fusion reactors requires testing of small volumes of candidate materials in high energy neutron irradiation facilities. As part of an effort to develop methods for extracting mechanical property information from small specimens, the authors investigated techniques to characterize flow properties of steels exhibiting Luders strains from ball indentation hardness/microhardness tests. A quantitative relationship was found between the amount of pile-up formed during indentation and the magnitude of the Luders strain exhibitied during tensile testing in SAE 1015 steel. Moreover, by nonlinear regression analysis, a single set of equations was found which correlated hardness data to the homogeneous true-stress-true-plastic strain relationship of steels in a variety of metallurgical conditions in the strain range 1 to 10% at room temperature. (24 refs.)

109644 Evaluating the service reliability of metals and alloys. O.N.Romaniv.
Met. Sci. & Heat Treat. (USA), vol.24, no.11-12, p.835-41 (Nov.-Dec. 1982). Translation of: *Metalloved. & Term. Obrab. Met. (USSR)*, vol.24, no.12, p.6-13 (Dec. 1982).
Presents certain results of investigations conducted in the Ukraine in the area of development of methods of evaluating service reliability based on the determination of the crack resistance of metals and alloys, and also of investigations of the structure aspects of controlling the crack resistance of steels. (32 refs.)

109645 Checking the metallurgical condition of ferrous alloy parts by electromagnetic measurements. A.Stossel (Commissariat a l'Energie Atomique, CEN de Cadarache, Saint-Paul-lez-Durance, France).
Mem. & Etud. Sci. Rev. Metall. (France), vol.80, no.6, p.325-31 (June 1983). In French.
Relationships between both the electrical and magnetic properties of ferrous alloys and their metallurgical properties are obtained from analysis of the impedance. Practical examples are given; check on surface treatments: case-hardening, depth of quench. (no refs.)

109646 Non-destructive evaluation of the microstructure of hypoeutectic Al-Si foundry alloys AS7G03. B.Closset (Univ. McGill, Montreal, Canada), H.Oger, S.A.Argyropoulos, J.E.Gruzleski.
Mem. & Etud. Sci. Rev. Metall. (France), vol.80, no.6, p.333-43 (June 1983). In French.
A choice of two techniques is available for the non-destructive evaluation of the microstructure: determination of electrical resistivity and thermal analysis. Influence of strontium content, porosity and rate of solidification of the resistivity is discussed. (10 refs.)

109647 Analysis of acoustic emissions from polymers. D.Betteridge, P.A.Connors, T.Lilley, N.R.Shoko (Chem. Dept., Univ. Coll. Swansea, Swansea, Wales), M.E.A.Cudby, D.G.M.Wood.
Polymer (GB), vol.24, no.9, p.1206-12 (Sept. 1983).
Acoustic emissions obtained from polymers under stress have been subjected to various mathematical analyses with the objective of relating the observed signals to accompanying chemical and physical changes in the polymer. The following methods have been investigated: frequency analysis, autocorrelation analysis, cepstrum analysis and cluster analysis (pattern recognition). It is possible to classify the signals from a given polymer sample into relatively few types. There is a periodicity in a number of plots of acoustic power vs. time. Differences between samples are evident, although it is not possible at this

stage to state that they are statistically significant. The materials examined include, nylon-6,6, 'Diakon', polypropylene and various composites. (24 refs.)

109648 Metallographic methods of preparation and analysis of enameled layers. M.Schwarz (BASF AG, Ludwigshafen/Rhein, Germany).
Prakt. Metallogr. (Germany), vol.20, no.6, p.267-79 (June 1983). In German, English.
Metallographic analysis and documentation determines layer structure, pores, cracks, as well as shape, size, distribution and fraction of the phases in glass enamel and glass-ceramic composite systems. Microhardness measurements and etching behavior are indicators for the properties of the different phases. The composition of the phases can be established by SEM. The effect of tempering upon crystallization is demonstrated. The metallographic surface analysis and replica technique for an examination of the enamel layer on a structural part is illustrated. (6 refs.)

109649 Material-oriented preparation of sintered ceramic bodies. G.Hubner (Inst. fur Werkstofftech., Rosenthal AG, Selb, Germany), H.Hausner.
Prakt. Metallogr. (Germany), vol.20, no.6, p.289-96 (June 1983). In German, English.
The method and energy for preparation of ceramographic sections should be adapted to the goal of the investigation. Demands for quality of the mounts as well as the possibilities for preparation have increased substantially, while working periods have decreased markedly. Relief etching and tearout should be kept to a minimum since they can easily falsify the structure. Semi-automatic equipment and diamond grinding and polishing media are very helpful in producing ceramographic sections in a short time. It is possible to get good results also without these measures, but often they require a multiple in time and experience. (11 refs.)

109650 An improved technique for the macrophotography of cracked steel specimens. B.Dixon (Materials Res. Lab., Defence Sci. & Technol. Organisation, Melbourne, Australia).
Prakt. Metallogr. (Germany), vol.20, no.6, p.306-9 (June 1983). In English, German.
The procedure involves using a chemical polish followed by an etch using modified Fry's reagent, an etchant commonly used to reveal deformation zones in mild steel. Macrophotography is done with oblique illumination while the specimen is submerged under alcohol. (1 ref.)

109651 Application of the four-point bending technique on single edge notched specimens to the fracture behavior of ceramics. A.Fontaine (Dept. des Materiaux, Ecole Polytech. Federale de Lausanne, Lausanne, Switzerland), D.Francois.
Rev. Int. Hautes Temp. & Refract. (France), vol.19, no.3, p.159-69 (1982). In French.
In order to better understand the conditions of validity of the fracture test on ceramics, four point bend specimens made of sintered alumina were tested under conditions of either fast or delayed fracture. Acoustic emission allowed one to detect in fast fracture tests an inition point to which a fracture toughness K_A which has a good reproducibility corresponds. The fracture toughness increases while the crack propagates until it stabilises when the damaged zone at the crack tip reaches its full development. The rate at which this plateau value, characteristic of each material, is reached, depends upon the loading rate. The delayed fracture tests were performed either at constant load or at constant displacement. In the first case, the three usual phases observed in stress corrosion cracking were observed while in the second one the plot of the logarithm of the crack velocity as a function of the logarithm of the stress intensity factor, had a single steep slope corresponding to a crack tip which propagates within a relatively large damaged zone. (7 refs.)

109652 Critical evaluation of double torsion tests. M.Boussuge, E.Inghels, J.Lamon (Ecole Nat. Superieure des Mines de Paris, Evry, France).
Rev. Int. Hautes Temp. & Refract. (France), vol.19, no.3, p.185-206 (1982). In French.
An elastic analysis of the double torsion specimen is proposed. It takes into account the deformations of the whole specimen and not just the torsion beams. The results are compared with the stresses and the deflections measured on metallic and PMMA specimens. The compliances predicted using this analysis are in good agreement with the measurements performed on reaction bonded silicon nitride. (7 refs.)

109653 Development of a high temperature double torsion apparatus. A.Mamoun, G.Fantozzi, G.Orange (Groupe d'Etudes de Metallurgie Phys. et de Phys. des Materiaux, INSA, Villeurbanne, France).
Rev. Int. Hautes Temp. & Refract. (France), vol.19, no.3, p.207-23 (1982). In French.
The strength degradation with time of ceramics is due to the onset of slow crack growth. The degradation can limit the utilization of these materials as structural components. So, it is fundamental to characterise the mechanisms reponsible for this degradation to assure reliability of components in service and also to optimize the microstructure in order to produce high performance materials. The authors have designed a double torsion apparatus working up to 1500°C, in different atmospheres, to determine the relationship between the crack velocity V and the stress intensity factor K_1. This apparatus has been tested aluminas (Al 23 and AF 997) at room temperature, in air and water, and at 600°C. The influence of specimen thickness on the diagram (K_1, V) has been studied. Tests under higher temperatures and under various atmospheres conditions (air and inert gas atmosphere) are presently in progress. (58 refs.)

109654 Investigation by Vickers indentation of the fracture toughness of experimental batches of sintered polycrystalline SiC. R.Moussa, J.L.Chermant, F.Osterstock (Lab. de Cristallographie, Univ. Caen, Caen, France).
Rev. Int. Hautes Temp. & Refract. (France), vol.19, no.3, p.225-38 (1982). In French.
The critical stress intensity factor has been determined for an experimental batch of SiC, using the controlled flaw method and the Vickers indentation radial crack size method. The difference between the values for K_C obtained according to the used methods, are linked to the existence of a process zone. The nature and the size of this zone of microcracking depends on the microstructure of the material. (23 refs.)

109655 Study of the thermomechanical behaviour of ceramics by acoustic emission. N.Ouanezar, D.Rouby, G.Fantozzi (Groupe d'Etudes de Metallurgie Phys. et de Phys. des Materiaux, INSA, Villeurbanne, France).
Rev. Int. Hautes Temp. & Refract. (France), vol.19, no.3, p.239-53 (1982). In French.
Notch opening tests were carried out on CT 10 specimens of zirconia (ZrO_2 PSZ-Mg). The acoustic emission originated in slow crack growth. Examples of detected signals are shown: the direct signal emitted from the source mechanism is pulse shaped; the signals following results from the wave's reflections and mode's conversion inside the specimen. Temporal analysis of the signals give access to the localization of the acoustic emission sources in the specimen. The results of the localization are shown and discussed in the light of the slow crack growth processes in the materials. A study of thermal shock by acoustic emission is presented. The thermal shock set-up is described. The evolution of the acoustic emission as a function of the thermal temperature is put forward. The advantage of the acoustic emission technique in the study of behaviour of ceramic materials is discussed. (13 refs.)

109656 Investigation of the link between the rate and magnitude of plastic deformation and acoustic emission energy. V.S.Ivanova, N.S.Kuznetsov.
Russ. Metall. (GB), no.1, p.163-7 (1982). Translation of: *Izv. Akad. Nauk. SSSR Met.*, no.1, p.191-5 (1982).
In the present investigation, based on concepts of the dislocation nature of acoustic emission signals and on the assumption that the energy of acoustic emission, caused by moving dislocations (or their groups) in the course of deformation, is proportional to their kinetic energy, the relationship between the acoustic emission energy and the parameters, which define the conditions and stages of deformation, is studied. (11 refs.)

109657 A new technique of hydrogen charging of a TEM specimen. H.Matsui, O.Kubota, N.Yoshikawa, M.Koiwa (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
Scr. Metall. (USA), vol.17, no.7, p.923-5 (July 1983).
Two types of very simple and reliable techniques for the hydrogen doping of Va metals (Nb, V, Ta) are reported. (5 refs.)

109658 Skoda concern's present methods of non-destructive material testing. M.Hampejs.
Skoda Rev. (Czechoslovakia), no.1, p.37-45 (1983).
Discusses the development of flaw detection methods by Skoda and its programme directed towards improvements. (no refs.)

109659 Determination of ultimate strength in bending for glass tubes by a radial compression method. E.A.Abramyan, D.L.Orlov, S.V.Golenkov (State Sci. Res. Inst. of Glass, Moscow, USSR).
Strength Mater. (USA), vol.14, no.7, p.992-5 (July 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.7, p.116-18 (July 1982).
In studying the effect of residual stresses in glass tubes on their strength properties the radial compression method proposed is preferred over other well-known methods, and a promising direction for improving the mechanical strength of glass tubes is to do away with the secondary anneal in a furnace and to create residual stresses at the inner surface during tube-drawing in the pit of the VTD machine by intensifying inner surface cooling. (6 refs.)

109660 Use of strain-measurement methods for recording acoustic emission. Yu.S.Vorob'ev, A.V.Kolodyazhnyi, V.V.Voronin (Inst. of Problems of Machine Building, Acad. of Sci., Khar'kov, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.8, p.1144-7 (Aug. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.8, p.126-8 (Aug. 1982).
The proposed method for recording acoustic emission was investigated with the use of a type KTD-2A silicon semiconductor strain gauge in pure bending of a 400×10×10 mm U8 steel beam with a triangular cut in the center. (2 refs.)

109661 Experimental equipment and method for examining damage cumulation in softening polymer composite materials. R.P.Apinis, S.L.Skalozub.
Strength Mater. (USA), vol.14, no.8, p.1151-4 (Aug. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.8, p.131-4 (Aug. 1982).
Experimental equipment is described for examining the dynamic modulus of elasticity and the mechanical loss angle of rigid polymer materials during fatigue failure. The equipment operates in resonance conditions. The resonance frequency is determined by the dynamic modulus of elasticity, dimensions, and configuration of the specimen. The load cycle is sinusoidal with a stress ratio of $r = -1$. In the equipment, the specimen can be cooled to suppress heating due to vibrations. (5 refs.)

109662 Equipment for fatique testing large numbers of specimens. A.d.Puzankov, Yu.I.Ivanov, A.A.Glotov, V.A.Konovalov (Moscow Inst. of Railroad Transport Engrs., Moscow, USSR).
Strength Mater. (USA), vol.14, no.8, p.1155-6 (Aug. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.8, p.135-6 (Aug. 1982).
The equipment consists of a vibration table, a static frequency converter, and a measuring system. The equipment, in which forces up to 12.10^4 N can be generated at an oscillation frequency of 18-20 Hz, can be used to test simultaneously six flat cantilevered specimens in cyclic bending and to produce a symmetric or asymmetric cycle of stress variants in each specimen. Power is supplied to the equipment from a 380 V three-phase mains with industrial frequency. The required power does not exceed 30 kW, and the equipment weighs 2500 kg. (no refs.)

109663 Stress-strain curves for high-temperature monotonic loading. N.A.Makhutov, V.N.Merkulov (Moscow Aviation Engng. Inst., Moscow, USSR).
Strength Mater. (USA), vol.14, no.10, p.1299-303 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.12-15 (Oct. 1982). [received: Sept. 1983]
It is concluded that in analyzing fracture under monotonic loading at high temperature, when elastoplastic strain is accompanied by creep strain and long-time static damages are accumulated, strain approaches can be justifiably used. Such approaches consider the degree of development of inelastic strain, the change in the resistance to deformation, long-time ductility characteristics, and the three-dimensional character of the stress state in crack zones. These factors are fundamental in the stage of stable crack growth and determine the limiting loads for the given loading conditions (with respect to rates and temperatures); the stress-strain diagrams obtained in this case permit evaluation of the limiting loads and critical flow size with allowance for flaw growth. (12 refs.)

109664 Determination of life under two-frequency loading. II. Proposed method. V.I.Trufyakov, V.S.Koval'chuk (E.O. Paton Inst. of Electronic Welding, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.10, p.1303-8 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.15-20 (Oct. 1982). [received: Sept. 1983]
For pt.I see ibid., vol.14, no.9, p.1165 (1982). A formula is proposed to evaluate the effect of the super-position of a high-frequency component on the fatigue life under two-frequency loading using the change in the life corresponding to low-frequency loading. (8 refs.)

109665 Study of the strain characteristics of materials and evaluation of deformation conditions in concentration zones with nonisothermal cyclic loading. A.G.Kazantsev (A.A. Blagonravov Inst. of Engng. Sci., Acad. of Sci., Ukrainian SSR).
Strength Mater. (USA), vol.14, no.10, p.1308-13 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.20-5 (Oct. 1982). [received: Sept. 1983]
Analysis of the results obtained shows that in isothermal loading at 150 and 650°C stabilization of the stress-strain curve leads to a situation whereby the loading on the hole contour and at the notch root approaches severe

(ϵ=const) conditions after the third half-cycle. In nonisothermal loading, there is no such complete stabilization after the same number of half-cycles. In this case, the strains are greater than those seen under isothermal loading at 150°C and less than those seen under isothermal loading at 650°C. This difference reaches 30-40%, which must be taken into account in evaluating low-cycle strength. When temperature changes within a broader range, as well as in the case of materials with a more pronounced dependence of strain characteristics on temperature, this difference may be even more substantial. (6 refs.)

109666 Prediction of endurance on the basis of characteristic loading parameters. I.G.Zavalich, L.A.Shefer (Chelyabinsk Polytech. Inst., Chelyabinsk, USSR).
Strength Mater. (USA), vol.14, no.10, p.1314-20 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.25-30 (Oct. 1982). [received: Sept. 1983]
A method is proposed which permits the conversion of fatigue characteristics from one process to another without schematization, and use of the fatigue damage summation hypotheses. The method is based on the equivalence of random and programmed loading processes. Tests were conducted in cantilever bending on flat specimens of materials differing in both chemical composition and strength properties (aluminum alloy AMg6, heat-resistant steel D152, glass-fiber-reinforced plastic PPN), making it possible to determine $\sigma_{\min}$ as a quantity independent of the test material. (7 refs.)

109667 Experimental determination of the stress intensity factor in bending for a cylindrical single-edge-cracked specimen. A.V.Prokopenko (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.10, p.1327-30 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.37-40 (Oct. 1982). [received: Sept. 1983]
A method is proposed for determining the SIF for surface single-edged fatigue cracks in smooth cylindrical specimens under bending load. This makes it possible to find the SIF for smaller cracks than can be determined by using the former method, which involves measurement of elastic yielding. For a relatively large crack length the proposed method produces results which are in good agreement with those obtained by the method of measurement of the elastic yielding of crack-bearing specimens. (13 refs.)

109668 One experimental method of determining the maximum stresses in splitting. V.I.Romanchenko, G.V.Stepanov (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.10, p.1345-7 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.53-5 (Oct. 1982). [received: Sept. 1983]
Investigates the possibility of directly finding the maximum tangential stresses σ_* in the plane of splitting, based on recording the profile of the load wave by a pressure sensor. (7 refs.)

109669 An apparatus for determining the deformability of a material in a complex strain state with neutron irradiation from the Neitron 9 unit. G.S.Pisarenko, A.P.Voloshchenko, M.M.Aleksyuk, V.K.Lukashev, V.I.Prokopenko, Yu.A.Kuzema, B.V.Samsonov, A.Ya.Rogozyanov, V.K.Gorbatov (Inst. of Strength Problems, Acad. of Sci, Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.10, p.1407-13 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.104-9 (Oct. 1982). [received: Sept. 1983]
The Neitron 9 equipment was developed for examining the deformation of materials in combined states of strain under neutron irradiation. The apparatus consists of a loading device placed in a reactor channel and control systems mounted in five instrument racks. Rack 2 contains the control system for the electric heater, while rack 3 contains the system for measuring and recording the data from the transducers, and rack 4 contains the system providing automatic control of the strain rate. The design involves locating the loading device within a channel at the minimum distance from the core. This reduces the length of the loading ties and thus minimizes the error due to deformation of these. The specimen is loaded with an axial tensile force and torque. Both loads are applied with constant strain rates and with a constant ratio between them. (8 refs.)

109670 Equipment of type DSO for fatigue testing in repeated impact and harmonic loading with various stress ratios. V.A.Degtyarev (Inst. of Strength Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Strength Mater. (USA), vol.14, no.10, p.1413-16 (Oct. 1982). Translation of: *Probl. Prochn. (USSR)*, vol.14, no.10, p.110-13 (Oct. 1982). [received: Sept. 1983]
The equipment was constructed to examine the effect of the stress ratio of the load cycle of impact loading on the fatigue of materials and welded joints in flat bending. The distinguishing features of equipment DSO-1 are the static loading mechanism and the unit for clamping the specimen. The clamping unit consists of the support for the cantilever clamping of the specimen. The support is designed in such a manner that the line of load application passes inside the contour of the surface by which the support is fixed to the body of the impact tester. (5 refs.)

109671 Feasibility of coating inspection by gamma-albedo method. O.I.Nedavnii (Sci. Res. Inst. of Electronic Introscopy, Tomsk, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.10, p.755-9 (Oct. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.10, p.3-8 (Oct. 1982). [received: Sept. 1983]
The feasibility of inspecting coatings of heavy materials on substrates of materials with low atomic number by utilizing the backscattering of low-energy gamma radiation is demonstrated on the lead-aluminum combination. The analysis is based on the physical model of an absorber-scatterer system. The effect of fluctuations of the substrate thickness on the accuracy of thickness measurements is evaluated. (9 refs.)

109672 A standard photometric method of determining beam sizes of defects. V.M.Zuev, V.I.Ivanov (Central Sci.-Res. Inst. of Technol. & Mech. Engng., Moscow, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.10, p.764-70 (Oct. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.10, p.14-21 (Oct. 1982). [received: Sept. 1983]
A standard photometric method is described for determining the sizes of defects in the beam direction, with allowance for the detailed working conditions. The method allows one to estimate the beam dimensions of the following types of defects in welded joints: gas pores, unwelded spots, slag inclusions, hair cracks, and runs. (8 refs.)

109673 Experimental study of flaw detection by means of laser radiation. R.E.Krzhizhanovskii, N.M.Filippov, A.D.Rumyantsev.
Sov. J. Nondestr. Test. (USA), vol.18, no.10, p.773-5 (Oct. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.10, p.26-7 (Oct. 1982). [received: Sept. 1983]
The detection of flaws by means of laser generated acoustic pulses is discussed. The influence of the relative disposition of a flaw, the probe, and the point of injection of the laser radiation, on the receiving conditions for the useful signal is examined. It is shown that an inspection can be performed in two stages with the same arrangement: a region is first searched for the presence of flaws and then they are studied in detail. (3 refs.)

109674 Nondestructive inspection of the quality of materials and components using multitransducer eddy-current devices. B.V.Korneev, A.P.Alekseev (Kuibyshev Inst. of Electrotech. Communications, Kuibyshev, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.10, p.778-86 (Oct. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.10, p.30-9 (Oct. 1982). [received: Sept. 1983]
Reports on eddy-current devices for nondestructive inspection with several transducers are systematized. Advantages of these devices in comparison with single-transducer devices are shown, and the direction of further improvement of the former is outlined. (59 refs.)

109675 Topography of electromagnetic field at ferromagnet-air interface generated by volume shear waves. R.S.Il'yasov, V.A.Komarov (Inst. of Metal Phys., Acad. of Sci., USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.10, p.796-800 (Oct. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.10, p.49-54 (Oct. 1982). [received: Sept. 1983]
Measurements were made of electromagnetic field distributions over the surface of an electrically conducting ferromagnetic material (Armco iron) polarized by a tangential magnetic field during electromagnetoacoustic two-fold conversion. It was found that volume shear waves are the ones most intensely excited when laid-on transducers are used. Here it is demonstrated that for measuring the electromagnetoacoustic field generated by such vibrations, it is most expedient to use search coils which record the normal component of the electromagnetic field. (6 refs.)

109676 Interference resistance of tests on ferromagnetic products by Barkhausen-noise parameters. V.A.Shakhnin, N.S.Kazakov, A.S.Petyaev (Omsk Polytech. Inst., Omsk, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.10, p.801-4 (Oct. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.10, p.54-7 (Oct. 1982). [received: Sept. 1983]
The results of an experimental investigation into the effects that the conditions of magnetization and the magnetic history of the testpiece have on the Barkhausen-noise EMF are reported. The authors show that magnetizing the testpiece by fields at two frequencies increases the reliability of the test results. (4 refs.)

109677 Measurement of the acoustical properties of plastics. I.N.Ermolov, V.I.Timofeev (Central Sci. Res. Inst. of Technol. & Mech. Engng., Moscow, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.10, p.806-9 (Oct. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.10, p.60-3 (Oct. 1982). [received: Sept. 1983]
A study of the acoustical properties of plastics is reported. The existing data on the attenuation of longitudinal ultrasonic waves in organic glass (Plexiglas type), polystyrene, and compound K-153 are subjected to a critical analysis. It is established that the published data on the ultrasonic velocities are in good agreement with the data obtained, but the values of the attenuation coefficients are too high. The attenuation coefficient is determined by comparing the amplitudes of bottom signals measured in two or more samples of different heights. It is shown that the multiple-reflection method of measuring the attenuation yields results that are too high. Practical recommendations are given for measuring the attenuation coefficient in plastics. (2 refs.)

109678 Acoustical characteristics of some polymers used as test specimens. V.A.Tokarev, E.I.Seregin, V.P.Glukhovskii (Sci.-Res. Inst. of Building Structures, Kiev, Ukrainian SSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.10, p.812-15 (Oct. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.10, p.67-70 (Oct. 1982). [received: Sept. 1983]
The acoustical characteristics of polymer materials (Plexiglas, ebonite, and Teflon) are investigated. It is shown that Plexiglas, in comparison with ebonite and Teflon, has the lowest temperature coefficient of the velocity of ultrasound. In the course of natural aging, Plexiglass retains a high stability of the velocity of ultrasound for a long period of time, making it the preferred material for the fabrication of standard specimens. (7 refs.)

109679 Effect of heat treatment conditions on the form of the scattered pulse and the mean level of structural noise for steels with a homogeneous structure. V.L.Busov (Sci.-Res. & Design Technol. Engng. Inst., Kramatosk, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.10, p.815-24 (Oct. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.10, p.70-81 (Oct. 1982). [received: Sept. 1983]
The method of small interferences was used to determine the form of the envelope of the echo signal and the mean level of structural noise in the backscattering of ultrasonic waves on specimens with a homogeneous structure. The effect of the dimensions of random inhomogeneities of the medium on the mean level of structural noise for annealed and quenched specimens was explained on the basis of the results. (15 refs.)

109680 Acoustic pulses excited by impacts on objects—their analytical representation and spectra. Yu.V.Lange, E.G.Ustinov (Sci.-Res. Inst. of Introscopy, Moscow, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.10, p.825-30 (Oct. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.10, p.81-7 (Oct. 1982). [received: Sept. 1983]
The problems of impact-excited elastic vibrations for the inspection of objects by the free-vibration method are discussed. A formula is proposed to approximate these pulses and it is compared with experimental data. The spectra of impact pulses having various degrees of asymmetry are calculated. (11 refs.)

109681 Characteristics of acoustic measurements in highly absorptive media. M.B.Gitis, A.A.Shenker (All-Union Sci.-Res. Inst. for Dev. of Nondestructive Methods & Means of Materials Quality Control, Kishinev, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.10, p.831-7 (Oct. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.10, p.87-94 (Oct. 1982). [received: Sept. 1983]
The distortions of elastic pulse shapes in highly absorptive media have been investigated. Asymptotic expressions have been derived that describe the shape of a rectangular wave packet with a high sinusoidal pulse-modulated frequency which are functions of parameters for the medium and the path that is traversed. It is shown that in certain situations the change of shape for signals during their propagation can substantially distort measurements made on the velocity and the coefficient of sound absorption by the usual methods. A modification of the procedure is proposed that makes it possible by means of low-frequency measurements to determine all the internal characteristics of a medium having a single relaxation time. (10 refs.)

109682 Nondestructive inspection by the method of magnetic leakage fields. Theoretical and experimental foundations of the detection of surface cracks of finite and infinite depth. F.Forster (Dr. F. Forster Inst., Reutlingen, Germany).
Sov. J. Nondestr. Test. (USA), vol.18, no.11, p.841-58 (Nov. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.11, p.3-25 (Nov. 1982). [received: Sept. 1983]
A historical review is given of the development of the method of magnetic leakage fields for nondestructive inspection. The leakage field of surface cracks of infinite and finite depth is examined for the linear case. Some calculation methods are presented which make it possible to express a number of regularities of magnetic leakage fields in simple elementary formulas. (13 refs.)

109683 Algorithm for determining the dimensions of flaws in the theory of eddy-current flaw detection by superposed transducers. Yu.K.Fedosenko (Sci. Res. Inst. of Introscopy, Moscow, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.11, p.859-63 (Nov. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.11, p.25-30 (Nov. 1982). [received: Sept. 1983]
On the basis of previously obtained formulas expressing the correlation of the insertion voltage with the dimensions of a flaw and of the transducer winding, the author investigates algorithms for determining parameters of inhomogeneity. The problem reduces to the numerical analysis of a system of five nonlinear equations. The author examines methods of forming such a system and ways of solving it. He analyzes possible special cases. (5 refs.)

109684 Inspection of case hardening by method of higher harmonics. E.G.Revkov, V.V.Klyuev, A.D.Pokrovskii, Yu.P.Khvalebnov (Moscow Inst. of Power Engng., Moscow, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.11, p.864-70 (Nov. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.11, p.30-8 (Nov. 1982). [received: Sept. 1983]
A method has been developed for evaluating the signals from a feedthrough transducer during inspection of case hardening by the method of higher harmonics. Modes of quality control are selected on this basis. Also, the change in electric field intensity necessary for optimal inspection of objects with variable length is estimated. (10 refs.)

109685 Magnetic testing of the mechanical properties of tube material using ferropickup coercimeters. V.I.Roitman, O.S.Konovalov, A.S.Golovko, R.M.Brusentsova, N.B.Batrak, M.V.Teneta (50th-Anniversary-of-the-Great-October-Socialist-Revolution Nikopol'skii Yuzhnotrubnyi Factory, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.11, p.871-7 (Nov. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.11, p.39-45 (Nov. 1982). [received: Sept. 1983]
An improved method for the magnetic monitoring of the mechanical properties of steel tubes is described, based on investigations of the behaviour of the demagnetizing current as a function of the diameter and thickness of the tube walls, which considerably reduces the time required to carry out such monitoring under industrial conditions. (8 refs.)

109686 Extension of the region of tuning out of the effect of changes in the gap between the transducer and the article under test in the pulsed magnetic method of testing. M.A.Mel'gui, V.F.Matyuk (Inst. of Appl. Phys., Acad. of Sci., Belorussia SSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.11, p.877-80 (Nov. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.11, p.46-9 (Nov. 1982). [received: Sept. 1983]
An approximation of the distribution of the gradient of the normal component of the residual field of a locally magnetized article by a power function is proposed. The region in which the effect of changes in the gap between the transducer and the article being monitored is tuned out is compared when measuring the sum of the gradients of the residual field on two sides of the article and when measuring their geometric mean. (3 refs.)

109687 A scanning induction transducer for the inspection of flat surfaces. A.I.Pashagin, V.E.Shcherbinin, B.A.Filippov (Inst. of Metals Phys., Acad. of Sci., USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.11, p.881-5 (Nov. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.11, p.50-5 (Nov. 1982). [received: Sept. 1983]
The authors describe a simple induction transducer with a stationary coil and a core rotating inside the coil eccentrically with respect to the coil axis. The transducer is used for the inspection of joints in pipes welded by arc welding. The detectability of defects with this transducer in magnetic inspection, in relation to the strength of the applied field and the defect size, is examined. The characteristics of the transducer are described in relation to the parameters of the cores. (4 refs.)

109688 Automatic devices for the electromagnetic inspection of the thickness of the coating on small components. A.S.Kanaev (Inst. of Phys., Acad. of Sci., Latvian SSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.11, p.886-90 (Nov. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.11, p.55-9 (Nov. 1982). [received: Sept. 1983]
Methods and devices for the detection of the presence and thickness of coatings on components are examined. Special attention is given to the special features of identifying multilayer components produced by powder metallurgy methods. The technical characteristics of automatic devices for electromagnetic inspection are presented. (3 refs.)

109689 Estimation of extra useful life of objects by monitoring acoustic emission. V.I.Ivanov (Central Sci.-Res. Inst. of Technol. & Machine Construction, Moscow, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.11, p.891-4 (Nov. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.11, p.60-4 (Nov. 1982). [received: Sept. 1983]
Based on a probability study of dependable operation for equipment, an expression has been obtained for determining its extra useful life. It is shown that by employing a nondestructive monitoring method, specifically the acoustic-emission method, it is possible to determine the guaranteed extra useful life. (4 refs.)

109690 Absolute sensitivity of series-produced ultrasonic defectoscopes. I.N.Ermolov, M.S.Naumov (Central Sci.-Res. Inst. of Technol. & Machine Construction, Moscow, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.11, p.895-7 (Nov. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.11, p.64-8 (Nov. 1982). [received: Sept. 1983]
The absolute sensitivity of several commercial defectoscopes is calculated from technical data and determined from actual measurements. It is demonstrated that this characteristic can serve as a basis for comparing the capabilities of various instruments with regard to flaw detection in fine-grain materials. (2 refs.)

109691 Effect of delay in contact layers on accuracy of measurement of ultrasound propagation time. I.I.Vainshtok, V.S.Lerner (Moscow Highway Inst., Moscow, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.11, p.898-902 (Nov. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.11, p.68-72 (Nov. 1982). [received: Sept. 1983]
The delay of ultrasound in contact layers of lubricant is examined in the case of obliquely incident waves. The dependence of the time delay on the acoustic properties of the materials forming the contact layer is analyzed, and a scheme is proposed for measuring the propagation time with compensation of delays. (7 refs.)

109692 Standardizing the terminology of the acoustic-emission method. Yu.B.Drobot, V.I.Ivanov, E.G.Smirnov (Central Sci.-Res. Inst. of Technol. & Mech. Engng., Moscow, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.11, p.902-5 (Nov. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.11, p.72-6 (Nov. 1982). [received: Sept. 1983]
Technical standardization documentation published in various countries on the terminology used in connection with acoustic emission is briefly surveyed. The terms relating to acoustic emission are given, along with their definitions and notation in accordance with the Soviet All-Union State Standard (GOST) 25.002-80. (17 refs.)

109693 Detection of a corner reflector with insonification at angles greater than 45°. V.S.Goncharov.
Sov. J. Nondestr. Test. (USA), vol.18, no.11, p.906-9 (Nov. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.11, p.76-9 (Nov. 1982). [received: Sept. 1983]
It is shown that the acoustic path for a corner reflector can be calculated by the method of images, using a simple expression. The expression takes into account the 'focusing' action of the plane when shear waves are incident on it at angles close to the critical, as well as the attenuation of the field upon reflection from a plane reflector having small dimensions in the plane of wave incidence. Since the calculated values of $A\gamma/A\gamma=45°$ have been confirmed experimentally, the derived expression can be used for flaw detection. (5 refs.)

109694 Evaluation of the information content of the characteristics of radiation scattered by the surface of geometrical bodies. E.G.Golikov, Yu.A.Kovyazin, V.S.Kortov (S.M. Kirov Ural Polytech. Inst., USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.11, p.915-20 (Nov. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.11, p.86-92 (Nov. 1982). [received: Sept. 1983]
The results are presented of experimental investigations into the differential characteristics of radiation scattered from objects of various geometrical form to evaluate the possibilities of the radiation inspection of the effective surface area on the basis of the energy albedo of bremsstrahlung of electron accelerators. (8 refs.)

109695 Increasing the information content of radiographic methods of inspection of welded joints. V.M.Zuev, V.I.Ivanov (Central Sci.-Res. Inst. of Engng., Moscow, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.11 (Nov. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.11, p.92-6 921-4 (Nov. 1982). [received: Sept. 1983]
Problems of increasing the information content of the radiographic inspection of welded joints by using improved methods of estimating the beam dimensions of defects are examined. The accuracy and information content of the standard-photometric method of determining the dimensions of defects in the direction of radiation are analyzed. (3 refs.)

109696 Measurement of mutual impedance in eddy current testing coils. I.Uetake, R.Kuwae, H.Ito.
Trans. Natl. Res. Inst. Met. (Japan), vol.25, no.2, p.87-96 (June 1983).
Describes the results of mutual impedance measurements of self-comparison type encircling coils for eddy current testing. The measurements were performed on coils with austenitic stainless steel (SUS304) and carbon steel (S25C) bars, variating the dimensions of the coil, specimen and defect, coil-to-coil spacing and DC magnetizing strength. It was shown that the locus of mutual impedance could be explained by the law of similarity and was influenced by DC magnetizing strength. (9 refs.)

109697 Stress analysis of a rotating cylinder experiment to determine crack growth in thick section steel. K.Reading, A.M.Clayton.
Report ND-R-892(R), UKAEA, Risley, Lancs., England (June 1983), 25 pp.
Available from HMSO, London, England.
An experiment has been proposed to validate fracture assessment methods for thick walled components under 'upper shelf' conditions, using a thick walled cylinder. The cylinder is rotated to produce primary stresses. To produce secondary stresses it is heated and then quenched on the inside face. The authors compare the stress system to that of a pressure vessel and specify suitable dimensions of the cylinder to obtain 2 mm of slow ductile tearing of a full length longitudinal starter crack on the inside wall, before net section yield occurs. The results from a specially developed computer program to analyse the cylinder fracture behaviour under thermal shock are described. It is shown that the rotating cylinder adequately reproduces the essential features of fracture in a large pressure vessel. (11 refs.)

Determination of high melting points of metals and slags by a contact method .... See Entry 105328

Optimization of design parameters of eddy-current feedthrough transducer .... See Entry 105337

General-purpose superposed transducer for inspecting the magnetic permeability of products made from weakly magnetic materials .... See Entry 105342

A portable densitometer with digital indication .... See Entry 105357

Thermal chamber for physicochemical experiments in the electron microscope .... See Entry 105423

X-ray flaw-detection apparatus .... See Entry 105439

BENCHMARK. Reference data on post irradiation analysis of light water reactor fuel samples .... See Entry 105980

Analysis of cleavage fracture potential of martensitic stainless steel fusion structures. II. Fracture analysis procedures for flawed fusion structures .... See Entry 106163

The development of small specimen mechanical test techniques .... See Entry 106166

PRIZ-1 set of ultrasonic measurement transducers .... See Entry 106955

An extensometer for axial strain measurement at high temperature .... See Entry 107081

Moire interferometry for damage analysis of composites .... See Entry 107082

Ballistic apparatus for examining the behavior of materials under shock loading .... See Entry 107085

Determination of the stress state of bodies with flaws by the method of holographic photoelasticity .... See Entry 107086

A digital instrumentation package for an improved torsion pendulum .... See Entry 107087

Evaluation of the efficency of the plan of X-ray experiments in constructing inverse pole figures .... See Entry 107482

Some applications of convergent beam electron diffraction in metallurgical research .... See Entry 107492

Extinction-contour method in examining bending in thin-film objects [electron microscopy] .... See Entry 107499

Studies of point defects by positrons and positive muons .... See Entry 107676

Statistical evaluation of the mechanical strength of insulators .... See Entry 107800

Stress induced magnetization changes of steel pipes—laboratory tests .... See Entry 108753

Relation between multiregion crack growth and dynamic fatigue of glass using indentation flaws .... See Entry 109457

Size and mechanical properties of craze zones at propagating crack tips in poly(methyl methacrylate) during fatigue loading .... See Entry 109486

Acoustic emission study of microcracking damage in polycrystalline $(V,Cr)_2O_3$ during thermal cycling of the near-room-temperature phase transition .... See Entry 109489

Evaluation methods of residual fatigue life of metallic materials .... See Entry 109501

Long-term corrosion tests of materials for thermal decomposition of sulphuric acid .... See Entry 109573

Mesure continue de l'epaisseur des revetements sur les toles (Continuous measurement of the thickness of coatings on metal sheets) .... See Entry 109603

Iron oxide electrodes for photoelectrolysis of water .... See Entry 109755

81.90 OTHER TOPICS IN MATERIALS SCIENCE

109698 New method for solid-state bonding between ceramics and metals. K.Suganuma, T.Okamoto, M.Shimada, M.Koizumi (Inst. of Sci. & Industrial Res., Osaka Univ., Ibaraki, Osaka, Japan).
J. Am. Ceram. Soc. (USA), vol.66, no.7, p.C117-18 (July 1983).
A new method for solid-state bonding between ceramics and metals was developed. An interlayer, which is a composite of the materials to be bonded, is used. The technique can be applied to materials which cannot be bonded by conventional diffusion-bonding methods because of thermal-expansion mismatches. It is expected that the bonded materials will have excellent thermal shock resistance. (4 refs.)

109699 Drying of materials in magnetic high-frequency field. Yu.P.Yulenets, A.K.Arkhipov, A.V.Zhogin (Lensovet Leningrad Technol. Inst., Leningrad, USSR).
J. Eng. Phys. (USA), vol.44, no.1, p.73-5 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.88-91 (Jan. 1983). [received: Sept. 1983]
A theoretical analysis is made of energy relations which determine the efficiency of drying granular materials in a magnetic high-frequency field. (5 refs.)

109700 Comparison of the adhesion and cohesion of triblock and random copolymers of styrene and butadiene. G.R.Hamed (Inst. of Polymer Sci., Univ. of Akron, Akron, OH, USA).
J. Adhes. (GB), vol.16, no.1, p.31-9 (1983).
A substantially greater detachment energy is required to strip a polyethylene terephthalate (Mylar) film from a styrene-butadiene-styrene (SBS) triblock copolymer compared to that for peeling from a random styrene-butadiene (SBR) copolymer. It is proposed that this difference in peel strength (between the SBS and SBR) is a consequence of the much higher dissipative capacity of the former elastomer. Another manifestation of this is the higher cohesive tear strength of the SBS compared to the SBR. Extents of energy dissipation within each elastomer during detachment of the Mylar adherend are consistent with the hypothesis that the average maximum stress experience before detachment is some similar fraction of each elastomer's tensile strength. (11 refs.)

109701 Scientific goals of the D1-mission (Spacelab). P.R.Sahm, R.Jansen (Aachen Inst. of Technol., Aachen, Germany).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.115-17
Tha aim of the D1-mission is to utilise microgravity environment in space for basic research in the field of materials science (MS) and the life sciences (LS). The various disciplines involved in this mission including important mission parameters are shown. Presently about 70 experiments have been preselected for the D1-mission. The ratio between MS and LS experiments is almost 2:1. In addition, two more technologically oriented experiments dealing with navigation will be on board. The lowest common denominator of most of the involved experiments still remains their microgravity relevance and resulting effects. The multiplicity of experiments has led to numerous contacts between scientists of different disciplines, and highly valuable scientific interactions have taken place. for example, crystal growers and fluid dynamicists are effectively interacting on crystal growth theory, and new knowledge has resulted. Also, first connections are being established presently between the life sciences and fluid dynamics. (no refs.)

Cold stress at high altitudes .... See Entry 106974

Winding on circular wire with extension .... See Entry 107089

The implications of surface energy in ice adhesion .... See Entry 108117

Investigation of the chemical bonding of Cr and Ti to silicon nitride .... See Entry 108242

ESCA study of the adhesion of Ag, Cu and Ni to polysiloxane resins used in the semiconductor industry .... See Entry 109838

82.00 PHYSICAL CHEMISTRY

82.20 CHEMICAL KINETICS

109702 The influence of catalyst dilution by inert particles on the effectivity of a catalytical process in a fluidized bed. A.A.Augenblick, V.A.Kernerman, G.N.Abayev, M.G.Slin'ko (Karpov Phys. Chem.-Inst., Moscow, USSR), Yu.A.Sergeev.
Chem. Eng. Sci. (GB), vol.38, no.8, p.1217-22 (1983).
The method of the increasing a selectivity of catalytic processes in fluidized bed reactor by decreasing local chemical reaction rates together with increasing a reactive volume is discussed. Based on the two-phase model of a fluidized bed it is shown that the dilution of a catalyst by inert particles leads to an increasing of effective interphase exchange coefficients and a decreasing of effective axial mixing coefficients. Restrictions to applications of the method connected with local features of a bed structure are discussed. (22 refs.)

109703 The hysteresis of steady states in a gradientless liquid-phase reaction system. A.H.Heemskerk, J.M.H.Fortuin (Lab. voor Chem. Technol., Amsterdam, Netherlands).
Chem. Eng. Sci. (GB), vol.38, no.8, p.1261-9 (1983).
The dynamic behaviour of a reaction system in a continuous-flow stirred tank reactor is described by a model comprising the unsteady mass and heat balances and the kinetics of the reaction system concerned. This model predicts that under certain conditions a hysteresis effect will occur, which manifests itself when the steady-state temperature of the reaction system is plotted against the reference temperature. A number of experiments concerning the hysteresis effect are reported. The measurements were carried out with a well-mixed and well-insulated 236 ml reaction vessel provided with a stirrer and baffles. The reactor was filled completely with an aqueous reaction system for the acid-catalyzed hydration of methyloxiran. (11 refs.)

109704 Thermal behaviour of agitated gas-liquid reactors with a vaporizing solvent. Air oxidation of hydrocarbons. K.R.Westerterp, P.R.J.J.Crombeen (Dept. of Chem. Engng., Twente Univ. of Technol., Enschede, Netherlands).
Chem. Eng. Sci. (GB), vol.38, no.8, p.1331-40 (1983).
Many highly exothermic gas-liquid reactions are carried out with a vaporizing solvent, which after condensation is returned to the reactor. In this way the liberated reaction heat for a large part is absorbed by the cooling water flowing through the condenser. In order to determine the influence of this evaporation on the behaviour of an agitated gas-liquid tank reactor a model second order reaction was studied. The temperature dependence of the enhancement factor is strongly affected by the solvent evaporation. The influence of several design and operation parameters such as liquid residence time, dilution of reactant with solvent, air excess in the gas phase and reactor pressure on the conversion and the reactor pressure is demonstrated. (35 refs.)

109705 Falsification of kinetic parameters by incorrect treatment of recirculation reactor data. S.Wedel, J.Villadsen (Dept. of Chem. Engng., Tech. High School, Lyngby, Denmark).
Chem. Eng. Sci. (GB), vol.38, no.8, p.1346-9 (1983).
The authors propose the falsification ratio C as a new criterion to estimate the error that arises from treating the recycle reactor as CSTR. (6 refs.)

109706 Falsification of kinetic parameters by incorrect treatment of recirculation reactor data. R.Broucek (Univ. Erlangen-Nurnberg, Erlangen, Germany).
Chem. Eng. Sci. (GB), vol.38, no.8, p.1349-50 (1983).
S. Wedel and J. Villadsen (see ibid., vol.38, p.1346-9 1983) propose the falsification ratio ρ as a new criterion to estimate the error that arises from treating the recycle reactor as CSTR. The missing information of an upper limit of ρ which can still be tolerated complicates the practical use of the new criterion. The present author shows that this upper limit could be derived from the well-known demand for a gradient-free catalyst bed concerning concentration and temperature. (2 refs.)

109707 The enumeration of reaction pathways using Burnside's lemma. T.J.McLarnan (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
Theor. Chim. Acta (Germany), vol.63, no.3, p.195-207 (1983).
Formulas are given for the number and statistical weights of reaction pathways and from one molecular conformation to another via a given transition state. Arbitrary mechanistic assumptions can be incorporated into this enumeration. These formulas arise as straightforward generalizations of an expression for the number of double cosets in any group, which can be proven in one line using Burnside's lemma. (26 refs.)

109708 Reactions in glass melt systems. G.H.Frischat, M.Braedt, W.Beier (Inst. fur Nichtmetallische Werkstoffe, Tech. Univ. Clausthal, Clausthal, Germany).
Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191), Madrid, Spain, 5-8 April 1983 (Paris, France: ESA 1983), p.161-5
The μg research project 'Reaction Kinetics in Glass Melts' includes the following subtopics: interdiffusion between glass melts of different compositions, corrosion of silica glass by melts, and self diffusion in glass melts. During the past five years three TEXUS rocket experiments have been undertaken and an experiment is in preparation for the FSLP mission in October 1983. The author reports on the different experiments, on their μg relevancy and how they will be designed and performed. The necessary ground-based research work is also discussed. Finally a summary of the kinetic results obtained thus far for different glass melt systems and an outline on further work are given. (9 refs.)

Theoretical study of the structure and reactivity of the pentazole anion .... See Entry 106301

A theoretical investigation on the role of solvent in solvolytic reactions. VI. An ab initio MO calculation for dissociation of fluoromethane in hydrofluoric acid .... See Entry 106332

NMR spectroscopy of cyclohexane. Gas-phase conformational kinetics .... See Entry 106449

Mixing of chemically reactive fluids by swirling in a tubular reactor .... See Entry 107268

Mode specificity of unimolecular rate constants in the Henon-Heiles system .... See Entry 109709

A simple perturbational approach for the determination of favourable reaction pathways .... See Entry 109710

Association reactions of Na^+ and some implications for interstellar chemistry .... See Entry 109712

Kinetic study of the reaction of OH with CO from 250 to 1040K .... See Entry 109713

Rates of OH radical reactions. The reaction $OH+SO_2+N_2$ .... See Entry 109717

On the theory of adiabatic electron-transfer reactions in polar solvents .... See Entry 109719

Thermodynamic analysis and kinetics of dissociation of SiC .... See Entry 109723

Apparatus for high-pressure studies in chemical kinetics in liquid ammonia from −40°C+150°C (233-423K) .... See Entry 109731

Mathematical model of heterogeneous reactions .... See Entry 109732

Kinetics of the interaction of a liquid diffusing into another one as studied by reflection spectroscopy (ATR) .... See Entry 109736

A model for mixing with fast chemical reactions .... See Entry 109739

NMR-electrolysis combined method (NMREL). Basic principles and some applications .... See Entry 109757

The adsorption of methanol on Ag(111) and its reaction with preadsorbed oxygen .... See Entry 109795

Asymptotic analysis of single pore gas-solid reactions .... See Entry 109798

The effect of surface diffusion on surface reaction rates .... See Entry 109800

Collisional-induced dissociation of the molecular hydrogen in rarefied gas .... See Entry 110902

82.20K Potential energy surfaces for chemical reactions

(see also 31.70F -in atomic and molecular physics, 34.20 Intermolecular forces, 34.50L Atomic and molecular beam studies)

109709 Mode specificity of unimolecular rate constants in the Henon-Heiles system. Yi Yan Bai, G.Hose, C.W.McCurdy, H.S.Taylor (Fundamenteel Onderzoek der Materie, Inst. voor Atoom-en Molecuulfysica, Amsterdam, Netherlands).
Chem. Phys. Lett. (Netherlands), vol.99, no.4, p.342-6 (12 Aug. 1983).
The tunneling widths of high-energy metastable states lying in the classical irregular region of the Henon-Heiles potential energy surface were calculated via complex analytical continuation of stabilization graphs. Mode specificity is demonstrated in that the lifetimes of normal-mode, local-bond-mode, and mode-mixed states at nearby energies differ by an order of magnitude. (21 refs.)

109710 A simple perturbational approach for the determination of favourable reaction pathways. V.Bachler (Max-Planck-Inst. fur Strahlenchem., Mulheim, Ruhr, Germany), E.A.Halevi.
Theor. Chim. Acta (Germany), vol.63, no.2, p.83-101 (1983).
A simple perturbational approach has been used to establish the symmetry conditions for energetically favourable nuclear motions on a potential energy surface. In particular, the operational rules of Orbital Correspondence Analysis in Maximum Symmetry (OCAMS) for specifying the symmetry species of the nuclear displacements, which make a symmetry forbidden pathway symmetry-allowed, have been derived. A general, symmetry-independent, procedure is then proposed for finding the energetically most favourable pathway by referring to the form of the overlap density function of non-correlating orbitals. The method is demonstrated by selecting from among the several symmetry-allowed nuclear motions on the potential energy surface for the H_2+D_2 exchange reaction, that which is energetically most favourable. (22 refs.)

109711 Search for saddle points of energy hypersurfaces using a multidimensional space of 'guiding' coordinates. I.Balint, M.I.Ban (Inst. of General & Phys. Chem., Attila Jozsef Univ., Szeged, Hungary).
Theor. Chim. Acta (Germany), vol.63, no.3, p.255-68 (1983).
For the determination of saddle points (SPs) of adiabatic potential surfaces a novel method defining a 'pseudo reaction path' (PRP) is presented. The PRP consists of two components, the one is being the function of some selected 'guiding' coordinates and the other is depending on the remaining ones. The tangent components of the PRP are parallel and antiparallel to the normals of the tangential planes of the equipotential surfaces defined by the two groups of coordinates. PRPs starting from points in an approximately chosen domain of the configurational space arrive at the SP. (46 refs.)

A study of the nonadiabatic effects in the $Li-Li_2^+$ system: typical minimum energy paths for the reaction $Li+Li_2^+ \to Li_3^+$ .... See Entry 109735

82.20R Energy distribution and transfer, relaxation

(see also 31.70H Time-dependent phenomena in atomic and molecular physics)

Infrared multiphoton excitation: energy distribution of reacting molecules from overtone excitation studies .... See Entry 106519

82.30 SPECIFIC CHEMICAL REACTIONS; REACTION MECHANISMS

109712 Association reactions of Na^+ and some implications for interstellar chemistry. D.Smith, N.G.Adams, E.Alge (Dept. of Space Res., Univ. of Birmingham, Birmingham, England), E.Herbst.
Astrophys. J. (USA), vol.272, no.1, pt.1, p.365-8 (1 Sept. 1983).
Three-body association reactions of Na^+ with a variety of neutral gases in the presence of He as third body have been studied in a SIFT at 80K. The measured rate coefficients are utilized to estimate radiative association rate coefficients at 20K. It is shown that Na^+-neutral radiative association reactions play a role in the depletion of Na^+ in dense interstellar clouds and can produce a sufficient amount of NaOH to explain its observed tentative abundance in Sgr B2. (25 refs.)

109713 Kinetic study of the reaction of OH with CO from 250 to 1040K. A.R.Ravishankara, R.L.Thompson (Engng. Experiment Station, Georgia Inst. of Technol., Atlanta, CA, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.377-81 (19 Aug. 1983).
Absolute rate coefficients (k_1) for the reaction of OH with CO have been measured in the temperature range of 250-1040K. The technique of flash photolysis-resonance fluorescence was employed for these measurements. The obtained data are best fit by the expression $k_1=\exp(-30.03+1.22\times10^{-3}T)$ cm^3 $molecule^{-1}$ s^{-1}. (14 refs.)

109714 Laser-assisted chemical reactions: semiclassical approach employing Floquet and *R*-matrix theories. M.Mohan, K.F.Milfeld, R.E.Wyatt (Dept. of Chem., Univ. of Texas, Austin, TX, USA).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.411-16 (19 Aug. 1983).
A general theory of laser-assisted reactions which includes multiphoton effects is presented. The scattering dynamics is determined by the quantal R-matrix formalism and the semiclassical radiation-complex interaction is described by nonperturbative Floquet theory. The theory is applied to a model collinear A+BC reaction in an IR laser field. (23 refs.)

109715 Chemiluminescence induced in the laser-promoted reaction of ethanol with oxygen. J.M.Riveros, P.C.Isolani (Inst. de Quimica, Univ. of Sao Paulo, Sao Paulo, Brazil), S.R.A.Leite.
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.442-4 (19 Aug. 1983).
The vibrational multiphoton excitation of ethanol in the presence of oxygen results in chemiluminescent reactions yielding CH^* and C_2^*. The rise times of the chemiluminescence become progressively slower and the intensity increases with additional O_2 pressure. At 15 Torr of O_2 the emission duration is longer than 10 μs. (14 refs.)

109716 Model compounds for protonation of benz[a]phenazine: spectroscopy of protonated 1,2- and 3,4-benzacridines. A.Mordzinski, A.Grabowska (Inst. of Phys. Chem., Polish Acad. of Sci., Warsaw, Poland).
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.450-5 (19 Aug. 1983).
Absorption fluorescence and MCD spectra of 1,2- and 3,4-benzacridines (1,2- and 3,4-BAc) and their conjugate acids ($BAcH^+$) are reported. Comparison with 1,2- and 3,4-$BAcH^+$ as model compounds for singly protonated benz[a]phenazine (BfH^+) support the prior hypothesis of its distortion in the S_1 state [1]. The model of distortion−folding of BfH^+ along its N-N axis−was reproduced by INDO/S calculations. (12 refs.)

109717 Rates of OH radical reactions. The reaction $OH+SO_2+N_2$. G.Paraskevopoulos, D.L.Singleton, R.S.Irwin (Div. of Chem., Nat. Res. Council of Canada, Ottawa, Canada).
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.83-7 (26 Aug. 1983).
Absolute rate constants for the reaction $OH+SO_2+N_2$ have been determined in the gas phase, at 297K, in the pressure range 50-760 Torr. OH radicals were generated by flash photolysis of N_2O/H_2 mixtures and were monitored by time-resolved resonance absorption. The second-order rate constant k_{II} was found to depend on the pressure of N_2 and may be expressed as: $k_{II}=7.4\times10^{11}/(1+237/P)$ where P is in Torr and k_{II} in cm^3 mol^{-1} s^{-1}. (20 refs.)

109718 Prediction and interpretation of collinear reactive scattering resonances by the diagonal corrected vibrational adiabatic hyperspherical model. J.Romelt (Lehrstuhl fur Theoretische Chem., Univ. Bonn, Bonn, Germany).
Chem. Phys. (Netherlands), vol.79, no.2, p.197-209 (1 Sept. 1983).
One-dimensional single-channel scattering calculations on an effective potential are used to discuss resonances in collinear reactions and to predict their energetic location almost quantitatively. The effective potential includes the vibrationally adiabatic potential and the adiabatic diagonal correction in Delves' mass-weighted polar coordinates (hyperspherical coordinates). This diagonal corrected vibrational adiabatic hyperspherical (DIVAH) model is tested for a variety of reactions ($H+H_2$, H+MuH, I+HI, $F+H_2$) and a detailed discussion of the effective potential and its physical implications is given. (46 refs.)

109719 On the theory of adiabatic electron-transfer reactions in polar solvents. A.B.Helman (Inst. of Inorganic Chem., Acad. of Sci., Novosibirsk, USSR).
Chem. Phys. (Netherlands), vol.79, no.2, p.235-44 (1 Sept. 1983).
A theory describing the rate of adiabatic electron-transfer reactions in a polar medium with an arbitrary spectrum of the dielectric losses is presented. All results are given in terms of analytical expressions via integrals over the frequency-dependent dielectric permittivity of the solvent. The present work is a generalization of the well-known work of Kramers, concerning escape over a potential barrier, for the case where the motion on the reaction coordinate is an arbitrary normal random process and it may serve as a substantiation of the transition-state method. (22 refs.)

109720 Gas-phase solvation of NO_2^- and NO_3^- by ethyl nitrate. S.Wlodek, Z.Luczynski, H.Wincel (Dept. of Radiation Chem., Inst. of Nuclear Res., Warsaw, Poland).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.149-63 (1 Sept. 1983).
The gas-phase clustering reactions $NO_2^-.(C_2H_5ONO_2)_{n-1}+C_2H_5ONO_2=NO_2^-.(C_2H_5ONO_2)_n$ (n=1-3) $NO_3^-.(C_2H_5ONO_2)_{n-1}+C_2H_5ONO_2=NO_3^-.(C_2H_5ONO_2)_n$ (n=1 and 2) have been studied by means of a high-pressure mass spectrometer at temperatures from 200 to 380K and at total pressures of 0.5-2 torr. Under the conditions used these reactions, with the exception of $NO_2^-+C_2H_5ONO_2=NO_2^-.C_2H_5ONO_2$, achieve thermodynamic equilibrium above 1 torr. On the basis of the temperature dependence measurements of the equilibrium constants, thermodynamic data have been determined. The following $\Delta H^0_{n-1,n}$ values were obtained: $NO_2^-.(C_2H_5ONO_2)_n$; $\Delta H_{0,1}^0=-20.9$ (indirectly obtained), $\Delta H_{1,2}^0=-8.5$ and $\Delta H_{2,3}^0=-7.3$ kcal mol^{-1}; $NO_3^-.(C_2H_5ONO_2)_n$; $\Delta H_{0,1}^0=-17.2$ and $\Delta H_{1,2}^0=-7.2$ kcal mol^{-1}. Semiempirical INDO MO calculations were performed for $NO_2^-.(C_2H_5ONO_2)_{n=1,2}$ and $NO_3^-.(C_2H_5ONO_2)_{n=1,2}$ to test the structures and binding energies of these systems. The experimental observations are discussed in terms of the structure stabilities of the solvated ions. (16 refs.)

109721 Metastable doubly-charged ions of methane studied by means of a triple-sector mass spectrometer. M.Rabrenovic, A.G.Brenton, J.H.Beynon (Royal Society Res. Unit, Univ. Coll. of Swansea, Swansea, Wales).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.175-82 (1 Sept. 1983).
A triple-sector mass spectrometer is described in which the ion beam traverses successively a magnetic sector and two electric sectors. The advantages of this arrangement in suppressing artifact peaks and in enabling fast and slow reactions of ions formed in the region between the magnetic sector and the first electric sector are described. The instrument is used to study the fragmentation of CH_4^{2+} ions of low internal energy formed by charge stripping. Whilst unstable CH_4^{2+} ions react to give CH_2^{2+} and C^{2+}, metastable CH_4^{2+} ions give the charge separation reaction leading to CH_3^+ and H^+. The lifetime of some CH_4^{2+} ions formed by charge stripping of CH_4^+ is several microseconds. (14 refs.)

109722 Mechanism of fragmentation of organic molecules during keV particle bombardment. D.W.Moon, N.Winograd (Dept. of Chem., Pennsylvania State Univ., University Park, PA, USA).
Int. J. Mass Spectrom. & Ion Phys. (Netherlands), vol.52, no.2-3, p.217-21 (1 Sept. 1983).
A simplified scheme is presented to distinguish between surface and gas-phase fragmentation of molecular ions in SIMS or FABMS experiments. The scheme is based on the measurement of the polar angle distribution of ejected

parent and daughter cluster ions and is derived from straightforward considerations of classical mechanics. Examples are given for chlorobenzene, benzene and pyridine adsorbed on to Ag(111) at 153K. (10 refs.)

109723 Thermodynamic analysis and kinetics of dissociation of SiC. S.V.Baranov, A.G.Vodop'yanov, G.K.Moiseev, G.N.Kozhevnikov (Inst. of Metall., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1097-100 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1300-3 (Aug. 1982).
Calculations which simulate thermal decomposition of SiC at 2000-3300K and total pressure of 9.81×10^{-2} MPa in an initial atmosphere of He and Co were performed on an ES-1040 computer based on a program which executes an algorithm for minimisation of the total potentials of the system. It was found that free carbon is formed in the condensed phase under ~2800K, while liquid silicon is also formed at 2800-3100K. Monoatomic silicon is the basic gaseous product of dissociation in an initial atmosphere of He, while silicon monoxide is the basic product in an initial atmosphere of CO. Dissociation of SiC at the same temperatures is more complete in CO than in the inert gas. The results of the computer simulation were experimentally confirmed: it was found that dissociation of SiC is more complete in CO than in the inert gas; carbon is found in samples of SiC heated to 2270K, while metallic silicon is found at 2770K. A correlation between the rate constant of dissociation of SiC and the temperature was obtained for the 2270-2670K interval in an atmosphere of CO. (2 refs.)

109724 Formation of tungsten carbides on reaction of tungsten trioxide with carbon in a low-temperature plasma. G.K.Moiseev, S.K.Popov, L.A.Ovchinnikova, N.A.Vatolin (Metall. Inst., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1101-4 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1304-7 (Aug. 1982).
Calculations have been carried out which model the formation of tungsten carbides from tungsten trioxide and carbon at 1000-4000K in a starting medium of Ar. The compositions and content of the components of the phases have been determined, plus the energy expenditures in carrying out the process. It has been found that at various starting concentrations of the reducing agent, up to 3100K, mixtures of crystalline WC and α-W_2C with carbon are formed; above about 3100K, liquid solutions of carbon in tungsten. In an $Ar+H_2$ plasma at 3000K and a treatment time of 180 sec, experiments have been performed on the preparation of tungsten carbides from tungsten trioxide and carbon at various ratios of these materials. It has been found that mixtures of WC, α-W_2C, and carbon are formed. Ratios of the carbides in these mixtures have been calculated from analytical chemical data. The results of the calculations and the experimental figures agree satisfactorily with one another. (8 refs.)

109725 Negative ion formation in collision of electron with H_2 and isotopes. S.Bhattacharyya (Dept. of Phys., Gokhale Coll., Calcutta, India), L.Chatterjee, T.Roy.
Indian J. Phys. Part B, vol.57B, no.2, p.184-9 (April 1983). [received: Sept. 1983]
Cross-section for unstable H^- ion formation from dissociative attachment (DA) of H_2 and D^- formation from D_2 are computed using non-relativistic quantum electrodynamics. Peaks are observed in the DA of H_2 and D_2 in the range 12 to 12.5 eV, corresponding experimental peaks (Rapp, Sharp and Briglia 1965) being observed in the range 10-12 eV. Experimental effect of smaller probability with heavier mass is also confirmed. (14 refs.)

109726 Energy and time dependence of the decay processes of toluene molecular cations. R.Bombach, J.Dannacher, J.-P.Stadelmann (Phys.-Chem. Inst., Univ. Basel, Basel, Switzerland).
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4205-11 (29 June 1983).
The breakdown diagram of toluene cation has been determined by time-resolved He Iα photoelectron-photoion coincidence spectroscopy. The data have been analyzed within the framework of RRKM theory. The most notable outcomes concern: evidence for the entirely statistical nature of the investigated dissociative processes, the rate-energy functions for the formation of tropylium and benzylium cation, the 0K enthalpies of formation of $\Delta H_f{}^{\circ}{}_0$(tropylium cation)$=872\pm6$ kJ/mol and $\Delta H_f{}^{\circ}{}_0$(benzylium cation)$=935\pm9$ kJ/mol, the rate-energy function for the secondary fragmentation of the $C_7H_7^+$ ions, an upper limit of $\Delta H_f{}^{\circ}{}_0(C_5H_5^+)=1034\pm15$ kJ/mol for the product ion of this latter reaction, and a quantitative determination of the considerable kinetic shift associated with this secondary process. The partly bimolecular character of ion cyclotron resonance and collisional activation data and the vastly unknown extent of the isomerization of the two isomeric $C_7H_7^+$ primary product ions prevent an extensive comparison with previous results. (32 refs.)

109727 Chemical properties of the gas-phase benzvalene radical cation. D.L.Miller, M.L.Gross (Dept. of Chem., Univ. of Nebraska, Lincoln, NE, USA).
J. Am. Chem. Soc. (USA), vol.105, no.13, p.4239-43 (29 June 1983).
The nature of the gas-phase benzvalene radical cation has been explored by means of comparative ion-molecule reactions studied by Fourier transform mass spectrometry and by comparative collision-induced dissociation spectra obtained by mass spectrometry/mass spectrometry. This C_6H_6 radical cation has a unique structure different from previously studied C_6H_6 radical cations, including ionized benzene. The authors conclude that the structure is similar to that of its neutral precursor. The rate constant of the reaction with neutral butadiene has also been measured and compared with the rate constant of the reaction of ionized fulvene and butadiene. (48 refs.)

109728 On the structure of anions derived from cycloheptatriene in the gas phase. R.L.White, L.Wilkins, J.J.Heitkamp, S.W.Staley (Dept. of Chem., Univ. of California, Riverside, CA, USA).
J. Am. Chem. Soc. (USA), vol.105, no.15, p.4868-70 (27 July 1983).
Fourier transform mass spectrometric studies of hydrogen-deuterium exchange in gas-phase anion-molecule reactions at 6×10^{-6} torr have led to the conclusion that a species with the time-averaged symmetry of the cycloheptatrienyl anion (2) is formed by proton abstraction from cycloheptatriene (1) and then rapidly rearranges to the benzyl anion (3) when OD^- (and possibly ND_2^-) is employed as the abstracting base. These conclusions are supported by the results of 1-7,7-d_2 or 1-1,2,3,4,5,6-d_6 and OH^-, which show the required scrambling of the label in 3, and by results of $C_7H_7^-$ from toluene, which parallel those for $C_7H_7^-$ from 1 with ND_3 of D_2O but not with CD_3OD. Anion 2 undergoes exchange but does not rearrange to benzyl in the presence of CD_3OD. Evidence was not obtained for electron autodetachment from 3 formed from 1. Since such behavior is expected for unimolecular isomerization, it is concluded that rearrangement occurs predominantly in a complex between 2 and water. (18 refs.)

109729 Molecular dynamical studies of the dissociation of a diatomic molecular crystal. I. Energy exchange in rapid exothermic reactions. D.H.Tsai (NBS, Washington, DC, USA), S.F.Trevino.
J. Chem. Phys. (USA), vol.79, no.4, p.1684-97 (15 Aug. 1983).
The authors discuss the results of a study of the exothermic dissociation of a model diatomic molecular crystal. Their main purpose is to investigate the dynamics of energy transport and energy sharing in this system during the dissociation process. The crystal was prepared in a metastable molecular form, in thermal equilibrium at a low initial temperature and pressure. When they heated the system to a higher temperature, at constant volume, they observed thermally initiated dissociations which progressed rapidly to completion. During the dissociation process, they found that the sharing of the potential energy released by the metastable molecules with the rest of the system, and the sharing of the kinetic energy of the dissociated fragments with the kinetic energy of the molecules in the translational degrees of freedom, were rather efficient. But the intra- and intermolecular exchange of the kinetic energy among the various degrees of freedom, namely translation-rotation, translation-vibration, and rotation-vibration was inefficient. Dissociation would occur in one of the regions of high local kinetic energy density, after a molecule in that region had acquired sufficient vibrational energy to break apart, and when the 'caging' effect was favorable to allow the molecule to dissociate. From such a reaction site, and there may be others, the reaction would spread to a neighboring site, and continue this way until all the molecules became dissociated. The induction time showed an approximately logarithmic dependence on the inverse of the temperature of the system after heating. But during the process of rapid dissociation, both the potential energy and the kinetic energy of the system underwent rapid changes, and thermal equilibrium was not reached until the end of the process. (31 refs.)

109730 Electron transfer in the $O_2^+(X^2\Pi_g, v=0\text{-}8)+O_2(X^3\Sigma_g, v=0)$ system. A.E.DePristo (Dept. of Chem., Iowa State Univ., Ames, IA, USA).
J. Chem. Phys. (USA), vol.79, no.4, p.1741-4 (15 Aug. 1983).
Total charge exchange cross sections for the $O_2^+/.O_2$ system were calculated for vibrational levels of the ion up to $v=8$ with ground state neutrals. Four different interaction potentials were utilized, each with different coupling strength between the two electronic arrangements, and the results compared to experimental data. Quantitative agreement was not obtained and qualitative agreement was determined to reflect mainly the use of accurate vibrational overlaps and energy gaps rather than the features of the interaction. The implication of these results for the general theoretical treatment of ion-molecule reactions is discussed briefly. (25 refs.)

109731 Apparatus for high-pressure studies in chemical kinetics in liquid ammonia from −40°C+150°C (233-423K). S.Balt, J.P.Musch, W.E.Renkema, H.Ronde (Dept. of Inorganic Chem., Free Univ., Amsterdam, Netherlands).
J. Phys. E (GB), vol.16, no.9, p.829-31 (Sept. 1983).
A high-pressure apparatus (0-700 MPa) is described that allows kinetic measurements ($t_{1/2}>6$ min) on a routine base in liquid ammonia by in situ spectrophotometry. As an illustration preliminary results on the nitrito-nitro linkage isomerisation reaction of the penta-amminecobalt (III) complex are reported. The activation volume for this reaction, at 5°C (278K) is reported. (4 refs.)

109732 Mathematical model of heterogeneous reactions. V.A.Kirakosyan, A.P.Baskakov (S.M. Kirov Ural Polytech. Inst., Sverdlovsk, USSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1104-10 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.589-97 (Oct. 1982). [received: Sept. 1983]
The authors consider the reactions of a spherical porous particle with gas or liquid in a sufficiently general form, but limit themselves to reactions which do not change the volume of the particle. The macrokinetics of the reaction will be represented as follows. The gaseous or liquid reagent reaches the surface of the particle by convection. Subsequently, it diffuses in the bulk of the solid reagent and simultaneously reacts with it. The gaseous or liquid product which is thus formed escapes from the reaction zone by diffusion and mass exchange into the surrounding medium. In the course of the reaction, the authors neglect the change of volume of the fluid reagent and also the kinetic and diffusion characteristics of the solid. At any point the reaction proceeds until all reagent at this point is used up. As a result, starting from a definite moment of time, a crust of the solid reaction product is formed on the surface of the particle. The thickness of this crust increases as the reaction develops until all volume of the particle undergoes the reaction. (6 refs.)

109733 Experimental evidence of nucleation induced transition in a bistable chemical system. J.C.Roux, P.De Kepper, J.Boissonade (Centre de Recherche Paul Pascal, Univ. de Bordeaux I, Talence, France).
Phys. Lett. A (Netherlands), vol.97A, no.4, p.168-70 (22 Aug. 1983).
It is experimentally shown that a chemical nonequilibrium bistable system presents metastability and stirring rate sensitivity in full agreement with theoretical predictions of nucleation induced transitions. (16 refs.)

109734 The unified thermal and chain branching model of hydrocarbon oxidation in a well stirred continuous flow reactor. I.Gonda, B.F.Gray (Dept. of Pharmacy, Univ. of Aston, Birmingham, England).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1796, p.133-52 (8 Sept. 1983).
The Gray-Yang 'skeleton' model of hydrocarbon oxidation, which unified the thermal and chain branching theories of hydrocarbon oxidation, is analysed in detail in order to probe its ability to account for the recent experimental observations in continuously stirred tank reactors. Using rigorous mathematical analysis, the nature of the thermokinetic steady states is investigated, and particular attention is paid to the existence of stable limit cycles originating from supercritical Hopf bifurcations. These oscillations representing the 'cool flames' disappear at the low temperature limit via limit cycle-saddle point bifurcations. The origin of 'two-stage' ignitions is traced to these bifurcations; the computed trajectories exhibit 'shoulders' characteristic of such ignitions. When the ambient temperature is traversed slowly upward or downward, rapid transitions between quasi-steady states occur. The system shows hysteresis in the transitions between oscillatory and non-oscillatory steady states. (23 refs.)

109735 A study of the nonadiabatic effects in the Li-Li_2^+ system: typical minimum energy paths for the reaction $Li+Li_2^+\rightarrow Li_3^+$. J.Vojtik, A.Krtkova, R.Polak (J. Heyrovsky Inst. of Phys. Chem. & Electrochem., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Theor. Chim. Acta (Germany), vol.63, no.3, p.235-43 (1983).
Mutual arrangement and nonadiabatic coupling between the lowest two singlet potential energy surfaces of the Li_3^+ system are studied along typical ground-state minimum energy paths for the reaction $Li+Li_2^+\rightarrow Li_3^+$. The potentials and nonadiabatic coupling matrix elements are obtained using the diatomics-in-molecules method. The relative Li-Li_2^+ motion along the pathways is predicted to be inefficient in causing nonadiabatic transitions from the ground state to the first excited state of the system. (19 refs.)

109736 Kinetics of the interaction of a liquid diffusing into another one as studied by reflection spectroscopy (ATR). A.Z.Trifonov (Inst. of Organic Chem., Bulgarian Acad. of Sci., Sofia, Bulgaria), B.K.Shishedjiev, R.B.Kuzmanova, R.Stefanova.
Waerme- & Stoffuebertrag. (Germany), vol.17, no.4, p.237-40 (1983).
An approach is offered for determining the reaction rate constant (k) between two liquid substances, the one penetrating into the other. The procedure is based on the experimental measurement of the diffusion coefficient ($\mathcal{D}$). As

model reaction the isotopic exchange process in the ketone octanone-2 molecule is chosen, whose active hydrogen atoms undergo deuteration by the strong base trioctyl-methyl-ammonium deuteroxide (TOMA-OD). The diffusion coefficient of the penetrating TOMA-OD, when this reaction takes place, and the rate constant of the latter are determined by an attenuated total reflection (ATR) spectroscopic method on the grounds of appropriate mathematical modeling. (5 refs.)

Oxidation-reduction properties of mixed oxides in lanthanum-uranium-oxygen system .... See Entry 105960

Controlled air pyrolysis incinerator .... See Entry 105989

Preparation of thorium metal sponge from thorium oxalate .. See Entry 106069

Preparation of (UPu)C, (UPu)N and (UPu) (CN) powders ...... See Entry 106070

Pyrohydrolysis reactions of UF_4 and UO_2F_2. Effect of oxygen on reactions .... See Entry 106071

Orbital SCF energies in the double proton transfer of the adenine-thymine base pair .... See Entry 106279

Ab initio molecular orbital calculations on the interconversion of allene and propyne cation radicals and the mechanism for hydrogen loss from $C_3H^+{}_4$ .... See Entry 106283

A theoretical investigation on the role of solvent in solvolytic reactions. VI. An ab initio MO calculation for dissociation of fluoromethane in hydrofluoric acid .... See Entry 106332

Photoionisation spectrum of Te I: autoionising series and relative cross section .... See Entry 106369

Vibrational analysis of acetate ion molecules and estimation of equilibrium constants for their hydrogen isotopic exchange reactions .... See Entry 106409

Picosecond transient Raman spectroscopy: the photoisomerization of trans-stilbene .... See Entry 106427

NMR spectroscopy of cyclohexane. Gas-phase conformational kinetics .... See Entry 106449

Influence of the relative position of nitro groups on intermolecular sodium exchange processes in dinitrobenzene ion pairs, investigated by EPR spectroscopy .... See Entry 106470

Fluorescence excitation spectrum of triptycene in a supersonic jet .... See Entry 106494

Proton affinity of GeH_4 and the shape of $GeH_5{}^+$ .... See Entry 106537

Collision energy dependence of vibration/rotational distribution of BaBr produced in the crossed beam reaction $Ba+CH_3Br$ .... See Entry 106545

Asymmetry effect in H^++H^- neutralization. Application to the $n=3$ pseudocrossing .... See Entry 106566

Reactions of carbonyl compounds and Group Ib metals in a plasma in the wake of a spark .... See Entry 107333

Reactions of Group Ib metal ions with selected hydrocarbons in the source of a spark source mass spectrometer .... See Entry 107334

Decomposition and polymerization of silicon tetrachloride in a microwave plasma. A mass-spectrometry investigation .... See Entry 107440

A study on the morphological changes due to reduction of WO_3 to α-W .... See Entry 107641

Microstructure and stability of iron chloride graphites .... See Entry 107642

Evaporation thermodynamics of lanthanum monotelluride ..... See Entry 107897

Interaction between platinum and melts of compounds containing bismuth oxides .... See Entry 107958

Gadolinium monophosphide at elevated temperatures .... See Entry 107982

Room temperature exchange reaction at the Al-InP (110) interface: soft X-ray photoemission studies .... See Entry 108073

Time and temperature dependences of phosphorus evolution from InP .... See Entry 108222

A new type of regular concretion of crystals [gypsum] .... See Entry 109144

Possibilities of deoxidation of molybdenum with manganese and metals of the iron group .... See Entry 109188

The influence of catalyst dilution by inert particles on the effectivity of a catalytical process in a fluidized bed .... See Entry 109702

The hysteresis of steady states in a gradientless liquid-phase reaction system .... See Entry 109703

Reactions in glass melt systems .... See Entry 109708

Mode specificity of unimolecular rate constants in the Henon-Heiles system .... See Entry 109709

Gas-phase chemiluminescent reactions of ozone with monoterpenes .... See Entry 109748

NMR-electrolysis combined method (NMREL). Basic principles and some applications .... See Entry 109757

Correlation between the photoelectron emission and photooxidation threshold energies of a solute in the condensed phase .... See Entry 109764

Reversible, light-induced isomerization of matrix-isolated molecules. Nitrosomethanol .... See Entry 109768

On the binding of ligands to macromolecules: an accurate procedure .... See Entry 109786

Saturated vapor pressure and heat of formation of As_4S_4 ...... See Entry 109788

Crystallisation and topochemical processes occurring on the surfaces of crystals of phosphates .... See Entry 109799

Sprayed CdS-Cu_2S solar cells. II. Preparation of CdS by airless spray .... See Entry 109891

Status of the cadmium thermoelectrochemical hydrogen cycle .... See Entry 109920

Collisional-induced dissociation of the molecular hydrogen in rarefied gas .... See Entry 110902

Synthesis of chain molecules in regions with partially ionised carbon .... See Entry 111172

On the calculation of ion-molecule reaction rates in interstellar space and planetary atmospheres .... See Entry 111187

82.35 POLYMER REACTIONS AND POLYMERIZATION

109737 Plasma polymerization of ethane. I. Experimental studies of effluent gas composition and polymer deposition rates. R.J.Jensen, A.T.Bell, D.S.Soong (Dept. of Chem. Engng., Univ. of California, Berkeley, CA, USA).
Plasma Chem. & Plasma Process. (USA), vol.3, no.2, p.139-61 (June 1983).
The plasma polymerization of ethane was studied in a flow reactor of rectangular cross section. The plasma was sustained between parallel-plate electrodes by an F generator operating at 13.56 MHz. The composition of the gas leaving the reactor was analyzed by gas chromatography. Polymer deposition rates were measured as a function of axial position in the reactor, using a quartz-crystal microbalance. The effluent gas is composed primarily of unreacted C_2H_6 and H_2. Significant concentrations of CH_4, C_2H_4, C_2H_2, and C_3H_8, and small amounts of C_3H_6, i-C_5H_{12}, and n-C_5H_{12} are also observed. The distribution of these products is a strong function of the discharge power and of the gas pressure and residence time in the plasma. These experimental variables also affect both the rate of polymer deposition and the shape of the deposition profile along the reactor axis. (29 refs.)

109738 Plasma polymerization of ethane. II. Theoretical analysis of effluent gas composition and polymer deposition rates. R.J.Jensen, A.T.Bell, D.S.Soong (Dept. of Chem. Engng., Univ. of California, Berkeley, CA, USA).
Plasma Chem. & Plasma Process. (USA), vol.3, no.2, p.163-92 (June 1983).
For pt.I see ibid., vol.3, no.2, p.139 (1983). A theoretical model has been developed to describe the deposition of polymer occurring in a capacitatively coupled, low-pressure RF discharge sustained in ethane. The reaction mechanism chosen for this model assumes that polymer formation is controlled by the formation of free radicals in the plasma and the subsequent reaction of these species at the surface of the electrodes used to sustain the plasma. Convective and diffuse transport is taken to occur in the direction parallel to the electrodes. Diffusive transport perpendicular to the electrodes is considered to be rapid, and hence the gradients in this direction are taken to be negligible. Both the composition of the gas leaving the plasma reactor and the axial profile of polymer deposition rate within the reactor, observed experimentally, are predicted accurately by the model. Results obtained from the model have also been used to estimate the kinetic chain length and degree of unsaturation in the polymer. Both predictions are in reasonable agreement with experimental observations. (78 refs.)

Decomposition and polymerization of silicon tetrachloride in a microwave plasma. A mass-spectrometry investigation .... See Entry 107440

Effect of lubricants on frictional polymerization of palladium electrical contacts .... See Entry 108525

82.40 CHEMICAL KINETICS AND REACTIONS: SPECIAL REGIMES

109739 A model for mixing with fast chemical reactions. V.G.Jenson (Dept. of Chem. Engng., Univ. of Birmingham, Birmingham, England).
Chem. Eng. Sci. (GB), vol.38, no.8, p.1151-7 (1983).
A previously published model of an unmixed spherical eddy containing an immobile reactant surrounded by a restricted volume of well mixed fluid has been improved by allowing all of the reactants and products to diffuse equally both within the eddy and in the surrounding fluid. The predicted development of the concentration profiles for a competitive consecutive second order reaction scheme is illustrated and shown to be physically reasonable. The final comparison with published experimental data confirms that the model is capable of predicting the results without the necessity of fitting any parameter values other than choosing the Kolmogoroff microscale for the diameter of the eddies. (9 refs.)

109740 Applicability limits of the stationary combustion model in the study of explosive initiation. S.G.Andreev, A.N.Isaev, V.S.Solov'ev, A.I.Chernov.
Combust. Explos. & Shock Waves (USA), vol.18, no.6, p.613-18 (Nov.-Dec. 1982). Translation of: *Fiz. Goreniya & Vzryva (USSR)*, vol.18, no.6, p.3-9 (Nov.-Dec. 1982).
Using the theory of stationary combustion, the authors establish limiting values for the parameters of hearth decomposition of an explosive. Use of the stationary combustion model permits qualitative analysis of the features of explosive combustion upon shock loading. (11 refs.)

109741 Erosion combustion of a solid fuel for various gas flow temperatures. A.M.Lipanov, I.G.Rusyak.
Combust. Explos. & Shock Waves (USA), vol.18, no.6, p.618-23 (Nov.-Dec. 1982). Translation of: *Fiz. Goreniya & Vzryva (USSR)*, vol.18, no.6, p.9-14 (Nov.-Dec. 1982).
In the theory of erosion combustion, turbulences in the flame zone is responsible for increasing the combustion rate of a solid fuel at high gas speeds. The authors examine the erosion combustion for various incident temperatures within the framework of the existing concepts. Two limiting cases are considered: 1) low pressures $p=2$-8 MPa, where there are two zones of heat production in the combustion region, and the combustion mechanism can be considered approximately as due to two successive overall reactions; 2) pressures $p>8$ MPa, where the two stages fuse into one and the combustion can be represented as due to a single overall reaction. (11 refs.)

109742 Dynamics of gas combustion in closed vessels with various laws of flame-surface variation. V.S.Babkin, P.K.Senachin, T.V.Krakhtinova.
Combust. Explos. & Shock Waves (USA), vol.18, no.6, p.623-8 (Nov.-Dec. 1982). Translation of: *Fiz. Goreniya & Vzryva (USSR)*, vol.18, no.6, p.14-20 (Nov.-Dec. 1982).
The authors investigate the general properties and features of the dynamics of gas combustion with different laws of the variation in the flame surface. The model laws of the variation in flame surface may expediently be chosen in the form of laws realized in the propagation of diverging of converging flames with spherical, cylindrical, and plane symmetry. Such flames give broad and, at the same time, systematic variations in the flame-front areas, imitating the broad range of real processes. (14 refs.)

109743 Flame zone in gas combustion in an inert porous medium. A.A.Korzhavin, V.A.Bunev, R.Kh.Abdullin, V.S.Babkin.
Combust. Explos. & Shock Waves (USA), vol.18, no.6, p.628-31 (Nov.-Dec. 1982). Translation of: *Fiz. Goreniya & Vzryva (USSR)*, vol.18, no.6, p.209-3 (Nov.-Dec. 1982).
The extent of the combustion zone of a gas mixture in a porous medium is determined, and a deduction is made that the combustion zone also contains products being cooled, in addition to chemical reaction foci. On the basis of the data obtained, the extent of the combustion zone is substantially greater than the thickness of the laminar flame front. It is deduced that the flame propagation regime in a porous medium is turbulent in nature. (6 refs.)

109744 Experimental study of stationary flame propagation in a tube under conditions of weightlessness. V.P.Samsonov, S.A.Abrukov, A.E.Davydov, V.A.Danilkin, V.Ya.Tyameikin.
Combust. Explos. & Shock Waves (USA), vol.18, no.6, p.650-2 (Nov.-Dec. 1982). Translation of: *Fiz. Goreniya & Vzryva (USSR)*, vol.18, no.6, p.45-8 (Nov.-Dec. 1982).
The authors investigate the changes in form of a laminar flame under the influence of natural thermal convection with stationary propagation in a vertical tube under normal gravitational conditions and under conditions of weightlessness, in which case convection is absent. (12 refs.)

109745 Existence and uniqueness of the steady solution of the equations of the problem of exothermal-wave propagation in a two-phase medium. P.L.Gusika.
Combust. Explos. & Shock Waves (USA), vol.18, no.6, p.690-5 (Nov.-Dec. 1982). Translation of: *Fiz. Goreniya & Vzryva (USSR)*, vol.18, no.6, p.90-6 (Nov.-Dec. 1982).
The author shows that the question of the existence and uniqueness of the solution of the system of equations as a whole, may be answered in the affirmative if it is proved that the specified initial and thermophysical parameters correspond to a unique value of the velocity and a unique solution of the equations for the reaction zone, satisfying the conditions at its boundaries with the heating zone and the thermal relaxation zone. (12 refs.)

109746 Method of calculating limits of stabilization of a flame of inhomogeneous mixtures traveling over a poorly streamlined body. V.L.Apollonov, V.N.Gruzdev, A.V.Talantov (A.N. Tupoleva Kazan Polytech. Inst., Kazan, USSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1068-72 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.548-54 (Oct. 1982). [received: Sept. 1983]
A method has been developed for calculating the range of stabilization of a flame of inhomogeneous mixtures with allowance for characteristics of the atomization, vaporization, and distribution of the fuel in the flow. (8 refs.)

109747 Fire and combustion systems. J.R.Lloyd (Dept. of Aerospace & Mech. Engng., Univ. of Notre Dame, Notre Dame, IN, USA).
Mech. Eng. (USA), vol.105, no.6, p.40-3 (June 1983).
The mathematical modeling of fires focuses on radiation, turbulence, and plumes. Topics such as spray combustion, turbulence effects on combustion, and coal combustion are but the tip of the iceberg. (no refs.)

Proceedings of the 4th European Symposium on Materials Sciences under Microgravity (ESA SP-191) .... See Entry 105032

Diameters and number densities of soot particles in premixed laminar flat flame propane/oxygen .... See Entry 105304

Characterization of the pressure wave originating in the explosion of an extended heavy gas cloud: Critical analysis of the treatment of its propagation in air and interaction with obstacles .... See Entry 106146

Experimental studies of electron-ion recombination .... See Entry 106586

Effect of vapor efflux from a spherical particle on heat transfer from a hot gas .... See Entry 107269

Reactions of carbonyl compounds and Group Ib metals in a plasma in the wake of a spark .... See Entry 107333

Reactions of Group Ib metal ions with selected hydrocarbons in the source of a spark source mass spectrometer .... See Entry 107334

Studies of ion-ion recombination using flowing afterglow plasmas .... See Entry 107337

The relative thermal value of tomorrow's fuels .... See Entry 109787

82.40D Atomic and molecular beam reactions

(see also 34.50L Chemical reactions as studied by atomic and molecular beams)

Collision energy dependence of vibration/rotational distribution of BaBr produced in the crossed beam reaction Ba+CH_3Br .... See Entry 106545

82.40T Chemiluminescence and chemical laser kinetics

(see also 42.55K Chemical lasers, 78.60P Chemiluminescence)

109748 Gas-phase chemiluminescent reactions of ozone with monoterpenes. P.K.Arora, J.P.S.Chatha, K.G.Vohra (Air Monitoring Section, Bhabha Atomic Res. Centre, Bombay, India).
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.93-8 (26 Aug. 1983).
Chemiluminescent reactions of ozone with monoterpenes such as linallol, geranoil, d-limonene and α-pinene have been studied in the gas phase at low pressures. Methylglyoxal phosphorescence has been observed in the first two reactions. Emissions from $HCHO(^1A_2)$ are observed in the reaction of ozone with d-limonene and formation of excited glyoxyl is found to be first order in ozone. The reaction of ozone with β-pinene gives rise to emission from a α-dicarbonyl compound and this is found to be first order in ozone. The mechanisms for the formation of excited species are proposed. (4 refs.)

109749 Luminescence of I_2/Ar mixture flowing out of a quenching setup at atmospheric pressure. V.E.Nosenko, I.I.Borisov, V.V.Naumov, V.A.Reisig, A.V.Solov'ev.
Combust. Explos. & Shock Waves (USA), vol.18, no.6, p.657-61 (Nov.-Dec. 1982). Translation of: *Fiz. Goreniya & Vzryva (USSR)*, vol.18, no.6, p.53-7 (Nov.-Dec. 1982).
The authors show that as a result of nonadiabatic cooling of the thermally excited mixture I_2/Ar in the process of transonic flow through a quenching setup at atmospheric pressure, recombination radiation of molecular iodine in the green region of the spectrum was obtained. (19 refs.)

Infrared multiphoton excitation: energy distribution of reacting molecules from overtone excitation studies .... See Entry 106519

Chemiluminescence induced in the laser-promoted reaction of ethanol with oxygen .... See Entry 109715

Optical emission from photoexcitation of aerosol particles produced by reaction of ozone with 1,3-butadiene .... See Entry 109931

82.45 ELECTROCHEMISTRY AND ELECTROPHORESIS

(see also 66.10 Ionic conduction in liquids; for electro-osmosis, see 82.65)

109750 Current distribution on the surface electrode, immersed in an aqueous medium, when this surface is partly subjected to a mechanical abrasion. L.Chincholle (Univ. Paris VI, Paris, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.20, p.1579-82 (6 June 1983). In French.
When a metal is dissolved in an aqueous medium, electrons are set free. If the film protecting the surface is permanently and regularly taken away, an electric current which can be analysed results. Then the electrode works as an electron generator with the properties of a classical, constant current supply. (no refs.)

109751 Influence of evolution of hydrogen on the value of the slope of polarization curves during cathodic deposition of metals of the iron group. V.M.Nagirnyi, V.M.Chaikovskaya.
Elektron. Obrab. Mater. (USSR), no.3, p.57-9 (1983). In Russian. English translation in: *Electrochem. Ind. Process. & Biol. (GB)*
Change in a fraction of the current of the hydrogen-evolution reaction during change in the density of the polarizing current leads to a deviation of the slope of the polarization curves from the true value. In order to obtain an approximate evaluation of this deviation it is necessary to allow for a correction to the change in a fraction of the current of the secondary reaction in the range of current density being measured, which can assume a value from 0 to 0.5. (7 refs.) *A.J.B.*

109752 Electrode wear in the treatment of low-carbon steel in electrolytic plasma in an anodic process. E.Resner, G.Marks, V.A.Zaitsev, A.M.Sukhotin.
Elektron. Obrab. Mater. (USSR), no.3, p.59-61 (1983). In Russian. English translation in: *Electrochem. Ind. Process. & Biol. (GB)*
It is shown that the wear of an electrode increases with increase in the concentration of hydrochloric acid and acetone, particularly at voltages corresponding to electrohydrodynamic conditions (325 V), and that the current efficiency under such conditions always exceeds 100%, independently of the duration of the tests. It is suggested that processes leading to wear of the anode in electroplasma heating are close in nature to the high-temperature oxidation of steel with the formation of FeO. (7 refs.) *A.J.B.*

109753 A laboratory testing apparatus for high speed electrolytes. F.Friedrich, C.J.Raub.
Galvanotechnik (Germany), vol.74, no.5, p.521-2 (May 1983). In German.
For the study of electrolytes with high rates of deposition, and electrolytes for selective plating in which the plating rate of the electrolyte is of special importance, a laboratory apparatus has been designed which enables the plating parameters to be simulated. The cathode can be used as a baffle which is sprayed. The anode acts as a nozzle. The apparatus can be employed in the service laboratory and elsewhere for the development of electrolytes. (3 refs.)

109754 The testing of electrodes for alkaline solution water electrolysis. J.Balajka (Res. Power Inst., Bratislava, Czechoslovakia).
Int. J. Hydrogen Energy (GB), vol.8, no.10, p.755-62 (1983).
The alkaline solution water electrolysis with the use of off-peak energy from nuclear power stations is proposed for hydrogen production in the initial stages of hydrogen energy system development. The energy consumption of this process could be reduced by the use of electrode improvements for both the anode and the cathode of bipolar electrolytic cells. These improvements comprise preparing an electrocatalytic surface layer, or the increase of an effective surface area by the use of Teflon-bonded electrodes or a Ni-layer on the asbestos diaphragm surface. The Teflon-bonded electrodes achieved the best results in the laboratory static test cell. In actual electrolytic cells difficulties with gas evolution arose. The simple and cheap electrode improvements, which were verified by the laboratory tests as well as by the test in the electrolyser module of 300 g H_2/h output were as follows: (1) Ni screen treated with a boiling solution of Na_2S in order to obtain a catalytically active surface layer of NiS_x, used as cathode; (2) Ni screen treated by thermal decomposition of Ni and Co nitrates in a molar ratio of 1:2 in order to obtain the spinel-like structure mixed oxide layer of $NiO.CO_2O_3$ as anode. This layer promotes resistance of the electrode surface to hot alkaline oxygen rich environments as well as the catalytic activity of the Ni screen electrode surface. (15 refs.)

109755 Iron oxide electrodes for photoelectrolysis of water. N.Giordano, E.Passalacqua, V.Antonucci (Istituto CNR di Ricerche sui Metodi e Processi Chimici per la Trasformazione e l'Accumulo dell'Energia, Messina, Italy), J.C.J.Bart.
Int. J. Hydrogen Energy (GB), vol.8, no.10, p.763-6 (1983).
Results of photoassisted electrolysis of water over iron electrodes oxidized in air between 200° and 1300°C are compared. Maximum photocurrents are found for electrodes activated at low temperatures (200-400°C). The current density greatly diminishes in the presence of a thick α-Fe_2O_3 overlayer. (25 refs.)

109756 Photomodulated and one-beam and two-beam potential modulated photoelectrochemical spectroscopies. J.F.McCann (School of Phys., Univ. of New South Wales, Kensington, NSW, Australia), M.Skyllas-Kazacos.
J. Electrochem. Soc. (USA), vol.130, no.7, p.1510-13 (July 1983).
Three techniques for measuring interband transitions in semiconductor electrodes in electrolytes are described. These are photomodulated and one-beam and two-beam potential modulated spectroscopies. The usefulness of the techniques is demonstrated by using each technique to measure the direct band gap transition for a single crystal n-CdSe electrode in a 1M S-1M Na_2S-1M NaOH electrolyte. The difference between a two-beam potential modulated photoelectrochemical spectrum and a corresponding one-beam spectrum is interpreted to be a measure of minority carrier recombination inside and at the surface of the semiconductor electrode. Peaks in the modulated photocurrent spectra at the direct bandedge of CdSe are attributed to field induced absorption effects. (15 refs.)

109757 NMR-electrolysis combined method (NMREL). Basic principles and some applications. V.G.Mairanovsky, L.Yu.Yusefovich, T.M.Filippova (All-Union Res. Vitamin Inst., Moscow, USSR).
J. Magn. Resonance (USA), vol.54, no.1, p.19-35 (Aug. 1983).
Electrolysis conducted directly in a sample tube of an NMR spectrometer (NMREL) has been applied to various kinetic and analytical problems and to the study of the mechanisms of electroorganic reactions. The kinetics of anion-radical decay was studied for benzoquinone, ubiquinone Q_0, ρ-nitrotoluene, 4-nitroorthoxylene, and ρ-toluenenitrile; and kinetics of electron transfer was studied for the symmetric system: $M^{\cdot -}+M \rightleftharpoons M+M^{\cdot -}$. Three NMREL techniques were tested to find the rate constants in the series of the compounds. Asymmetric electron transfer $M^{\cdot -}+N \rightleftharpoons M+N^{\cdot -}$ was studied for

endoergic reactions leading to both stable $N^{\cdot}$ and unstable $N^{\cdot}$, and the electron transfer and $N^{\cdot}$-decay rate constants were estimated. An analytical treatment has been proposed based on NMR signal broadening due to electron exchange, brought about by an electrochemical reaction. The potentialities of this treatment were demonstrated by the analysis of a 3-nitroorthoxylene+xylene mixture: the presence of xylene was detected accurately even for 20-fold excess of the other component. For electroreduction of vitamin A in DMF-d_6, NMREL has found an earlier unknown axerophtene isomer along with the usual product. (25 refs.)

109758 Magnetoelectrolysis. T.Z.Fahidy (Dept. of Chem. Engng., Univ. of Waterloo, Waterloo, Ontario, Canada).
J. Appl. Electrochem. (GB), vol.13, no.5, p.553-63 (Sept. 1983).
The influence of an imposed magnetic field on electrochemical processes is reviewed. In particular, the effects of combined electric/magnetic fields on electrolyte properties, mass transport, electrode kinetics and the quality of electroplated metals is emphasized. (101 refs.)

109759 Energy consumption of aluminium smelting cells containing solid wetted cathodes. R.C.Dorward (Kaiser Aluminum & Chem. Corp., Pleasanton, CA, USA).
J. Appl. Electrochem. (GB), vol.13, no.5, p.569-75 (Sept. 1983).
Tests with 10 kA pilot cells show that substituting a wetted, dimensionally stable cathode for the turbulent metal cathode allows the anode-cathode distance (ACD) to be decreased, with an attendent voltage reduction of about 1 V, depending on current density. Since high current efficiency is retained, specific energy consumption is decreased by about 20%. These savings are not as great as anticipated, however, because the effective electrical resistivity of the electrolyte increases as the ACD is lowered. This effect is ascribed to an increased void fraction of anode gas in the interpolar space, which appears to be dependent on anode size. (15 refs.)

109760 A new electrochemical technique for bleaching cellulose pulp. M.N.Nassar, O.A.Fadaly (Dept. of Chem. Engng., Tech. Univ. of Nova Scotia, Halifax, Nova Scotia, Canada), G.H.Sedahmed.
J. Appl. Electrochem. (GB), vol.13, no.5, p.663-7 (Sept. 1983).
A study of electrochemical bleaching of cellulose pulp was carried out in an electrolyte cell composed of a horizontal graphite anode and a parallel stainless screen steel cathode, using NaCl as electrolyte. Variables studied were: current density, sodium chloride concentration, pulp concentration, pH and temperature. The rate of bleaching was found to increase with increasing current density, salt concentration and temperature. The rate of bleaching was found to decrease with increasing pH and pulp concentration. Energy consumption ranged from 0.1 kWh kg^{-1} (pulp) to 1.75 kWh kg^{-1} (pulp), depending on current density and degree of bleaching. The quality of electrochemically bleached pulp was found to compare favourably with that of chemically bleached pulp. (6 refs.)

109761 Reverse electrodialysis. Electric energy detained from mixing of solutions of different salinity. R.Audinos (Lab. de Chimie Phys. et Electrochimie, Univ. Paul Sabatier, Toulouse, France).
J. Power Sources (Switzerland), vol.10, no.3, p.203-17 (Aug. 1983). In French.
It is possible to obtain, in the form of electric power, the energy of mixing of two solutions of different salinity by reverse electrodialysis. The laboratory electrodialyzer used was fitted in turn with two different pairs of permselective membranes, AMV-CMV and ARP-CRP. Solutions of $ZnSO_4$ (216/18.8, 201/34.6, 110/40.2 and 127/14.2 g/l) and of NaCl (245/13 and 250/1 g/l) were used in batch recirculation. Only NaCl solutions (294/1, 295/1 and 150/1 g/l) were used in continuous flow operation. Results show the influence of type of membrane, composition and concentration of solutions and type of electrode. The maximum power obtained is 400 nW/m^2. (14 refs.)

109762 Peculiarities of the electroreduction of aluminum from high-temperature aluminum chloride melts. Yu.K.Delimarskii, V.F.Makogon (Inst. of General & Inorganic Chem., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Electrochem. (USA), vol.18, no.10, p.1232-6 (Oct. 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.10, p.1386-90 (Oct. 1982).
The main results obtained in a study of the cathodic process of reduction of aluminium chloride at the temperature 700-800°C, i.e., above the melting point of aluminum, are presented. The formulation of the question is due to searches for possibilities of electrolysis of aluminum chloride. An electrochemical substantiation of the use of the electrolyte, electrodes, and methods was performed. The influence of the cationic composition of the electrolyte on the kinetics and mechanism of the electrode process was studied. The influence of side processes on them was evaluated. (14 refs.)

3rd Tri-Service Cathode Workshop .... See Entry 105010

Technology of high-purity HgI_2 .... See Entry 106218

Viscosity of some strong electrolytes in DMF-H_2O binary solvents at 35°C .... See Entry 108007

Superlattices formed by electrodeposition of silver on iodine-pretreated Pt(111); studies by LEED, Auger spectroscopy and electrochemistry .. See Entry 108235

Fermi levels in electrolytes and the absolute scale of redox potentials .... See Entry 108260

Photoelectronic properties of Cu_3PS_4 and Cu_3PS_3Se single crystals .... See Entry 108416

Electrochemical synthesis of photoactive MoS_2 .... See Entry 109178

Numerical simulation of the long-term performance and corrosion of photoelectrochemical cells .... See Entry 109548

Morphological study of porous PbO_2 formed in aqueous H_2SO_4 on Pb-Sb and Ca-Sn-Pb alloys .... See Entry 109598

Fabrication of a low cost controlled potential coulometer ..... See Entry 109839

Resource and energy management of synfuels production with hydrogen and oxygen requirements from electrolysis .... See Entry 109845

Corrosion and polarisation characteristics of zinc in battery electrolyte analogues and the effect of amalgamation .... See Entry 109866

The impedance of the lithium-thionyl chloride primary cell ... See Entry 109867

The delayed action of magnesium anodes in primary batteries. I. Experimental studies .... See Entry 109868

The delayed action of magnesium anodes in primary batteries. II. Theoretical studies .... See Entry 109869

Design and performance of a sodium/sulphur multitube cell .. See Entry 109874

In situ conductance measurements of lead accumulator negative plates .... See Entry 109875

Optimization of the vanadium oxide (V_6O_{13}) electrode in a nonaqueous secondary lithium cell .... See Entry 109876

The effect of current density and thickness of the active mass upon the corrosion rate of the spines of lead-acid battery plates .... See Entry 109877

Sodium tungsten bronze thin films: variation of chemical potential with sodium concentration .... See Entry 109878

Intercalation electrodes in copper solid-state cells .... See Entry 109879

Status of the cadmium thermoelectrochemical hydrogen cycle .... See Entry 109920

Technological aspects of sulfur dioxide depolarized electrolysis for hydrogen production .... See Entry 109921

Quasi-elastic light scattering studies on T7 DNA in the presence of a sinusoidal electric field .... See Entry 109967

82.50 PHOTOCHEMISTRY AND RADIATION CHEMISTRY

(see also 33.50 Fluorescence, phosphorescence; radiationless transitions)

109763 Production and detection of energetic species by laser photolysis and detection techniques. J.R.McDonald (Chem. Div., Naval Res. Lab., Washington, DC, USA).
AIP Conf. Proc. (USA), no.100, p.307-16 (1983). (Topical Meeting on Excimer Lasers, Incline Village, NV, USA, 10-12 Jan. 1983).
The impact of lasers on photochemistry and spectroscopy has had an evolutionary effect. The author demonstrates the use of laser techniques adapted to the study of reaction chemistry and spectroscopy by discussion of a few recent experiments. The experiments involve the study of the spectroscopy or reactions of a group of energetic short-lived molecules—molecular free radicals. The author takes advantage of the high brightness short pulse capability of ultraviolet lasers to create the radicals and the tunability and narrow band width capability of dye lasers to probe the internal states and evolutionary processes of these reactive systems. In many instances the use of laser photolysis techniques has allowed the author to cleanly produce a radical for study which has not been feasible by more classical methods. In other cases, the use of laser induced fluorescence (LIF) allows one to uniquely follow the reactive fate of a single species in a mixture of reactive intermediates which is too complex to be studied by traditional product analysis techniques. (6 refs.)

109764 Correlation between the photoelectron emission and photooxidation threshold energies of a solute in the condensed phase. T.B.Truong (Lab. de Phys.-Chimie des Rayonnements, Univ. Paris-Sud, Orsay, France).
Chem. Phys. Lett. (Netherlands), vol.100, no.1, p.76-82 (26 Aug. 1983).
The photoelectron emission threshold energy E_t of a solute is related to its photooxidation threshold energy I_S by the following correlation: $E_t=I_S-P_--V_0$, where V_0 is the solvent conduction band depth and $P_-=-(e^2/2r)(1-D_{op}{}^{-1})$ is the polarization energy of the mobile electron with r derived from a solute-solvent cage charge-transfer model. For the first oxidation state, $A \rightarrow A^+ + e^-$, the E_t of a solute A differs from its gas-phase oxidation energy by a solute-solvent cage interaction terms ΔH_{CT}. (19 refs.)

109765 Deuterium separation and infrared photochemistry in CF_2HCl. J.E.Moser, P.Morand, R.Duperrex, H.van den Bergh (Inst. de Chimie Phys., Ecole Polytech. Federale, Lausanne, Switzerland).
Chem. Phys. (Netherlands), vol.79, no.2, p.277-88 (1 Sept. 1983).
Deuterium separation has been demonstrated by studying the infrared multiphoton dissociation of CF_2DCl and CF_2HCl/CF_2DCl mixtures. It is shown how the parameters which control the infrared photochemistry of CF_2DCl such as the temperature and the pressure, as well as the wavelength, the energy fluence and the intensity of the laser pulse, can be optimised for deuterium separation. Infrared analysis of the disappearing CF_2DCl and CF_2HCl peaks indicates isotopic selectivities in excess of 10^4. Dissociation yields of up to 5% are observed at fluences around 6 J cm^{-2} with 30 ns pulses at pressures in the range 0.3 to 150 Torr. A new route is presented for redeuteration of the deuterium-depleted CF_2HCl to natural abundance by way of high-temperature exchange in the gas phase. (49 refs.)

109766 Effect of a polar substituent on olefin triplet lifetime. R.A.Caldwell, M.Singh (Dept. of Chem., Univ. of Texas, Richardson, TX, USA).
J. Am. Chem. Soc. (USA), vol.105, no.15, p.5139-40 (27 July 1983).
The lifetimes of olefin triplets are important parameters for the study of the vast number of olefin triplet-state isomerizations and cycloadditions. They also serve as models for intersystem crossing rates in flexible organic triplet biradicals and biradicaloids. Several structural factors are expected to influence intersystem crossing in and thus the lifetimes of such species: interterminal distance, relative orientations of the orbitals bearing the unpaired electrons, and the degree of ionic character in the singlet wave function. The authors have sought systems that can test the importance of these factors one by one. They report the triplet lifetimes of chalcones with a wide range of polar substituents, presumably a valid test of the last factor. They observe essentially no effect, in contrast to what might have been expected. (19 refs.)

109767 Correlation effects in vibrational hole burning. J.Friedrich, D.Haarer (Phys. Inst., Univ. Bayreuth, Bayreuth, Germany).
J. Chem. Phys. (USA), vol.79, no.4, p.1612-15 (15 Aug. 1983).
The paper presents a theoretical model which describes correlation effects in nonresonant photochemical holes. The model calculations are compared with experiments of photochemical hole burning (PHB) in electronically excited vibrational states of 1,4-dihydroxyanthraquinone (DAQ) in alcohol glass matrices. Vibrational hole burning shows some specific features such as the occurrence of several nonresonant holes in the electronic origin which differ considerably in their widths and integrated optical density from the resonant hole. The difference in linewidth is related to a vibrational inhomogeneity which is superimposed on the observed relaxation broadening. The experiments show that the vibrational inhomogeneity is not uniform but varies with the vibrational state. (14 refs.)

109768 Reversible, light-induced isomerization of matrix-isolated molecules. Nitrosomethanol. R.P.Muller, J.R.Huber (Phys.-Chem. Inst., Univ. Zurich, Zurich, Switzerland).
J. Phys. Chem. (USA), vol.87, no.14, p.2460-2 (7 July 1983).
A reversible, light-induced isomerization of the previously unknown nitrosomethanol molecule $[H_2C(OH)(NO)]$ has been investigated by IR spectroscopy in an argon matrix. Two distinct conformers of the molecule—the intramolecularly hydrogen bonded cis form and an open-chain trans form—were reversibly interconverted by selective excitation with green and red light, respectively. (10 refs.)

109769 Intramolecular donor-acceptor systems. VII. Solvent dielectric relaxation effects on the photophysics of 6-(phenylamino)-*N*,*N*-dimethyl-2-naphthalenesulfonamides. E.M.Kosower (Dept. of Chem., Tel-Aviv Univ., Tel-Aviv, Israel), H.Kanety, H.Dodluk, G.Striker, T.Jovin, H.Boni, D.Huppert.
J. Phys. Chem. (USA), vol.87, no.14, p.2479-84 (7 July 1983).
For pt.VI see Chem. Phys. Lett., vol.84, p.48 (1981). Excitation of 6-[(4-X-phenyl)amino]-*N*,*N*-dimethyl-2-naphthalenesulfonamides (X=Br, H, CH_3,

OCH_3) produces a nonplanar S_1 ($S_{1,np}$) state which undergoes intramolecular electron transfer in a wide polarity range of solvents to form a charge-transfer S_1 state ($S_{1,ct}$), the processes being defined by emission maxima and fluorescence quantum yields as a function of solvent polarity and phenyl substituent. From the variation of fluorescence lifetimes with solvent polarity using dioxane-water and dioxane-methanol mixtures, solvent dielectric relaxation rates are implicated as the controlling feature for the nonradiative electron-transfer process which quenches the charge-transfer fluorescence and reforms the S_0 state. (12 refs.)

109770 Pulse-rate effects in the photochemistry of gas-phase bromobenzene ions. A study of ion relaxation mechanisms. R.C.Dunbar (Chem. Dept., Case Western Reserve Univ., Cleveland, OH, USA).
J. Phys. Chem. (USA), vol.87, no.16, p.3105-8 (4 Aug. 1983).
Two-photon photochemistry of gas-phase bromobenzene ion using a repetitively pulsed light source was studied in the ion cyclotron resonance (ICR) spectrometer and modeled by numerical integration of the kinetic equations. Theoretical modeling and experiment were in excellent agreement, showing as expected that effects of pulse rate depend strongly on the relation of pulse rate and ion relaxation rates. Effects attributable to infrared radiative relaxation of ions were clearly evident, and this relaxation was found to have a rate between 1 and 3 s^{-1}. (14 refs.)

109771 Radical cations of halogenobenzenes. An electron spin resonance study. P.Maj, A.Hasegawa, M.C.R.Symons (Dept. of Chem., Leicester Univ., Leicester, England).
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.8, p.1931-8 (Aug. 1983).
Exposure of dilute solutions of a range of halogenobenzene derivatives in fluorotrichloromethane to ^{60}Co γ-rays at 77K gave the corresponding radical cations, characterized by their ESR spectra. The approximate π spin densities on halogen estimated therefrom increased from ca. 8% for PhF^+ to 23% for $PhCl^+$, 30% for $PhBr^+$ and 46% for PhI^+, in accord with the fall in ionization potential for this series of halogens. For *p*-fluorotoluene well defined methyl- and ring-proton hyperfine coupling was obtained, the methyl-proton coupling (19 G) being slightly greater than that for the toluene cation (18.5 G). For $PhBr^+$, replacement of para-hydrogen by Br, OH and SH gave a steady fall in spin density on bromine, reflecting increasing π-delocalization onto the para-substituent. For concentrated solutions of the chloro-, bromo- and iodo-derivatives dimer cations were detected. (38 refs.)

109772 Selectivity of muonic radical formation in methyl-substituted buta-1,3-dienes. E.Roduner (Phys.-Chem. Inst., Zurich Univ., Zurich, Switzerland), B.C.Webster.
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.8, p.1939-50 (Aug. 1983).
Muonium-substituted free radicals are observed by muon spin rotation when polarised positive muons are stopped in several substituted liquid dienes. There is a preference for the most energetically stable radical to be formed. The selectivity of formation obeys the Evans-Polanyi relation between activation energies and heats of reaction. Two models are discussed for the radical-formation process and upper limits are set on the lifetimes of possible muonic radical precursors: 20 ps for $Mu(\equiv\mu^+e^-)$ and 2 ns for μ^+ in diamagnetic environments. (36 refs.)

109773 The effect of gold salts on the chemical mechanisms of photographic sulfur sensitization of silver halide photoemulsions: stabilization of adsorbed sulfide at the crystal surface. D.J.Cash (Minnesota 3M Res., Harlow, England).
Photogr. Sci. & Eng. (USA), vol.27, no.4, p.156-60 (July-Aug. 1983).
Different reactions occurring in gold and sulfur sensitization have been resolved. These were (1) sulfide formation, (2) sulfur sensitization due to silver sulfide specks, (3) gold sensitization due to gold-silver sulfide specks, (4) digestion fog due to sulfide specks, (5) premature fog due to reduction of gold to the elemental state. Kinetic measurements indicated that the essential chemical mechanism of sulfur sensitization, hence its photographic corollaries, was conserved in the presence of gold ion. The gold sensitization could be performed during or after the sulfur sensitization. With fast sulfide formation the presence of gold caused a decrease in the rate of photographic digestionl. This was attributed to retardation of sulfide speck growth by gold ion analogous to that by organic photographic stabilizers. A mechanism was suggested which involved the coordination of adsorbed sulfide by gold ion at kink sites or coordinated with the methionine residue of gelatin. Fog due to elemental gold could be completely removed by oxidizing agents with no loss of sensitization. This supported a gold (+ sulfur) sensitization mechanism due to gold ions involving the formation of mixed gold-silver sulfide specks. (35 refs.)

109774 Redistribution of development centers after sulfur sensitization. V.Zhelev, Y.Astrov (Central Lab., Bulgarian Acad. of Sci., Sofia, Bulgaria).
Photogr. Sci. & Eng. (USA), vol.27, no.4, p.160-70 (July-Aug. 1983).
Observations made under a variety of conditions suggest that silver aggregates formed in pure AgBr may be unstable, even when large enough to catalyze development. These aggregates readily decompose under the influence of deep electron traps introduced by sulfur sensitization. It is shown that adsorption of Ag_2S on the surface initiates an internal-to-surface redistribution of silver built up into the volume prior to the sensitization procedure. This redistribution should be distinguished from redistribution and decay processes following the exposure to long wavelength radiation where additional energy is introduced to the Ag/AgBr system. A long-range action of the sensitizer has been established consisting in induction (or speeding) of diffusion transfer of silver at a considerable distance from the surface. The model proposed assumes that Ag aggregates, termed quasistable, are in dynamic equilibrium with the conduction band thus supplying free electrons to deeper trapping sites. The data reported can be interpreted in favor of the Gurney-Mott model assuming particularly that Ag_2S provides deeper trapping levels than any others present in pure AgBr, whereupon Ag_2S specks operate as efficient concentration centers. A possibility of studying the function of a sensitizer under conditions where photoholes do not accompany the aggregation of silver is proposed. (68 refs.)

109775 Influence of chemical sensitization on photographic response: a computer modeling study. M.R.V.Sahyun (Central Res. Lab., 3M Center, St. Paul, MN, USA).
Photogr. Sci. & Eng. (USA), vol.27, no.4, p.171-7 (July-Aug. 1983).
A comprehensive computer model of latent formation in silver halide emulsion grains is attempted: size and effectiveness distributions of sulfide sensitivity specks, their dispersion among emulsion grains, and the process of latent image formation, according to the phase formation theory are all considered. Characteristic and DQE curves are calculated and presented for high-intensity exposure conditions. Results are related to conditions and parameters of chemical sensitization. Accordingly, directions of future, fruitful experimental investigations of the photographic process as well as the principal possibilities for its significant improvement, are considered. (53 refs.)

109776 Efficiency modulated sensitization. J.R.Harbour (Xerox Res. Centre of Canada, Mississauga, Ontario, Canada).
Photogr. Sci. & Eng. (USA), vol.27, no.4, p.178-81 (July-Aug. 1983).
ZnO particles surface modified through the synthetic deposition of Zn phthalocyanine exhibit a unique type of sensitization. With these particles, the normal photoactivity of ZnO, produced through excitation with 380 nm light can be modulated by coincident red light excitation adsorbed by the ZnPC. The ZnPC does not spectrally sensitize this ZnO photoactivity in the absence of the 380 nm irradiation. Using ESR spectroscopy, the author was able to monitor the photoinduced formation of the ZnPC cation radical and the $g=1.96$ ZnO signal associated with trapped conduction electrons. These ESR results corroborate a proposed mechanism for this sensitization in which a reduction of hole/electron recombination is mediated by the photo-excitation of ZnPC. (29 refs.)

109777 Spectral properties of flavins in hydrophilic matrices. K.Bystra, R.Drabent, L.Szubiskowska, B.Smyk (Inst. of Phys. & Food Chem., Acad. of Agriculture & Technol., Olsztyn, Poland).
Spectrosc. Lett. (USA), vol.16, no.7, p.513-30 (1983).
Absorption and emission properties of flavins (riboflavin 5-phosphate (FMN), riboflavin and 10-formylmethylisoalloxazine) in hydrophilic matrices have been studied. The results were discussed in terms of a possible change of the isoalloxazine nucleus geometry. The angles between absorption transiton moments and emission transition moment were estimated. It is suggested that FMN stabilized by PVA matrix can be treated as the energetically-well-isolated molecular system. (35 refs.)

109778 The effect of ammonia ions on the absorption and fluorescence of an oxazine dye. J.F.Giuliani, T.W.Barrett (Chem. Div., US Naval Res. Lab., Washington, DC, USA).
Spectrosc. Lett. (USA), vol.16, no.7, p.555-63 (1983).
The addition of ammonium hydroxide to a weakly acidic oxazine perchlorate dye produces a color change by means of a deprotonation mechanism in which the hydroxyl radical abstracts a loosely bound proton, leaving the positively charged ammonium cation to counter balance the perchlorate anion. This reaction produces significant absorption and fluorescence band shifts which can be accounted for by a semi-classical oscillator model predicting two dichroic electronic band systems associated with this dye. Peculiar wavelength excitation dependent fluorescence band shifts are attributed to overlapping triplet states simultaneously excited. (6 refs.)

109779 On the determination of emission quantum yields in turbid solid and liquid solutions. J.Bendig (Sektion Chem., Humboldt-Univ. zu Berlin, Berlin, Germany).
Z. Phys. Chem., Leipzig (Germany), vol.264, no.4, p.807-12 (1983). In German.
The known method of determination of fluorescence quantum yields does not apply to cases of turbid solid and liquid solutions, because of the light scattering. A new method is described, which is based on the measurement of a mixture of fluorophore and standard solutions. The necessary experimental conditions are given. The method is tested on the combination N-methylacridone/9,10-diphenylanthracene in ethanol at 77K. (14 refs.)

The theoretical influence of Gaussian grain size distributions on the characteristic curve of photographic film .... See Entry 105396

Silver dye-bleach colour microfilm .... See Entry 105397

The stability and permanence of Cibachrome images .... See Entry 105398

A review of the application of UV-absorbers in colour recording materials .... See Entry 105401

Gilding and sealing daguerreotypes .... See Entry 105402

The T_1 state of *p*-nitroaniline and related molecules: a CNDO/S study .... See Entry 106330

Photoionisation spectrum of Te I: autoionising series and relative cross section .... See Entry 106369

ESR of the cation radicals from γ-irradiated ketenes in haloalkane and SF_6 matrices .... See Entry 106469

The photophysics and photochemistry of weakly bound dimers of *s*-tetrazine .... See Entry 106492

Homogeneous linewidth and optical dephasing of the $S_1 \leftarrow S_0$ transition of magnesium porphin in an *n*-octane crystal: a study by transient and photochemical hole-burning .... See Entry 106502

Laser isotope separation of tritium from deuterium: CO_2-laser-induced multiphoton dissociation of C_2TF_5 in C_2DF_5 .... See Entry 106625

Direct kinetic study of $CH(A^2\Delta)$ .... See Entry 106634

Dye stability under excimer-laser pumping. II. Visible and UV dyes .... See Entry 106753

Theoretical description of photochemical hole burning in soft glasses .... See Entry 107852

Nature of group Ib metal films deposited on polymer surfaces photooxidised with far-ultraviolet (185 nm) radiation .... See Entry 108234

Characterization of intrinsic amorphous hydrogenated silicon as a thin-film photocathode material. Efficient photoreduction processes in aqueous solution .... See Entry 108546

Electrochemical synthesis of photoactive MoS_2 .... See Entry 109178

Numerical simulation of the long-term performance and corrosion of photoelectrochemical cells .... See Entry 109548

Laser-assisted chemical reactions: semiclassical approach employing Floquet and *R*-matrix theories .... See Entry 109714

Photomodulated and one-beam and two-beam potential modulated photoelectrochemical spectroscopies .... See Entry 109756

The measurement of light transmission through an irradiated fluidised bed .... See Entry 109905

Photochemical solar collector for the photoassisted reduction of aqueous carbon dioxide .... See Entry 109906

82.50E Photodissociation, photoionization as studied by luminescence and radiationless transitions

109780 Photoselection of conformational substrates and the hyposochromic photoproduct of rhodopsin. A.Cooper (Dept. of Chem., Glasgow Univ., Glasgow, Scotland).
Chem. Phys. Lett. (Netherlands), vol.99, no.4, p.305-9 (12 Aug. 1983).
Inhomogeneous broadening of visual pigment spectra may be due, in part, to the known dynamic conformational properties of protein molecules. As a consequence, the blue-shifted species formed by long-wavelength irradiation of rhodopsin at very low temperatures could be an artefact arising from pho-

toselection ('hole burning') of different conformational substates of the protein chromophore in the frozen matrix. Numerical simulation of this process mimics many of the observed spectral properties of hypsorhodopsin. (29 refs.)

Ab initio CI study of the photodissociation of nitrosyl chloride (ClNO) ....See Entry 106310

Infrared multiphoton excitation: energy distribution of reacting molecules from overtone excitation studies ....See Entry 106519

Neutron activation measurements of As and Ga loss during transient annealing of GaAs ....See Entry 107758

Conductivity measurement of an X-ray absorption spectrum: Re L_{III} near-edge structure of $Re_2(CO)_{10}$ in 2,2,4-trimethylpentane ....See Entry 109047

Formation of surface states on strontium oxide powders. [Photoluminescence observations] ....See Entry 109804

82.55 RADIOCHEMISTRY

109781 The point of zero charge and adsorption properties of natural magnetite. S.K.Milonjic, M.M.Kopecni, Z.E.Ilic (Boris Kidric Inst. of Nuclear Sci.-Vinca, Beograd, Yugoslavia).
J. Radioanal. Chem. (Switzerland), vol.78, no.1, p.15-24 (1983).
The authors report the point of zero charge (pH_{zpc}) of natural magnetite and its adsorptive properties with regard to alkali metal ions. pH_{zpc} of freshly ground, untreated magnetite is 6.5, decreasing, after treatment with HCl, to the value of pH 3.8. This discrepancy might be explained as a consequence of possible structure changes on the magnetite surface. Adsorption properties of magnetite with respect to Li^+, Na^+ and K^+ ions in the concentration and pH ranges varying from 0.1 to 1.0 $mol.dm^{-3}$ and 6.5 to 10, respectively, were examined. For the used chloride media used, the adsorption sequence obtained is $Na^+ > K^+ > Li^+$. (37 refs.)

Separation of some radionuclides from fission product elements by adsorption on diethylene glycol succinate ....See Entry 106074

Pressurized water reactor chemistry/radiochemistry sampling programs ....See Entry 106092

82.60 CHEMICAL THERMODYNAMICS

(see also 05.70 Thermodynamics)

109782 Partial molal volumes of some halobenzenes in carbon tetrachloride. F.Shahidi (Dept. of Chem. Engng. & Appl. Chem., Univ. of Toronto, Toronto, Ontario, Canada).
Can. J. Chem. (Canada), vol.61, no.7, p.1414-16 (July 1983).
The partial molal volumes at infinite dilution $\bar{V}^0$ for a number of halobenzenes are measured and related to their van der Waals volumes. Results indicate larger volume increments for halogen atoms in halobenzenes than those in alkyl halides. Possible explanations are forwarded. The effect of steric overcrowding in ortho-substituted benzenes on the $\bar{V}^0$ values are evaluated. (11 refs.)

109783 Diffusion with hydrolysis equilibria: transport coefficients of aqueous SO_2, NH_3 and Na_2CO_3. D.G.Leaist (Div. of Chem., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
Can. J. Chem. (Canada), vol.61, no.7, p.1494-9 (July 1983).
Practical equations are derived for estimating diffusion coefficients and Onsager transport coefficients of aqueous solutes subject to hydrolysis. The derivation is based on the Nernst-Hartley method which is extended to include chemical reaction of solute with solvent. The derived equations and existing mobility data are used to estimate transport coefficients of aqueous SO_2 (20°C), NH_3 (15°C) and Na_2CO_3 (25°C). In dilute solution where hydrolysis is extensive, rates of diffusion of SO_2 and NH_3 are increased by about 50% and 25%, respectively, relative to unhydrolyzed solute. Because of the carbonate-bicarbonate equilibrium, diffusion in aqueous Na_2CO_3 is a ternary process characterized by coupled transport of NaOH. In dilute solution the NaOH flux may exceed the flux of Na_2CO_3. (44 refs.)

109784 A systematic study on volumetric interactions of cyclohexanone with various aliphatic hydrocarbons. B.Chawla, R.Parkash, S.K.Suri (Dept. of Chem., Indian Inst. of Technol., New Delhi, India).
Can. J. Chem. (Canada), vol.61, no.7, p.1647-50 (July 1983).
Excess volumes of mixing, V^E, for binary mixtures of cyclohexanone with *n*-hexane, *n*-heptane, *n*-octane, *n*-nonane, *n*-decane, *n*-dodecane, *n*-tetradecane and *n*-hexadecane at 25°C were determined from the precise and accurate experimental density data. The sign and magnitude of $\bar{V}^E$ were discussed in terms of the strength of the unlike interactions present in the binary mixtures. Excess volumes of mixing of equimolar concentration (${V_{0.5}}^E$) were also obtained. Attempts were made to interpret ${V_{0.5}}^E$ in terms of the size and polarity of the constituent molecule. The two effects could not be separated, but a good linear relation between ${V_{0.5}}^E$ and the solubility parameter was found. (13 refs.)

109785 Heat integration of distillation columns into overall processes. B.Linnhoff (Dept. of Chem. Engng., Univ. of Manchester Inst. of Sci & Technol., (UMIST),,England). Manchester, H.Dunford, R.Smith.
Chem. Eng. Sci. (GB), vol.38, no.8, p.1175-88 (1983).
The authors put the design of individual distillation columns into context with the heat integration for the overall process. Good integration between distillation and the overall process can result in columns operating at effective zero utility cost. Some of the traditionally well-known schemes may in certain circumstances turn out counter-productive. They can prevent good integration and therefore eliminate the change of obtaining zero utility costs. Generally, the authors define good integration as a column not crossing the heat recovery pinch of the process and either the reboiler or the condenser being integrated with the process. If these criteria can be met, energy costs for distillation can effectively be zero. (16 refs.)

109786 On the binding of ligands to macromolecules: an accurate procedure. G.Baldini, M.Succi, G.Varani (Dipartimento di Fisica, Univ. di Milano, Milano, Italy).
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.1065-74 (July-Aug. 1983).
The determination of equilibrium constants, seen, e.g., in the usual scatchard plots, may be highly inaccurate because generally the values of the bound-ligand response are known with large uncertainty. A common cause of this inaccuracy stems from the use of samples that contain small amounts of free ligand, hardly avoided, or from equilibrium dialysis which is generally affected by the Donnan effect, dye losses, etc. From an analysis of this problem a simple procedure is derived, so that, in spite of the above drawbacks, the equilibrium parameters can be obtained with better precision. (5 refs.)

109787 The relative thermal value of tomorrow's fuels. H.C.Hottel (Dept. of Chem. Engng., MIT, Cambridge, MA, USA).
Ind. & Eng. Chem., Fundam. (USA), vol.22, no.3, p.271-6 (Aug. 1983).
An examination of the enthalpy-temperature relation for the products of combustion with air of twenty representative gas, liquid, and solid fuels showed that if the enthalpy is normalized by division by its value at a standard temperature—1800K was chosen—the so-normalized enthalpy-temperature function H^* (T) is, with accuracy adequate for engineering use, the same for all fuels studied. In consequence the T-Q path of furnace gases from a superior fuel may be exactly matched with an inferior fuel if additional input enthalpy is made available. The H^* concept permits quantitative formulation of RTV, relative thermal value, the value for use in furnaces of a Btu in a subject fuel compared to its value in a standard superior fuel. The concept also permits limited modeling of furnace performance of good fuels with poor ones, using a fuel-fired air preheater. RTV shows that methane is thermally inferior to syngas. (7 refs.)

109788 Saturated vapor pressure and heat of formation of As_4S_4. A.S.Pashinkin, A.A.Izergin, R.A.Amirov, A.S.Alikhanyan, A.V.Steblevskii (Moscow Electronics Inst., Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1056-9 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.L253-6 (Aug. 1982).
The vapour pressure of crystalline arsenic tetrasulfide was measured by the Knudsen method with continuous recording of the change in the weight of the effusion chamber. The equilibrium of the dissociation $As_4S_4 \rightleftarrows As_4(g) + 2S_2(g)$ was investigated by a mass spectrometric method, using a double effusion chamber. The heat of sublimation of As_4S_4 and the heat of its formation in the crystalline and gaseous states were calculated according to the data obtained (under standard conditions). (10 refs.)

109789 Enthalpy of formation of rubidium vanadates. M.Ya.Khodos, V.N.Krasil'nikov, A.A.Fotiev (Inst. of Chem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.8, p.1140-2 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1346-8 (Aug. 1982).
Five rubidium vanadates—Rb_3VO_4, $Rb_4V_2O_7$, $RbVO_3$, $Rb_3V_5O_{14}$, $Rb_2V_6O_{16}$—exist in the subsolidus region of the system Rb_2O-V_2O_5. The values of the change in the standard enthalpies of formation of the vanadates $Rb_4V_2O_7$, $RbVO_3$, $Rb_3V_5O_{14}$, $Rb_2V_6O_{16}$ were determined by the method of calorimetry of the heats of solution. The standard enthalpy of formation of rubidium orthovanadate was estimated. (8 refs.)

109790 Neutron diffraction study of cubic ice nucleation in a porous silica network. D.C.Steytler, J.C.Dore (Phys. Lab., Univ. of Kent, Canterbury, England), C.J.Wright.
J. Phys. Chem. (USA), vol.87, no.14, p.2458-9 (7 July 1983).
Nucleation of supercooled water (D_2O) contained in the porous silica, Spherisorb S20W, has been studied by neutron diffraction. The onset of freezing occurred at −13°C giving a diffraction pattern characteristic of the metastable cubic form of ice I (ice I_c) containing a small amount of the more stable hexagonal polymorph (ice I_h). In addition to these crystalline phases there is also evidence of a more disordered structure indicating the presence of a considerable proportion of unfrozen water. (17 refs.)

109791 Search for a simplified procedure for the evaluation of the Gibbs free energy of hydrogen-bond formation. M.M.Szczesniak (Inst. of Chem., Univ. of Wroclaw, Wroclaw, Poland), P.Hobza.
J. Phys. Chem. (USA), vol.87, no.14, p.2608-14 (7 July 1983).
An attempt is made to correlate the theoretical stabilization energies of hydrogen-bonded complexes with theoretical vibrational frequencies, the change of zero-point energy, the vibrational part of the temperature dependence of the enthalpy change, and the vibrational part of the entropy change, within a set of 16 hydrogen-bonded complexes. The correlation found between the stabilization energy and the sum of terms depending on vibrational frequencies enables one to estimate the ΔG of formation of hydrogen-bonded complexes. (34 refs.)

109792 Transient effects on the droplet-formation barrier and the nucleation rate in deeply supersaturated metastable phases. H.Furukawa (Dept. of Phys. Sci., Yamaguchi Univ., Yamaguchi, Japan).
Phys. Rev. A (USA), vol.28, no.3, p.1729-37 (Sept. 1983).
Assuming that the nucleation occurs in a small region with the volume of the order $(Dt)^{3/2}$, where D is the diffusion constant and t is the time passing after a quench, the author finds, that the droplet-formation barrier undergoes a transition from an infinitely large value to a finite value indicating the existence of the onset of the nucleation reaction. This finite value of the droplet-formation barrier is smaller in deeply supersaturated phases than the value required for the stabilization of the supersaturated phase, i.e. $\sim 60k_BT - 70k_BT$. Thus the cloudiness should occur just after the droplet-formation barrier has undergone the transition. For a deeply supersatured phase the locus of the cloud point is described by $y_1 \propto \varepsilon^{-\phi} {t_1}^{-3/8}$, where $y_1 \propto \rho/\Delta\rho$ and $T_c(1-\varepsilon)$ are a reduced density (with $\Delta\rho$ being the coexistence curve) measured from the coexistence state, and the temperature of supersaturated phase with T_c being the critical temperature, respectively. t_1 is the observation time after a quench. The exponent ϕ is found to be 0.70 for the liquid and 0.47 for the kinetic Ising-spin system. At low temperatures or for large t_1, the cloud point is given by the traditional one. The comparisons of the present result with experimental data are presented. (18 refs.)

109793 Thermochemistry of the cubic and hexagonal lithium tungsten bronze phases Li_xWO_3. P.G.Dickens, S.A.Kay (Inorganic Chem. Lab., Univ. of Oxford, Oxford, England).
Solid State Ionics (Netherlands), vol.8, no.4, p.291-5 (July 1983).
The enthalpies of formation of hexagonal WO_3, hexagonal and cubic Li_xWO_3 have been determined by solution calorimetry. The ambient-temperature materials h-$Li_{0.44}WO_3$ and c-Li_xWO_3 (x=0.51, 0.71) were prepared by *n*-butyl lithiation in hexane. The thermochemistries of the lithium insertion compounds were examined and related to structural features. (21 refs.)

109794 Analyses of G^E data for binary systems in terms of generalized quasi-lattice theory. M.Diaz Pena, A.Crespo Colin, A.Compostizo, I.Escudero (Dept. de Quimica Fisica, Facultad de Quimicas, Univ. Complutense, Madrid, Spain).
Z. Phys. Chem., Leipzig (Germany), vol.264, no.4, p.699-704 (1983). In German.
Experimental data on the excess Gibbs free energy for binary mixtures consisting of methylcyclohexane, cyclohexane or benzene with either chlorobenzene, fluorbenzene or thiophene were interpreted on the basis of the lattice model. Five different types of interaction were considered. Each molecule has been assigned a given number of sites in a lattice whose coordination number was four. The assignment of a site number for each molecule is based on the assumption that benzene occupies four sites and is used as a reference. Interaction energies determined for each contact type based on data on the systems were consistent for all of them. (12 refs.)

Vibrational analysis of acetate ion molecules and estimation of equilibrium constants for their hydrogen isotopic exchange reactions ....See Entry 106409

Concentration dependence of the heat of formation of binary liquid alloys ....See Entry 107520

Vapor-liquid equilibria calculations by means of an equation of state ....See Entry 107856

Modified Redlich-Kwong equation of state for saturated vapour-liquid equilibrium ....See Entry 107857

Evaporation thermodynamics of lanthanum monotelluride ..... See Entry 107897

On the dissolving of polymers and photoresists ....See Entry 107961

Gadolinium monophosphide at elevated temperatures ....See Entry 107982

Thermodynamic properties of liquid mixtures of krypton+methane ....See Entry 107986

Study of the synthesis of complex analogs of TlSe by a thermographic method ....See Entry 109143

Thermal behaviour of agitated gas-liquid reactors with a vaporizing solvent. Air oxidation of hydrocarbons ....See Entry 109704

Experimental evidence of nucleation induced transition in a bistable chemical system ....See Entry 109733

Surface reactions and excitations ....See Entry 109807

Phase composition of aqueous/hydrocarbon systems containing organic salts, alcohol, and sodium chloride ....See Entry 109813

Equilibrium species in cobalt(II) carbonic anhydrase ....See Entry 109953

82.65 SURFACE PROCESSES

109795 The adsorption of methanol on Ag(111) and its reaction with preadsorbed oxygen. T.E.Felter, W.H.Weinberg (Div. of Chem. & Chem. Engng., California Inst. of Technol., Pasadena, CA, USA), G.Ya.Lastushkina, P.A.Zhdan, G.K.Boreskov, J.Hrbek.
Appl. Surf. Sci. (Netherlands), vol.16, no.3-4, p.351-64 (July-Aug. 1983).
The adsorption and oxidation of methanol on Ag(111) has been studied by photoelectron spectroscopy. He II ultraviolet photoelectron spectroscopy (UPS) has been employed for adsorbed monolayers and condensed multilayers of methanol on the surface at 95K, and relatively small shifts are found. X-ray photoelectron spectroscopy (XPS) was also employed and shows that for thick multilayers an enhanced intensity for the carbon 1s compared to the oxygen 1s occurs which can be explained by simple considerations of the escape depth. Larger coverages of surface intermediates were observed with XPS when active oxygen was initially on the surface. The intermediates include formaldehyde, methoxide, and possibly hemiacetyl alcoholate. The observation of formaldehyde implies a desorption limited formation step contrary to earlier published work. The kinetics of the oxidation reaction can be described by a simple Langmuir-Hinshelwood mechanism with rate parameters $\nu=10^{-9}$ cm^2 and $E=8.7$ kcal/mol. (25 refs.)

109796 X-ray photoemission spectroscopy of potassium promoted Fe and Pt surfaces after H_2 reduction and CO/H_2 reaction. H.P.Bonzel, G.Broden, H.J.Krebs (Inst. fur Grenzflachenforschung und Vakuumphys., KFA Julich, Julich, Germany).
Appl. Surf. Sci. (Netherlands), vol.16, no.3-4, p.373-94 (July-Aug. 1983).
Samples of Fe and Pt were cleaned in ultra-high vacuum (UHV) and then moved out to atmosphere to be covered with unknown amounts of KNO_2, K_2CO_3 and KOH in aqueous solution. After subsequent evaporation of water and heating to 470 and 690K the adsorbates were characterized by X-ray photoemission spectroscopy (XPS) and Auger electron spectroscopy. They were then reduced in 1 bar flowing H_2 at 570K for 5 min. XPS of the O(1s) core level provides evidence for the formation of adsorbed KOH in all cases. KOH is believed to be present in the form of K^+ and OH^-. The K coverage is estimated to be about one monolayer or higher. The K-promoted Fe samples were also subjected to a CO/H_2 mixture at 570K to produce hydrocarbons. XPD of the carbon layer deposited during this reaction showed C(1s) peaks at 289.0, 285.4 and 283.7 eV indicative of carbonate, CO and CH_x-type carbon, respectively. The high coverage of CO for K-promoted Fe is in accord with an increase in the adsorption energy of CO. The implications of these results of the hydrogenation of CO on K-promoted Fe are discussed. (32 refs.)

109797 Inelastic electron tunneling spectroscopic studies of adsorption of simulated epoxy resin. S.Affrossman (Dept. of Pure & Appl. Chem., Univ. of Strathclyde, Glasgow, Scotland), N.M.D.Brown, R.A.Pethrick, V.K.Sharma, R.J.Turner.
Appl. Surf. Sci. (Netherlands), vol.16, no.3-4, p.469-73 (July-Aug. 1983).
A model compound has been synthesised to simulate an amine cured epoxy resin. IET spectra of the compound adsorbed on a junction from solution suggest that bonding to the oxide occurs by chemisorption. Possible modes of bonding are discussed with reference to IETS results from related compounds. (18 refs.)

109798 Asymptotic analysis of single pore gas-solid reactions. K.Shankar, Y.C.Yortsos (Dept. of Chem. Engng., Univ. of Southern California, Los Angeles, CA, USA).
Chem. Eng. Sci. (GB), vol.38, no.8, p.1159-65 (1983).
The single-pore model for gas-solid reactions is used to develop exact, closed-form solutions for the concentration, pore radius and conversion profiles in a long, narrow pore for both cylindrical and slab geometries. For relatively large values of the Thiele modulus, the solutions portray the asymptotic behavior of the reaction scheme in a finite pore. The cases of incomplete conversion associated with pore closure at low initial porosities and complete conversion associated with a moving reaction zone at high initial porosities are analyzed. It is shown that the asymptotic results provide very accurate estimates of the overall conversion in applications involving large pore diffusional resistance or fast reactions. The sensitivity of the conversion to various physicochemical parameters is also examined. (14 refs.)

109799 Crystallisation and topochemical processes occurring on the surfaces of crystals of phosphates. E.A.Prodan, V.V.Samuskevich, T.N.Galkova, S.I.Pytlev (Inst. of General & Inorganic Chem., Acad. of Sci., Belorussian SSR).
Inorg. Mater. (USA), vol.18, no.8, p.1124-7 (Aug. 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.8, p.1329-32 (Aug. 1982).
Describes the characteristic forms of localisation of topochemical reactions occurring on the surfaces of $Na_3P_3O_9.6H_2O$ crystals (dehydration) and $MnHPO_4.3H_2O$ crystals (dehydration, disproportionation, and ammonisation). They show that the parameters of the reaction depend on the growth conditions and face development of the crystal, and that the rate of crystallisation of the product is related to the features of the reaction and its characteristic localisation. (7 refs.)

109800 The effect of surface diffusion on surface reaction rates. R.I.Cukier (Dept. of Chem., Michigan State Univ., East Lansing, MI, USA).
J. Chem. Phys. (USA), vol.79, no.5, p.2430-5 (1 Sept. 1983).
The author presents a simple model to explore the role of surface diffusion on the rate of reaction between a surface diffusing species and a set of fixed randomly distributed reactive sites. A Langmuir adsorption/desorption term is used to describe the influence of the bulk phase on the surface. Reaction is modeled by a fast, with respect to surface diffusion, absorption on the perimeters of the reactive sites. A general effective medium theory is formulated for this model and solved approximately for the rate k_f and diffusion coefficient D, which characterize the transport of the reactive density on a scale large compared with intersite dimensions. The author finds that surface diffusion can be an important contributing factor to the rate of reaction. In particular, when surface diffusion is rapid relative to the Langmuir adsorption/desorption rate, the reaction rate increases strongly with increasing reactive site surface concentration relative to its value for low surface site concentration. (12 refs.)

109801 Chemisorption of oxygen at Ag(110) surfaces and its role in adsorbate activation. [Photoelectron spectra observations]. Chak-tong Au, S.Singh-Boparai, M.W.Roberts (Dept. of Chem., Univ. Coll. Cardiff, Cardiff, Wales), R.W.Joyner.
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.8, p.1779-91 (Aug. 1983).
Oxygen has been shown by X-ray photoelectron spectroscopy (XPS) and ultraviolet photoelectron spectroscopy (UPS) studies to be adsorbed both molecularly and dissociatively at an Ag(110) surface at 80K. Chemisorbed chlorine inhibits the formation of the dissociative state. The interaction of water vapour with Ag(110) is influenced strongly, even at 80K, by the presence of O^{2-} (a). The formation of surface hydroxyls and hydrogen-bonded water clusters is discussed. Surface oxygen undergoes a chemisorptive replacement reaction with HCl (g) below 175K. At 473K there is strong evidence from both XPS and UPS for three states of oxygen; one of these is a strongly chemisorbed dioxygen species, while the other two involve dissociated oxygen one of which is sub-surface. Comparisons are made between the core and valence-level spectra observed with the Ag(110)-Cl+O_2 system and those obtained with an industrial silver catalyst known to be active in ethylene epoxidation. (19 refs.)

109802 Error simulation experiments. The virial equation in the absorption of isobutene on Aerosil. J.Cortes, H.Puschmann, E.Valencia (Facultad de Ciencias Fisicas y Matematicas, Univ. de Chile, Santiago, Chile).
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.8, p.1833-42 (Aug. 1983).
The adsorption of 2-methylprop-1-ene on Aerosil has been investigated as a prototype system for studying the precision with which the coefficients of the virial adsorption isotherm can be determined from experimental data. An experiment simulation method is developed to calculate the error produced in the determination of parameters for a model applied to an experimental system. (11 refs.)

109803 Characterization of the surfaces of MgO-ZnO solid solutions by CO and H_2 adsorption at room temperature. G.Ghiotti, F.Boccuzzi (Istituto di Chimica Fisica, Univ. di Torino, Torino, Italy).
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.8, p.1843-56 (Aug. 1983).
Solid solutions of ZnO and MgO with larger surface areas than those previously reported in the literature have been prepared and their formation tested by ultraviolet-visible reflectance spectroscopy. The surface chemistry of CO and H_2 (or D_2) interactions has been studied by infrared spectroscopy. Large differences with respect to the surface chemistry of the pure oxides have been found. CO is mainly adsorbed on MgO couples as oxidized carboxylate-type species which are stable up to 373K and then transformed into carbonate-type species. H_2 is mainly chemisorbed by heterolytic dissociation on three different Zn-O couples. (31 refs.)

109804 Formation of surface states on strontium oxide powders. [Photoluminescence observations]. S.Coluccia (Chem. Div., AERE, Harwell, England), A.J.Tench.
J. Chem. Soc. Faraday Trans. I (GB), vol.79, pt.8, p.1881-9 (Aug. 1983).
A detailed study of the formation of the oxide surface has been carried out by following the evolution of the various components of the photoluminescence spectra at successive stages of the thermal pretreatment of the samples. Different sets of ions in low coordination on the surface are correlated to specific bands in the emission as well as in the excitation spectra. At 300K, the results are consistent with energy transfer from the surface sites in high coordination to those in low coordination. (16 refs.)

109805 Comment on graphite intercalated with H_2SO_4. L.B.Ebert (Corporate Res.-Sci. Labs., Exxon Res. & Engng. Co., Linden, NJ, USA), E.H.Appelman.
Phys. Rev. B (USA), vol.28, no.3, p.1637-8 (1 Aug. 1983).
Salaneck, Brucker, Fischer, and Metrot (Phys. Rev. B 24, 5037, 1981) have stated that X-ray-photoelectron spectroscopic data indicate that the intercalant of the graphite-sulfuric-acid system consists of species containing a variety of $S_nO_{4n}{}^{2-}$ ions. The authors question the evidence for these peroxy sulfate species, since $C_{17}{}^+$ can be formed at potentials 0.23 to 0.38 V below that necessary to make $S_2O_8{}^{2-}$. The reaction of the chemically similar SO_4F^- species with graphite yields a product which does not contain SO_4F^-, suggesting that strong chemical oxidants will not be stable with respect to graphite. (20 refs.)

109806 Reply to 'Comment on graphite intercalated with H_2SO_4'. W.R.Salaneck, C.F.Brucker (Xerox Webster Res. Center, Webster, NY, USA), J.E.Fischer, A.Metrot.
Phys. Rev. B (USA), vol.28, no.3, p.1639 (1 Aug. 1983).
For comment see ibid., vol.28, no.3, p.1637 (1983). The authors defend their proposal that peroxidation can account for most of the charge accumulated between $C_{27}{}^+$ and $C_{12}{}^+$ in the graphite-bisulfate intercalation system. (4 refs.)

109807 Surface reactions and excitations. A.Howie (Cavendish Lab., Univ. of Cambridge, Cambridge, England).
Ultramicroscopy (Netherlands), vol.11, no.2-3, p.141-8 (1983). (Surface Imaging and Analysis with High Spatial Resolution, Wickenburg Inn, AZ, USA, 12-15 Jan. 1983).
Observations are presented of the growth of oxide nuclei on Al and Cu which illustrate the power of clean surface and RHEED techniques when combined with electron microscopy. Inelastic scattering and image potential effects in the RHEED and glancing angle microscopy situation are estimated using classical dielectric excitation theory. Attention is drawn to resonance effects which may occur in the surface excitations on small particles. Possible Bloch wave transitions corresponding to novel inelastic scattering processes inside the crystal and which may be significant in the glancing angle case are described. (22 refs.)

109808 Reactivity and optical properties of silicate glass surfaces. H.H.Dunken (Friedrich-Schiller-Univ. Jena, Jena, Germany).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.2-3, p.263-83 (1983). In German. (Otto-Schott-Colloquium on the State of Optical Glass Research 1982, Jena, Germany, 1982).
The chemical durability of silicate glasses is investigated by means of selected experimental methods. The reactivity experimental data are discussed on the basis of quantumchemical cluster-calculations. The same quantumchemical model is used to calculate the optical properties, especially oscillator strengths and dispersion. The influence of structure and composition on the reactivity and optical properties of the glasses is also discussed. (30 refs.)

Chemographic images of silicon surfaces .... See Entry 105389

Separation of some radionuclides from fission product elements by adsorption on diethylene glycol succinate .... See Entry 106074

Eight-vertex model of two-dimensional domain walls .... See Entry 107866

Microstructure and microanalysis of bismuth molybdates .... See Entry 107966

Room temperature exchange reaction at the Al-InP (110) interface: soft X-ray photoemission studies .... See Entry 108073

Surface studies with (clean) supported metal particles and clusters .... See Entry 108147

Absorption of carbon from residual gases during Ti implantation of alloys .... See Entry 108153

The effect of metal composition on the adsorption of zinc di-isopropyldithiophosphate .... See Entry 108154

Specimens in the $MnO-Fe_2O_3-H_2O$ system .... See Entry 108164

Inelastic changes during the formation of multilayers of C_2H_6 on Ag(110) .... See Entry 108187

Adsorption of NO on a Rh-10% Pt (111) surface: non-uniform spatial distribution .... See Entry 108190

Work function change of hydrogen chemisorbed Si (100) surface .... See Entry 108522

Characterization of intrinsic amorphous hydrogenated silicon as a thin-film photocathode material. Efficient photoreduction processes in aqueous solution .... See Entry 108546

Fermi-level pinning energy and chemistry at InP (100) interfaces .... See Entry 108550

High-resolution proton magnetic resonance and catalytic studies concerning Bronsted centers of amorphous Al_2O_3-SiO_2 solids .... See Entry 108793

Surface-enhanced Raman scattering of polymethine dyes on silver colloidal particles .... See Entry 108935

Study of acid properties of ferrierite surface by IR spectroscopy .... See Entry 108946

Elementary surface excitations and electron energy loss spectroscopy .... See Entry 109074

XPS studies on xanthate adsorption on galena surfaces .... See Entry 109091

Hydrogen diffusion and hydride formation at the metal-hydride interface .... See Entry 109096

Kinetics of the crystallisation of barium sulphate. Effect of additives, stirring rate and barium:sulphate ratio on the rate of precipitation .... See Entry 109125

Tribochemical processes and wear resistance of polymeric materials .... See Entry 109521

XPS and XAES studies of transient enhancement of Cu^I at CuO surfaces during vacuum outgassing .... See Entry 109538

Examination of solid-phase transformations in the surface layers of titanium .... See Entry 109585

The testing of electrodes for alkaline solution water electrolysis .... See Entry 109754

The point of zero charge and adsorption properties of natural magnetite .... See Entry 109781

Hydrogen sorption performance of pure magnesium during continued cycling .... See Entry 109923

82.70 DISPERSE SYSTEMS

(for flow behaviour, see 47.55K)

109809 Dielectric properties of sulfopropyl Sephadex gel beads dispersed in aqueous solutions. A.Ishikawa, T.Hanai, N.Koizumi (Inst. for Chem. Res., Kyoto Univ., Kyoto-Fu, Japan).
Jpn. J. Appl. Phys. Part 1 (Japan), vol.22, no.6, p.942-7 (June 1983).
Dielectric measurements were carried out on beds consisting of beads of the ion-exchange resin sulfopropyl Sephadex of the strong-acid type over the frequency range 30 Hz to 130 MHz. Striking dielectric relaxations were observed with dielectric increments of 10^2-10^3 in dielectric units and relaxation frequencies of 10 MHz. The relative permittivities and electrical conductivities of ion-exchange resins with different ionic forms were evaluated by the method proposed in recent investigations on the basis of theories of interfacial polarization. The values of the relative permittivities thus determined were unchanged irrespective of the ionic form and were smaller than the value for water. The values of the electrical conductivities changed with the ionic species of the counter ions. (29 refs.)

109810 Method for determining the effectiveness of dispersants for magnetic oxide. R.L.Bradshaw, S.J.Falcone, R.L.Price, A.Simonetti (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.26, no.2, p.447-8 (July 1983).
The dispersant and magnetic oxide particles are mixed and a particle size analysis is used to assess the effectiveness of the dispersant. This method is particularly useful to classify the ability of dispersants to properly disperse chromium dioxide particles in a polymer/solvent coating link, which coating ink is used to coat a substrate, in the process of manufacturing magnetic recording media. (no refs.)

109811 Diffusion-controlled flocculation: the effects of attractive and repulsive interactions. P.Meakin (Central Res. & Dev. Dept., E.I. du Pont de Nemours & Co. Inc., Wilmington, DE, USA).
J. Chem. Phys. (USA), vol.79, no.5, p.2426-9 (1 Sept. 1983).
A Monte Carlo computer model has been used to investigate the effects of repulsive interactions (sticking probabilities less than 1.0) and attractive interactions (particle capture) on diffusion-controlled aggregation processes. The author finds that particle capture leads to clusters with lower densities, whereas small sticking probabilities lead to higher density clusters. The radii of gyration (R_g) of clusters grown under diffusion-controlled conditions can be related to the number of particles in the cluster by $R_g = AN^{\beta}$. Despite the considerable difference in densities, the author finds that clusters grown with small sticking probabilities or large capture radii give quite similar values for the radius of gyration exponent (β) in the limit of large cluster sizes. The model details are expressed in the radius of gyration amplitude factor A. The results reported in the paper were obtained using a two-demensional nonlattice model. The author expects that similar results will be found in three-dimensional simulations. (10 refs.)

109812 Analysis of small angle neutron scattering spectra from polydisperse interacting colloids. M.Kotlarchyk, Sow-Hsin Chen (Dept. of Nuclear Engng., MIT, Cambridge, MA, USA).
J. Chem. Phys. (USA), vol.79, no.5, p.2461-9 (1 Sept. 1983).
In the paper, the authors outline a simple procedure for analyzing small angle neutron scattering (SANS) spectra from interacting colloids containing a continuous distribution of particle sizes. In particular, the effects of polydispersity on the apparent interparticle structure factor S′(Q) observed by SANS is investigated. They find that the oscillations in S′(Q) are significantly damped in comparison to those of the true structure factor S(Q). When their procedure is extended to the analysis of SANS spectra from nonspherical particles, they find that orientational averaging affects S′(Q) in a qualitatively similar way. The applicability of the procedure to the analysis of real data is demonstrated with spectra taken from water-in-oil microemulsions, ionic micelles, and interacting protein. (24 refs.)

109813 Phase composition of aqueous/hydrocarbon systems containing organic salts, alcohol, and sodium chloride. P.C.Ho, T.M.Bender (Chem. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
J. Phys. Chem. (USA), vol.87, no.14, p.2614-20 (7 July 1983).
The phase compositions of five-component systems containing *n*-octane, water, 1-butanol, sodium chloride, and one of two low-equivalent-weight organic salts (protosurfactants) have been analyzed. The organic salts are sodium 2,5-diisopropylbenzenesulfonate or sodium 3,5-diisopropylsalicylate, both of which have six alkyl carbons on side chains of the benzene ring. The similarities earlier observed in phase behaviour of protosurfactant systems and surfactant systems are extended in these results. The distribution of organic salts between phases with changes in composition follows the trends known for surfactants. (23 refs.)

109814 Determination of interparticle structure factors in ionic micellar solutions by small angle neutron scattering. D.Bendedouch, Sow-Hsin Chen (Dept. of Nuclear Engng., MIT, Cambridge, MA, USA).
J. Phys. Chem. (USA), vol.87, no.14, p.2621-8 (7 July 1983).
A series of small-angle neutron-scattering (SANS) intensity spectra measurements were carried out on aqueous micellar solutions of ionic detergent lithium dodecyl sulfate (LDS). A systematic study of the system was conducted as a function of both detergent concentration, from 0.008 to 1.107 M, and salt (LiCl) concentration, from 0.0 M, at around 37°C. The data show that LDS micelles stay 'small' within this range of solution conditions, and therefore analysis can be made regarding the micelles as approximately monodisperse macroions suspended in a solution of given ionic strength. Analysis is made by using a mean spherical approximation for a model charged hard-sphere system to compute the interparticle structure factor, and a uniform prolate spheroidal structure for the micellar core to model the intraparticle structure factor. (24 refs.)

109815 Electrostatic curvature contributions to interfacial tension of micellar and microemulsion phases. D.J.Mitchell, B.W.Ninham (Dept. of Appl. Math., Australian Nat. Univ., Canberra, Australia).
J. Phys. Chem. (USA), vol.87, no.16, p.2996-8 (4 Aug. 1983).
Analytic expressions are derived for the interfacial tension of ionic micellar and microemulsion systems. The theory assumes validity of the nonlinear equation. Comparison with data for sodium dodecyl sulfate (SDS) provides strong support for earlier theories of self-assembly of ionic surfactants. (21 refs.)

109816 Solutions and critical times for the polydisperse coagulation equation when $a(x,y)=A+B(x+y)+Cxy$. J.L.Spouge (Trinity Coll., Oxford, England).
J. Phys. A (GB), vol.16, no.13, p.3127-32 (11 Sept. 1983).
Gives solutions of the polydisperse Smoluchowski coagulation equation $\partial f(x,t)/\partial t = {}^1/_2\int_0^x f(y,t)f(x-y,t)a(y,x-y)\mathrm{d}y - f(x,t)\int_0^\infty f(y,t)a(x,y)\mathrm{d}y$, $f(x,0)=g(x)$ for arbitrary $g(x)$ when the coagulation kernel $a(x,y)=A+B(x+y)+Cxy$. The solutions are given as recursions and infinite series and are practical for computation. For the given kernels the author also gives the gelation times t_g at which $M_2(t)=\int_0^\infty x^2 f(x,t)\mathrm{d}x$ becomes infinite. (13 refs.)

109817 The effect of Brownian diffusion on shear-induced coagulation of colloidal dispersions. D.L.Feke, W.R.Schowalter (Dept. of Chem. Engng., Princeton Univ., Princeton, NJ, USA).
J. Fluid Mech. (GB), vol.133, p.17-35 (Aug. 1983).
The effect of a small amount of Brownian diffusion on shear-induced coagulation of spherical particles has been calculated. This has been accomplished by considering the binary collision process between a test sphere and identical spheres interacting with the test sphere through induced-dipole attraction, electrostatic repulsion and hydrodynamically induced forces. The effect of diffusion is found by means of an expansion in inverse Peclet number. Specific calculations were performed for uniaxial extension and for laminar shear flow. It is found that Brownian diffusion, the effect of which is nonlinearly coupled with flow type and strength, can act to increase or decrease the coagulation rate. (14 refs.)

109818 Kinetics of the aggregation of a dilute, finely disperse system at low shear velocities. Yu.A.Buevich, K.S.Kuvalkin (Ural'sk State Univ., Sverdlovsk, USSR).
J. Eng. Phys. (USA), vol.43, no.4, p.1083-90 (Oct. 1982). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.43, no.4, p.565-73 (Oct. 1982). [received: Sept. 1983]
The formation of doublets of spherical particles in a shear stream due to Brownian motion is considered with allowance for their hydrodynamic interaction and the breakup of doublets with a low binding energy. (16 refs.)

109819 Multiple Rayleigh-Gans-Debye scattering in colloidal systems—general theory and static light scattering. J.K.G.Dhont (Van't Hoff Lab., voor Fys. en Colloidchem., Rijksuniv. Utrecht, Utrecht, Netherlands).
Physica A (Netherlands), vol.120A, no.1-2, p.238-62 (1983).
For small differences in the refractive index between the Brownian particles and the solvent, the total scattered field strength may be represented as a series of single-, double- and higher-order scattered field strengths. Equations for these *n*th-order field strengths, scattered from a collection of Brownian particles with fixed orientations and positions are derived. Scattered intensities (up to second order) from a colloidal system containing identical spherical particles are then obtained by ensemble averaging over position coordinates, taking interaction into account. The resulting formulas are relatively simple, and can be used for routine correction of scattering data for double scattering. The geometry of the scattering system plays an important role here.

Experiments on colloidal solutions containing latex and silica particles are performed, testing the theory and the interactive correction method for double scattering. The author used cylindrical cuvettes with rectangular incident and detected beams of radiation. The agreement between experiment and theory is good, yielding a routine correction procedure for double scattering, up to double scattering percentages of about 50%. (11 refs.)

109820 Estimation of the co-ordination number in a multi-component mixture of spheres. M.Suzuki, T.Oshima (Dept. of Chem. Engng., Himeji Inst. of Technol., Himeji, Japan).
Powder Technol. (Switzerland), vol.35, no.2, p.159-66 (July-Aug. 1983).
A simple model of a 2-component mixture of spherical- or disk-type particles was proposed for estimating the co-ordination number, which is the number of contact points on a particle. To verify the validity of the model, the co-ordination numbers calculated from the model were compared with those obtained from the computer simulation of a 2-component mixture and there was fairly good agreement between the two sets of data. An extension of the model was made to calculate the effect of multi-component spherical particles on the co-ordination number. The model gives a good approximation to the existing experimental data for 4- and 5-component mixtures. (6 refs.)

LAS-02 laser dispersed-phase photoelectric analyzer ....See Entry 105380

The theoretical influence of Gaussian grain size distributions on the characteristic curve of photographic film ....See Entry 105396

Mechanics of aerosols in nuclear reactor safety: a review ....See Entry 106114

On the optimum direction of magnetic force in magnetic separation experiments ....See Entry 106648

Scattering and absorption by atmospheric aerosol models ....See Entry 106677

Kinematic, integral, and thermal characteristics of turbulent stream of gaseous suspension under nonsteady thermal conditions ....See Entry 107105

Diffusion and mass transfer in moderately concentrated disperse system with small Peclet numbers ....See Entry 107221

Generalisation of P.P. Ewald's intensity function for microparacrystals in colloids and their superstructures ....See Entry 107546

Gelation/crystallisation of poly(vinyl chloride) ....See Entry 107561

Cloud points in ionic surfactant solutions ....See Entry 107900

Determination of ferrofluid structure by neutron polarization analysis ....See Entry 108724

Some comments on the complex permittivity of ellipsoids dispersed in continuum media ....See Entry 108855

Surface-enhanced Raman scattering of polymethine dyes on silver colloidal particles ....See Entry 108935

A new look at the enhanced low-angle scattering in moderately concentrated polymer solutions ....See Entry 108962

On the determination of emission quantum yields in turbid solid and liquid solutions ....See Entry 109779

Optical emission from photoexcitation of aerosol particles produced by reaction of ozone with 1,3-butadiene ....See Entry 109931

82.80 CHEMICAL ANALYSIS AND RELATED PHYSICAL METHODS OF ANALYSIS

109821 Auger electron spectroscopy as a tool in an industrial laboratory. P.-E.Nilsson-Jatko, S.Sehlstedt, L.Unneberg.
ASEA J. (Sweden), vol.56, no.1, p.26-31 (1983).
Some examples of the areas within ASEA where this technique has been successfully applied are described. The analytical technique makes it possible to determine the chemical composition of extremely thin surface layers. The analysis depth is of the order of two to three atomic layers, that is about 10 Å. (no refs.)

109822 Influence on microwave device performance of n-GaAs surface chemical composition deviation induced by mask layer growth. Chen Keming, Wang Sen, Chen Weide, Fang Puming (Inst. of Semiconductors, Acad. Sinica, Beijing, China).
Chin. J. Semicond. (China), vol.4, no.4, p.334-9 (July 1983). In Chinese.
The influence of (100) n-GaAs surface chemical composition deviation on characteristics of Schottky barrier and ohmic contact is investigated using ϕ550 AES/ESCA system with ion sputtering. The deviation is formed while SiO_2 deposited at different temperatures on n-GaAs is used as a mask. On the basis of the above studies it is suggested that the usual SiO_2 deposition process is composed of two physical processes, i.e. primarily the SiO_2 deposition and the arsenic volatilization followed by oxygen from As-O bonds transfer to Ga to form additional Ga-O bonds. The answer is given to why the performance of a 3 mm mixer using SiO_2 deposited at 400°C as mask is superior to that of a 4 mm mixer using SiO_2 deposited at 700°C, and it is shown that unsatisfactory performances of the latter are due to the β-Ga_2O_3 still existing at Ni/n-GaAs interfaces and leading to more defects. (7 refs.)

109823 Entropy changes during an ideal gas chromatographic separation. M.Jaffar (Dept. of Chem., Quaid-i-Azam Univ., Islamabad, Pakistan).
Arabian J. Sci. & Eng. (GB), vol.8, no.2, p.141-3 (April 1983).
The present investigation attempts to put forward a modified quantitative approach to study the isentropic/nonisentropic gas liquid chromatography (GLC) separations, taking into account the entropy changes as a function of concentration profile variations arising from changes in the carrier gas flow in the retentive regions of an ideal column. In addition, the present work offers a mathematical analysis for estimating thermodynamic properties of multi-component mixtures through GLC parameters. (6 refs.)

109824 An activation method to determine the isotopic ratio of ^{6}Li/^{7}Li in lithium compounds. J.Asher, M.T.Swinhoe (Nuclear Phys. Div., AERE, Harwell, England).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.2-3, p.503-6 (1 Aug. 1983).
A method to determine the isotopic composition of lithium compounds has been developed, with two variations. In one, the activity of ^{7}Be, produced when the sample is bombarded with 4.8 MeV deuterons [via the ^{6}Li(d,n) reaction], is compared with the activity produced in a sample of the same compound with a known ^{6}Li/^{7}Li ratio. In the second, a cross-comparison is made between samples of different composition for both deuteron- (^{6}Li activation) and proton-(^{7}Li activation) induced activities of ^{7}Be, giving ^{6}Li/^{7}Li ratio measurements independent of calibration. The method works well for compounds not containing hydrogen; a lower limit on the sensitivity to ^{6}Li content was found because of residual hydrogen in the compounds investigated. (6 refs.)

109825 The determination of trace inorganic contaminants in polyimides. E.Sacher (Dept. of Engng. Phys., Ecole Polytech., Montreal, Quebec, Canada).
IEEE Trans. Electr. Insul. (USA), vol.EL-18, no.4, p.369-73 (Aug. 1983).
Several techniques capable of measuring inorganic contaminants in the PPM to PPB range have been used to analyze both polyimides and their aqueous extracts for mobile ions. The techniques include plasma spectroscopy, ion chromatography and neutron activation analysis. Their combination has shown that the most hostile mobile ions present are alkali metal ions. While halide ions are present in bulk polymer they are not mobile. The techniques, their limitations, and possible contamination sources are discussed. (18 refs.)

109826 Spectrographic analysis of semiconductor silicon and germanium with a hollow-cathode discharge. N.K.Rudnevskii, D.E.Maksimov, A.N.Tumanova, T.M.Shabanova.
J. Appl. Spectrosc. (USA), vol.37, no.5, p.1219-21 (Nov. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.722-4 (Nov. 1982). [received: Sept. 1983]
Because of the practical needs of the technology of manufacture of semiconductor materials with desired parameters, it is necessary to develop highly sensitive methods for analysis of germanium and silicon used both in monitoring the purity of the starting materials for semiconductor preparation and for monitoring the technological process of their doping. The combined use of direct spectrographic methods with preconcentration of impurities is of interest in the analysis of various semiconductor materials based on germanium and silicon. Because of the increased requirements imposed by manufacture of semiconductor substances, it is necessary to lower the limits of detection of impurity elements. The greatest possibilities for lowering the detection limits by spectrographic analysis of semiconductor germanium and silicon consist in optimization of the spectrum excitation processes. One of the promising ways is the use of a hollow-cathode discharge as the excitation source. Using this light source, the authors have developed direct spectrographic methods for analysis of germanium and silicon and also a method for analysis of germanium with chemical preconcentration of impurities. (1 ref.)

109827 Distribution of laser erosion products on a substrate and its use for spectral analysis. V.I.Derzhitskaya, M.L.Petukh, A.A.Yankovskii.
J. Appl. Spectrosc. (USA), vol.37, no.5, p.1222-4 (Nov. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.724-7 (Nov. 1982). [received: Sept. 1983]
The method of emission spectral analysis can be used to determine the thickness and composition of thin coatings. Lasers permit analyzing arbitrary coatings on both electrically conducting and nonconducting substrates using the same method. In order to increase the sensitivity of determination of low concentrations, lasers are usually used together with electrical discharges. The authors used a variant of this method in which the operations of laser removal of a specimen and its evaporation in electrical discharges were separated. (3 refs.)

109828 Simultaneous radiochemical determination of chemically similar elements by the method of concentration dependent distribution. II. Theory of the method based on substoichiometric masking and auxiliary extractants. M.Kyrs, J.Halova (Nuclear Res. Inst., Rez, Czechoslovakia).
J. Radioanal. Chem. (Switzerland), vol.78, no.1, p.29-41 (1983).
For pt.I see ibid., vol.52, p.53 (1979). The distribution of a radioactively labelled substance was measured in two different solvent extraction systems in the presence of substoichiometric amounts of different masking reagents. The theory of the errors involved in the method is elaborated, recommendations are given for the choice of the conditions of the determination, e.g. which combination of extractant and masking reagent is preferable, which of the two elements should be labelled, what is the optimum concentration of the masking reagent and what values of distribution ratios are desirable. (12 refs.)

109829 Polarographic waves of tri-n-butyl phosphate and polarographic determination of uranium in the presence of tri-n-butyl phosphate. A.Sobkowska (Dept. of Analytical Chem., Inst. of Nuclear Res., Warszawa, Poland).
J. Radioanal. Chem. (Switzerland), vol.78, no.1, p.43-51 (1983).
The results of a study on the polarographic behaviour of TBP and its influence on the determination of uranyl ions is presented. The half-wave potential of the adsorption wave of TBP depends on the concentration of TBP, type of supporting electrolyte and its concentration. In the presence of TBP the polarographic wave of U(VI) ion is changed. Below 7×10^{-5} M TBP the polarographic wave of U(VI) is not affected, between 7×10^{-5} and 2×10^{-4} M TBP the shape, height and half-wave potential of U(VI) waves are changed and above 2×10^{-4} M, up to saturated solution of TBP, the waves of U(VI) do not change further. (15 refs.)

109830 Calibration of Micromatter Co. standards used for the calibration of PIXE analysis systems. D.W.Mingay (Phys. Div., Atomic Energy Board, Pretoria, S Africa).
J. Radioanal. Chem. (Switzerland), vol.78, no.1, p.127-35 (1983).
The evaluation of the accuracy of thin elemental standards produced by Micromatter Co., which are widely used for the calibration of the detection sensitivity of PIXE analysis systems, is presented in terms of Rutherford scattering measurements of the thickness of 68 standards covering a range of 59 different elements. (14 refs.)

109831 Estimation of depth profiles of boron in silicon on ion beam etched sloping cuts by means of neutron induced autoradiography. K.Freyer, H.C.Treutler, G.Deuretzbacher, J.Flachowsky (Central Inst. for Isotope & Radiation Res., Acad. of Sci., Leipzig, Germany).
J. Radioanal. Chem. (Switzerland), vol.78, no.1, p.149-53 (1983).
A new method for the estimation of depth profiles of boron in silicon in extremely thin layers by means of neutron induced autoradiography is described. By the aid of ion beam etching it is possible to produce sloping cuts with angles down to 10^{-4}-$10^{-5\circ}$. This means an extension of the depth profile by a factor of up to 5×10^4. In this way a depth resolution of about ±10 nm is possible. The autoradiographic model of the sloping cut for the evaluation is described and first results are discussed. (7 refs.)

109832 Quantitative autoradiography of semiconductor materials with phosphorus diffusion standards. H.C.Treutler, K.Freyer (Central Inst. for Isotope & Radiation Res., Acad. of Sci., Leipzig, Germany), J.Dubnack.
J. Radioanal. Chem. (Switzerland), vol.78, no.1, p.155-63 (1983). In German.
A suitable standard sample was developed and tested on the basis of phosphorus for the quantitative autoradiography of elements of interest in semiconductor technology. By the aid of silicon disks with a phosphorus concentration of 6×10^{17} atoms.cm^{-2} the error of the quantitative autoradiographic method is determined. The relative mean error of the density measurement is at best ±4%; the relative mean error of the determination of phosphorus concentration by use of an error-free standard sample is about ±15%. This method will be extended to other elements by use of this standard sample of phosphorus. (no refs.)

109833 Rutherford backscattering with heavy ions. I. Mass and depth resolution. R.T.Sullins, C.V.Barros Leite, E.A.Schweikert (Center for Trace Characterization, Texas A&M Univ., College Station, TX, USA).
J. Radioanal. Chem. (Switzerland), vol.78, no.1, p.171-9 (1983).
The analytical features of using heavy ions for Rutherford backscattering spectrometry, particularly the mass and depth resolution capabilities, are discussed. (8 refs.)

109834 Rutherford backscattering with heavy ions. II. Sensitivities and applications. R.T.Sullins, C.V.Barros Leite, E.A.Schweikert (Center for Trace Characterization, Texas A&M Univ., College Station, TX, USA).
J. Radioanal. Chem. (Switzerland), vol.78, no.1, p.181-7 (1983).
For pt.I see ibid., vol.78, p.171-9 (1983). The authors extend the discussions of Part I to include quantitative aspects of heavy ion Rutherford backscattering and present examples of its application. (3 refs.)

109835 Trace elements in Turkish tobacco determined by instrumental neutron activation analysis. M.C.Gulovali (Ankara Nuclear Res. & Training Center, Ankara, Turkey), G.Gunduz.
J. Radioanal. Chem. (Switzerland), vol.78, no.1, p.189-98 (1983).
The concentration of 20 trace elements in nine different brands of Turkish cigarette tobacco and in a brand of pipe tobacco and in tobacco ash has been determined by instrumental neutron activation analysis. The percent transference of elements into smoke has been estimated from the amounts remaining in the ash. (13 refs.)

109836 Pulsed-laser atom-probe FIM study of solid surfaces. T.T.Tsong, T.J.Kinkus (Phys. Dept., Pennsylvania State Univ., University Park, PA, USA).
Phys. Scr. (Sweden), vol.T4, p.201-3 (1983). (Nordic Conference on Surface Science, Tampere, Finland, 18-20 Aug. 1982).
A linear type pulsed-laser time of flight atom-probe field ion microscope has been developed which uses laser pulses of 300 ps from a nitrogen laser for field desorbing surface atoms. It is a time of flight mass spectrometer and an ion energy analyzer of single atom detecting sensitivity with good mass and energy resolution. The new system is used to study the energy distribution of field desorbed inert gas atoms such as Ne^+ and Ar^+, and field evaporated metal ions. The formation of metal helide ions such as $RhHe^{++}$, $PtHe^{++}$ and $PtHe_2^{++}$, and metal hybrid ions such as AuH^+, AuH_2^+, and AuH_3^+ has been studied by observing both the mass spectra and the energy distributions. The formation of H^+, H_2^+, and H_3^+ from atomically well defined metal surfaces under the influence of an applied field is also studied. (10 refs.)

109837 ESCA studies on silicon compounds using an internal standard for calibration. B.Folkesson (Inorganic Chem. 1, Chem. Center, Univ. of Lund, Lund, Sweden).
Spectrosc. Lett. (USA), vol.16, no.7, p.531-9 (1983).
X-ray photoelectron spectra (ESCA) for some silicon compounds have been measured. As an internal standard the Cls binding energy of the carbon atoms of incorporated phenyl groups have been used. In this way a correlation between the binding energy of the silicon atom (Si2p) and its effective charge (q_{Si}) could be set up: $E_b=1.53\ q+100.6$. (17 refs.)

109838 ESCA study of the adhesion of Ag, Cu and Ni to polysiloxane resins used in the semiconductor industry. A.Torrisi, G.Marletta, O.Puglisi, S.Pignataro (Istituto Dipartimentale di Chimica e Chimica Industriale, Univ. di Catania, Catania, Italy).
Surf. & Interface Anal. (GB), vol.5, no.4, p.161-6 (Aug. 1983). (International Conference on Quantitative Surface Analysis, Teddington, England, 24-25 Nov. 1981).
Commercial polysiloxane resins used in the semiconductor industry were moulded on Ag, Ni and Cu real surfaces. The samples were broken by using a pull test machine and the joint strength measured. The 'resin' and 'metal' faces obtained in the rupture process were analysed by ESCA. The chemical composition of the two faces was very different. The one from the resin side resembled that of the bulk. That from the metal side was rich in additives from the commercial resin. Some differences were found between the three metals, whilst the spiral flow of the resin in the range examined influenced the results in only a very limited way. The weak boundary layer in which the above additives accumulate seems responsible for the low adhesion level found. The Pb/Si concentration ratio at the fracture locus is correlated with the adhesive joint strength. The multifactorial nature of the adhesion in practical samples is discussed. It is suggested that the influence of the heavy elements present in the additive has to be explored in connection not only with the adhesion problem but also with the electrical reliability of the device. (16 refs.)

109839 Fabrication of a low cost controlled potential coulometer. M.Venkataramaiah, G.N.Rao, R.Mulchandani (Indian Inst. of Technol., New Delhi, India).
Trans. SAEST (India), vol.18, no.1, p.59-65 (Jan.-March 1983).
A new circuit using locally available IC operational amplifiers has been designed and a controlled potential digital coulometer has been fabricated. The unit gave satisfactory results. The cost of the unit including the power supply is estimated to be about four thousand rupees. (3 refs.)

Zeeman atomic absorption spectroscopy .... See Entry 105384

Ion microscopy using electron-desorbed ions .... See Entry 105421

Monochromatized Ag Lα X-rays as a source for higher energy XPS .... See Entry 105429

Certification of a uranium metal reference material for chemical analyses .... See Entry 105979

Pressurized water reactor chemistry/radiochemistry sampling programs .... See Entry 106092

Technology of high-purity HgI_2 .... See Entry 106218

Spark source mass spectrographic analyses of α-HgI_2: a comparison of samples from different laboratories .... See Entry 106223

Search for correlations between electrical characteristics and stoichiometry in mercuric iodide .... See Entry 106227

Electron microprobe analysis of a glass fibre .... See Entry 106883

Microstructure and stability of iron chloride graphites .... See Entry 107642

Neutron activation measurements of As and Ga loss during transient annealing of GaAs .... See Entry 107758

Microstructure and microanalysis of bismuth molybdates .... See Entry 107966

Gadolinium monophosphide at elevated temperatures .... See Entry 107982

Surface study of a Ag electrode on a solid electrolyte used as oxygen sensor .... See Entry 108130

XPS and AES quantitative surface analysis: comparison on oxide powder systems .... See Entry 108144

Absorption of carbon from residual gases during Ti implantation of alloys .... See Entry 108153

Palladium on GaAs: a reactive interface .... See Entry 108217

Atomic composition of RF-sputtered alumina coatings determined by XPS method .... See Entry 108230

Superlattices formed by electrodeposition of silver on iodine-pretreated Pt(111); studies by LEED, Auger spectroscopy and electrochemistry .... See Entry 108235

Electronic characteristics of Ge-GaAs interface having chemisorbed oxygen at the GaAs surface .... See Entry 108538

Characterisation of computer differentiation of spectra in AES and its relation to differentiation by the modulation technique .... See Entry 109064

Secondary ion emission from transition metals bombarded by hydrogen ions .... See Entry 109079

XPS studies on xanthate adsorption on galena surfaces .... See Entry 109091

Dependence of surface composition of Zr-Ni intermetallic compounds on bulk composition and treatment .... See Entry 109092

Quantitative analysis of titanium nitride thin film by means of X-ray photoelectron spectroscopy .... See Entry 109101

The Tl_2Se-As system .... See Entry 109257

The $TlAsSe_2$-Tl system .... See Entry 109258

The Tl_4AsSe_2-AsSe system .... See Entry 109259

XPS and XAES studies of transient enhancement of Cu^I at CuO surfaces during vacuum outgassing .... See Entry 109538

Some investigations on anodic oxide films on gallium arsenide .... See Entry 109546

Surface composition of stainless steel at active corrosion .... See Entry 109584

Radiowave inspection of substances by the method of differential modulation of probe radiation .... See Entry 109616

Plasma polymerization of ethane. I. Experimental studies of effluent gas composition and polymer deposition rates .... See Entry 109737

Production and detection of energetic species by laser photolysis and detection techniques .... See Entry 109763

The adsorption of methanol on Ag(111) and its reaction with preadsorbed oxygen .... See Entry 109795

X-ray photoemission spectroscopy of potassium promoted Fe and Pt surfaces after H_2 reduction and CO/H_2 reaction .... See Entry 109796

Chemisorption of oxygen at Ag(110) surfaces and its role in adsorbate activation. [Photoelectron spectra observations] .... See Entry 109801

Interferences in the radiochemical determination of ^{230}Th [in soil and water] .... See Entry 109946

Enriched uranium as an activatable tracer in environmental research .... See Entry 109947

Comparative determination of bromine and iodine in three air sampling media via instrumental thermal and epithermal neutron activation analysis .... See Entry 109948

ISFET, a chemical sensor: an ion-sensitive transistor developed at the TH Twente .... See Entry 110232

The development of linear sweep voltammetry with carbon paste electrodes in vivo .... See Entry 110264

Chemical study of the Tama River. V .... See Entry 110507

Chemical composition of precipitation. V .... See Entry 110598

82.90 OTHER TOPICS IN PHYSICAL CHEMISTRY

109840 Mixing in mechanically agitated gas-liquid contactors, bubble columns and modified bubble columns. A.B.Pandit, J.B.Joshi (Dept. of Chem. Technol., Univ. of Bombay, Bombay, India).
Chem. Eng. Sci. (GB), vol.38, no.8, p.1189-215 (1983).
Mixing time measurements were made in 300 and 1000 mm mechanically agitated contactors with different types of impellers, located at different heights from the bottom of the vessel. Mixing time measurements were also made in 150, 200, 385 and 1000 mm bubble columns with varying liquid heights. Transient pH measurement and conductivity measurement were used to measure the mixing times. Impeller speed was varied in the range of 3.33-20 r/sec in the case of mechanically agitated contactors and gas superficial velocity was varied in the range of 10-250 mm/sec in bubble columns. Effect of physical properties of the fluid (surface tension, ionic strength, liquid viscosity) and that of the nonNewtonian behavior on mixing time was studied. Mixing time in the presence of drag reducing agents was also investigated. A procedure is given for the prediction of the critical impeller speed for gas phase dispersion in mechanically agitated contactors. (23 refs.)

109841 Parameter evaluation of an extractor with back mixing. A.Heyberger, M.Kratky, J.Prochazka (Inst. of Chem. Process Fundamentals, Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Chem. Eng. Sci. (GB), vol.38, no.8, p.1303-7 (1983).
From measured longitudinal solute concentration profiles in a vibrating plate extraction column parameters of a stagewise model with back mixing were evaluated as functions of the axial coordinate of the column. In the model the parameters were represented by polynomials of the stage number and the dependence of model error on the degrees of the polynomials was studied. Very good agreement of measured and calculated concentration profiles was obtained with polynomials of not higher than 4th degree, whereas the model with constant parameters in most cases failed to describe adequately the profiles and the exit concentrations. As a possible cause of the variability of parameters along the column the existence of hold-up profiles is suggested. (6 refs.)

Analysis of transport processes with granular media using the constricted tube model .... See Entry 107234

A continuous method of zone melting .... See Entry 109137

Particle growth mechanisms in fluidised bed granulation. I. The effect of process variables .... See Entry 109180

Particle growth mechanisms in fluidised bed granulation. II. Comparison of experimental data with growth models .... See Entry 109181

86.00 ENERGY RESEARCH AND ENVIRONMENTAL SCIENCE

86.10 ENERGY RESOURCES AND THEIR UTILISATION

(inc. economic aspects; for nuclear engineering and nuclear power studies, see 28.00)

109842 Technology characterization for energy system analysis. S.Koyama, T.Kashihara, E.Endo (Electrotech. Lab., Ibaraki, Japan).
Bull. Electrotech. Lab. (Japan), vol.47, no.4, p.284-309 (1983). In Japanese.
An international collaborative project, Energy System Analysis Project (SA), was conducted by the International Energy Agency (IEA) from 1976 to 1979 to provide analytical information for development of IEA energy R&D strategy. Based on the result of the project, another project, Energy Technology System Analysis Project (ETSAP), was started by the IEA in November 1980, scheduled to last for two years. Main subjects expected in the first year are the characterization of energy technologies and the transfer of energy system model 'MARKAL' to participating countries. A main subject expected in the second year is the analysis of energy system by the use of MARKAL and the data obtained in the first year. These subjects have been carried out according to a task sharing sheme. Japan has started the role of characterizing 27 technologies, of which 14 are to be characterized at the Electrotechnical Laboratory through collaboration with specialists of respective technologies. The basic definition of main data items, concept of data adjustment, and collected and adjusted data are summarized. (29 refs.)

109843 Case study, candidate technologies to relieve the European energy systems: Ireland. L.Killen.
Report EUR 8035 EN, Comm. European Communities, Luxembourg (1982), 50 pp.
Presents the results for Ireland of the case study entitled 'Candidate Technologies to relieve the European Energy System', using the EFOM-12-C model. The previous case study, 'The Escalating Supply Rationing' examined the sensitivity of the European energy systems to progressive restrictions in energy imports. The results for Ireland were not flexible in this regard, with a maximum saving of only 6% in the cost of energy imports possible, and this was achieved at the expense of an increase of 19% in total system cost. This reflects the relatively insecure situation in which Ireland finds itself, with very few indigenous energy resources and therefore a high dependence upon imported energy, and in particular upon imported oil.

86.10B Fossil and other fuels

109844 Coal gasification—the proof of the pudding. N.A.Holt (Electric Power Res. Inst., Palo Alto, CA, USA).
Mod. Power Syst. (USA), vol.3, no.6, p.20-8 (June 1983).
By removing the sulphur bearing and particulate matter from the gas prior to combustion, coal gasification offers attractive schemes for environmentally superior domestic resource based plants. Currently, the Lurgi dry ash, Koppers-Totzek, Winkler and Wellman Galusha processes are operated commercially. However, at this time only the small Wellman producers are in use in the USA. A Lurgi dry ash plant based on North Dakota lignite is under construction for Great Plains Associates. Proposals for plants based on the Koppers-Totzek and Winkler processes and other gasification technologies are currently before the US Synthetic Fuels Corporation. Over the next five years several other coal gasification processes should be demonstrated at commercial sizes. They include the Texaco, British Gas Corporation/Lurgi, Shell, Westinghouse, pressurised Winkler, and Allis-Chalmers Kilngas processes. Commercial operation on a larger scale is expected in the 1990s. (no refs.)

109845 Resource and energy management of synfuels production with hydrogen and oxygen requirements from electrolysis. R.H.Shannon, R.D.Richardson.
Int. J. Hydrogen Energy (GB), vol.8, no.10, p.783-92 (1983).
The Resource and Energy Management System (REM) is an integrated self-sufficient system for the efficient and clean recovery of synthetic crudes at high yields from a variety of heavy hydrocarbon deposits. The system integrates the following: heavy oil/tar sand bitumen/shale oil/coal recovery; upgrading by 'hydrogen addition'; residual oil/coal gasification; and combined cycle electricity generation for water electrolysis. Recovered heavy hydrocarbons are upgraded by 'hydrogen addition'. Hydrogen is available, in the REM system, from electrolysis, from gasifying the waste carbonaceous residues from upgrading and from gasifying coal. Gasification is efficiently carried out with oxygen, available from electrolysis. Gasifier synthesis gases are also used in a combined-cycle power system to generate power. Power, produced economically by this means, is used to electrolyse water which is the source of hydrogen for upgrading and of oxygen for gasification. Favourable technical and economic circumstances now prevail for the commercialization of large-scale electrolytic units in the synfuels industry according to a technical and economic analysis. (19 refs.)

109846 An airline view of LH2 as a fuel for commercial aircraft. K.G.Wilkinson.
Int. J. Hydrogen Energy (GB), vol.8, no.10, p.793-6 (1983).
Fuel for air transport is a particularly important matter, because it is an energy-intensive form of transport. Price and energy density are therefore correspondingly critical. Airlines' views tend to be short term because there is no future if they do not survive tomorrow. Thus, although petroleum supply and price has been unstable since 1973, airlines' primary concern has been with economizing the use of fuel and specifying more fuel economic equipment for the future, rather than serious pursuit of more radical solutions. LH2 gives promise of being a serious candidate for the longer term but there is not yet convincing proof that cheaper seat mile costs could be produced in today's circumstances. This situation could be changed by the realization of laminar flow by surface cooling at subsonic speeds. There is a strong case for a modest programme of carefully aimed research on an international basis to fill the most important gaps in our knowledge on the design of LH2 fueled aircraft. Future crises in energy supplies may well raise questions of transport fuel strategy which will heed this background for wise decision-making. Particular significance attaches to the place of nuclear power in world energy policy since this dominates the question of LH2 availability and price. (2 refs.)

86.10D Wind energy

109847 Economic evaluation of wind energy applications for remote location power supply.. P.C.Bandopadhayay (Div. of Energy Technol., CSIRO., Highett, Victoria, Australia).
Wind Eng. (GB), vol.7, no.2, p.67-78 (1983).
An economic evaluation methodology based on the Present Value Analysis is proposed. In this method, graphical representations of the system performance and the economic requirements are used to examine the economic implications of using Wind Energy Conversion Systems (WECS) to supply electrical power to an isolated user. The method can also be used to determine the optimum sizes of the wind energy convertor and the electrical storage size of the simple WECS. The cost of electricity generation using a Total Energy Wind Conversion System is compared, using Present Value Analysis, with that of a WECS and a liquid fuel operated generating system. (4 refs.)

109848 The Weibull distribution function and wind power statistics.. G.J.Bowden, P.R.Barker, V.O.Shestopal, J.W.Twidell (School of Phys., Univ. of New South Wales, Kensington, NSW, Australia).
Wind Eng. (GB), vol.7, no.2, p.85-98 (1983).
The properties of the Weibull distribution function are used to show that there are some simple relationships between the Weibull parameters (K,c) and the wind speed moments $(\bar{v},\bar{v}^3)$. In particular, to within 1%, $\bar{v}={}^{1}/_{2}\pi^{1/2}c$ (for $1.6\leq k\leq 3.0$) and $\bar{v}^3={}^{1}/_{2}\pi^{1/2}(3c^3/k)$ (for $1.8\leq k\leq 2.3$). These results are subsequently used to examine the relationship between seasonal, yearly and many-yearly Weibull parameters for a given site. Some simple 'sum-rules' are derived which conserve their time-averaged moments $\bar{v}$ and $\bar{v}^3$. These sum rules are used, in turn, to suggest a 'generalised Weibull distribution function' which can be used to model the fluctuation, which will occur from year to year, in the average moments $\bar{v}$ and $\bar{v}^3$. In addition, some new results for Lord Howe Island are presented, which show that the annual wind speed, at selected sites is $\sim 8.1\ \mathrm{ms}^{-1}$. Finally some comments are also made concerning the choice of distribution function to model wind speed statistics. (17 refs.)

109849 A strategy for optimization of wind energy systems. S.Westberg (Dept. of Mech. Engng., Univ. of Linkoping, Linkoping, Sweden).
Wind Eng. (GB), vol.7, no.2, p.104-14 (1983).
The paper presents a strategy to deal with wind energy systems as an optimization problem. An attempt is made to create a general procedure to describe a complete system. The system is divided into three independent parts, the application, the wind turbine and the state of wind. In this way the problem becomes more tractable and each part can easily be changed while the others are unaffected. An illustrative example is described where a wind rotor is directly connected to the compressor of a heat pump. (6 refs.)

Noise characteristics of large wind turbine generators ....See Entry 106925

Evaluation of human exposure to the noise from large wind turbine generators ....See Entry 106926

86.10H Geothermal energy

Isotopes in geothermal energy exploration ....See Entry 110335

Mapping and analysis of aerial conductivity measurements from INPUT system over geothermal areas ....See Entry 110705

86.10K Solar energy

109850 Directional intercept factor of truncated CPCs. J.C.Minano (Univ. Politecnica, Inst. de Energia Solar, ETSI Telecomunicacion, Ciudad Univ., Madrid, Spain).
Appl. Opt. (USA), vol.22, no.17, p.2747-50 (1983).
The fraction of power reaching the collector of a truncated cylindrical compound parabolic concentrator, out of the total power arriving as its entry aperture in a given direction, is calculated without ray tracing for all directions. (5 refs.)

109851 Limit of concentration under extended nonhomogeneous light sources. J.C.Minano, A.Luque (Inst. de Energia Solar, Ciudad Univ., Madrid, Spain).
Appl. Opt. (USA), vol.22, no.17, p.2751-60 (1983).
Static photovoltaic concentrators, which see the sky as an extended distribution of radiance, are analyzed in a general way. The rules for achieving the highest energy on the cell are derived and the appropriate figures of merit are defined. It is concluded that casting increasingly high values of energy on the cell, which would be bifacial, require collecting a lower portion of the total sky energy. The corresponding figures of merit for the concentrators of the CPC family are analyzed, concluding that a better type of concentrator should be developed for photovoltaic applications. (5 refs.)

109852 Automatic methods of adjusting facet concentrators and heliostats. R.A.Zakhidov, R.A.Khakimov, A.A.Abdurakhmanov, Yu.M.Sizov, V.K.Baranov (Central Design Office of Sci. Instrument Manufacture, Acad. of Sci., Uzbek SSR).
Appl. Sol. Energy (USA), vol.18, no.5, p.27-30 (1982). Translation of: *Geliotekhnika (USSR)*, vol.18, no.5, p.23-6 (1982). [received: Aug. 1983]
Automatic adjustment devices for mirror elements have been developed to automate the process of adjustment of facet concentrators, thus substantially reducing the amount of time and effort involved in adjustment. In addition, by storing the adjusted position, it is possible to automatically activate and deactivate individual mirror elements. This makes it possible to regulate the light flux in the focal region of facet concentrators. The remote control unit for facets is an element of a facet-concentrator prototype and is intended for developing automatic methods of adjusting groups of facets. It includes a framework, a group of 10 facets with individual drives, reducers, and a control panel. (4 refs.)

109853 Investigation of the equations of motion of the heliostats of a tower-type solar electric power plant. M.N.Kachanovskii, V.M.Dubilovich (Krzhizhanovskii Sci. Res. Inst. of Power Engng., USSR).
Appl. Sol. Energy (USA), vol.18, no.5, p.37-42 (1982). Translation of: *Geliotekhnika (USSR)*, vol.18, no.5, p.31-5 (1982). [received: Aug. 1983]
The authors obtain equations for determining the position and speed of rotation of heliostats at 'antishadow' points. (3 refs.)

109854 Investigation of accumulated energy and thermal conditions in shed-type hothouses. A.I.Imamkulov, Yu.N.Yakubov (Ordzhonikidze Bukhara State Pedagogical Inst., USSR).
Appl. Sol. Energy (USA), vol.18, no.5, p.61-4 (1982). Translation of: *Geliotekhnika (USSR)*, vol.18, no.5, p.50-3 (1982). [received: Aug. 1983]
The authors investigate the thermal conditions in their radically new design for shed-type and traditional hothouses, and also of commercial shed-type and traditional hothouses with an area of 300 and 500 m^2. (3 refs.)

109855 On the determination of the heat-insulating characteristics of transparent film shielding for solar hothouses. A.T.Temurkhanov, A.B.Vardiashvili, G.Ya.Umarov, V.D.Kim (Alimdzhan Karshin State Pedagogical Inst., USSR).
Appl. Sol. Energy (USA), vol.18, no.5, p.65-70 (1982). Translation of: *Geliotekhnika (USSR)*, vol.18, no.5, p.53-8 (1982). [received: Aug. 1983]
Considers two-layer film shielding and buffer film shielding. Tests were conducted using two identical model installations 1×0.44×0.34 m in size. To reduce heat loss, the windows of the installation were two-layer windows with a glass-wall filler. The installations were heated by means of 600-W electric heaters. The heating level was adjusted by means of a laboratory transformer. The temperature inside the model and in the transparent shielding was measured. The measurement errors were taken into account. It is seen that, in the case of film shielding, the heat-transfer coefficient of buffer insulation is 10-12% lower than for two-layer insulation. (3 refs.)

109856 Incoming direct solar radiation onto an arbitrary surface. A.Galkanov (Voroshilovgrad Machine Building Inst., USSR).
Appl. Sol. Energy (USA), vol.18, no.5, p.74-6 (1982). Translation of: *Geliotekhnika (USSR)*, vol.18, no.5, p.61-3 (1982). [received: Aug. 1983]
The author derives a formula for computing the amount of direct solar radiation at a point on a specified surface. (1 ref.)

109857 Problem of accumulation of solar energy in the form of heat. Yu.A.Yakubov, A.I.Imamkulov, N.K.Radzhabov (Ordzhonikidze Bukhara State Pedagogical Inst., USSR).
Appl. Sol. Energy (USA), vol.18, no.5, p.77-81 (1982). Translation of: *Geliotekhnika (USSR)*, vol.18, no.5, p.63-6 (1982). [received: Aug. 1983]
The authors investigate the possibility of accumulating solar energy in hothouses, and develop an optimality efficient hothouse design. The problem of accumulation obviously requires optimization of the amount of energy accumulated in solar installations with observance of the following conditions: 1) maximum entry of radiation; 2) minimum heat loss through enclosing surface of absorber; 3) optimization of heat-accumulating materials with optimal dimensions. These conditions are considered. (3 refs.)

109858 Heliothermic index for the evaluation of the potential of solar energy. R.Dogniaux (Inst. Royal Meteorologique de Belgique, Brussels, Belgium).
Int. J. Sol. Energy (Switzerland), vol.1, no.6, p.441-9 (1983).
The object of the present note is to propose and define simple index for characterizing and differentiating, at the mesoscale range, climatic areas answering criteria suited for heliothermic applications. The meteorological elements most liable to influence the behaviour of heliothermic systems are solar and atmospheric irradiances, air temperature and wind speed. It is thus quite natural to call on a simple function of these variables to define, as simply as possible, heliothermic index that can be applied to glass-shielded systems. (3 refs.)

109859 Analysis of solar sand heater. S.Singh, S.Ram, N.K.Bansal (Centre of Energy Studies, Indian Inst. of Technol., New Delhi, India).
Int. J. Energy Res. (GB), vol.7, no.3, p.241-53 (July-Sept. 1983).
This paper presents an analysis of an air/water heater, consisting of pipes, laid in a solid block; the surface of the block exposed to the sun is blackened and glazed, whereas the other surface is insulated, with outer surface of the insulation being in contact with ambient air. The block can consist of sand (laboratory model heater) (Sodha et al., 1980) or a south facing wall or roof; thus the concept represents an integration of the heater with the building. The modes of operation considered are (i) when the glazing is not insulated at night and (ii) when the glazing is insulated at night. (5 refs.)

109860 Economic comparison of solar absorption and photovoltaic-assisted vapour compression cooling systems. S.Ayyash, M.Sartawi (Kuwait Inst. for Sci. Res., Safat, Kuwait).
Int. J. Energy Res. (GB), vol.7, no.3, p.279-88 (July-Sept. 1983).
When the solar absorption and vapour compression cooling systems are viewed from the point of view of electrical energy consumption the differences between them can be expressed in terms of electrical energy saving with the former. As such, it is proposed that an economic comparison between photovoltaic-assisted vapour compression and solar absorption cooling systems be conducted, assuming that the former receives an amount of solar electricity equal to the potential electrical energy saving with the latter. The comparison is conducted with particular emphasis on the operational conditions in Kuwait. Analysis has shown that the potential electrical energy saving with a solar absorption cooling system is equal to 16 per cent of its refrigeration generation. The cost of supplying an equal amount of solar electricity is compared with the difference between the life-time costs of a solar absorption system and an equivalent vapour compression system. The economic comparison is conducted on the basis of the difference between the net present values of both systems. Given the current cost estimates and the prevailing climatic conditions in Kuwait it is shown that photovoltaic-assisted vapour compression cooling systems are likely to compete with the solar absorption cooling systems. This is particularly true in such applications where cooling is required for few hours during the day, and as the cost of the photovoltaic system decreases. (6 refs.)

109861 Transient performance of closed loop solar water heating system with heat exchanger. G.N.Tiwari, B.N.Sharma, A.Srivastava (Centre of Energy Studies, Indian Inst. of Technol., New Delhi, India).
Int. J. Energy Res. (GB), vol.7, no.3, p.289-94 (July-Sept. 1983).
The present paper deals with an analysis of a forced circulation closed loop solar water heating system; withdrawal of hot water of constant flow rate from a storage tank through a heat exchanger is considered. The effect of flow rate and heat exchanger length on the performance has also been discussed for a typical set of parameters and for a typical cold day in Delhi (26 January 1980). (4 refs.)

109862 Shade beneath solar collectors: a potential agriculture resource. R.H.Sauer (Pacific Northwest Lab., Richland, WA, USA).
Sol. Energy (USA), vol.31, no.4, p.411-14 (1983).
At a solar generating station, the solar collectors would provide the shade, as do the shrubs, but unlike the shrubs, would not compete for the limited water supply. The reduced heat and drought beneath the collectors may increase vegetative productivity to the point where harvesting a crop would be economical. The objective of this research was to study changes in the soil water and temperature conditions and plant production in the shade, compared to an unshaded area. The partial shade beneath solar collectors in the desert appears to offer better growing conditions compared to an unshaded area, with respect to soil water content and air temperature. However, in this research, the test plants did not show a positive response to the better growing conditions, possibly because too much light was excluded. These results suggest this approach to making use of the otherwise unused soil beneath solar collectors should be pursued. (5 refs.)

Infrared sensor for remote temperature monitoring of solar thermal central receivers .... See Entry 105372

Limit of concentration for cylindrical concentrators under extended light sources .... See Entry 106847

Maximum statistical increase of optical absorption in textured semiconductor films .... See Entry 109031

Optimization of static or quasi-static photovoltaic installations .... See Entry 109899

Studies of a thermoelectric generator operating from tubular solar collectors .... See Entry 109904

Photochemical solar collector for the photoassisted reduction of aqueous carbon dioxide .... See Entry 109906

Tests of a module for a parabolocylindrical solar installation .... See Entry 109909

Method of making heat-engineering calculations for a passive solar heating system (nonsteady conditions) .... See Entry 109910

Regulation of daily refrigerating-capacity schedule of a solar absorption refrigerating unit .... See Entry 109911

Effect of angle of inclination on the operating efficiency of a solar radiative drying installation .... See Entry 109912

On the improvement of solar heating and cooling systems .... See Entry 109913

Simulation of behaviour of a drying system for grain .... See Entry 109914

Status of the cadmium thermoelectrochemical hydrogen cycle .... See Entry 109920

Experimental validation of a spectral direct solar radiation model .... See Entry 110602

Contribution to the study of solar radiation in Burgos, Spain .... See Entry 110603

Estimation of the total solar radiation from meteorological data in the Italian climatic area .... See Entry 110605

86.10N Nuclear energy

109863 The availability of uranium, thorium and heavy water in the world in the light of the results of the INFCE study. M.Petrovic (Savezni Komitet za energetiku, Beobrad, Yugoslavia).
Elektroprivreda (Yugoslavia), vol.36, no.5-6, p.188-97 (May-June 1983). In Croatian.
Gives a brief review of the results of two years of work on the INFCE study in the part related to the long-term development in the world of the industry of nuclear raw materials (uranium and thorium) and heavy water, in which the author also took part on behalf of Yugoslavia. In accordance with the estimated development of the nuclear industry up to the year 2025, as well as with the possible development of individual technologies of the nuclear fuel cycle and reactor systems, the demand in the world for nuclear raw materials and heavy water, as well as the possibilities to meet this demand have been estimated. (5 refs.)

86.30 ENERGY CONVERSION

86.30D Electrochemical conversion: general

(for superionic conductors, see 66.30H)

Reverse electrodialysis. Electric energy detained from mixing of solutions of different salinity .... See Entry 109761

86.30E Primary cells

109864 Zinc-air cells: power source of the future. R.E.Pytches (Gould Micropower Products Div., Wrexham, Wales).
Electron. & Power (GB), vol.29, no.7-8, p.577-80 (July-Aug. 1983).
Modern-day microelectronic products demand similarly miniaturised reliable power sources, in some cases even operating in a standby mode. This article states the case for the zinc-air cell, originally used in hearing aids, as opposed to its main competitors. (no refs.)

109865 The prediction of the state-of-charge of some commercial primary cells. S.A.G.R.Karunathilaka, N.A.Hampson, M.Hughes (Dept. of Chem., Univ. of Technol., Loughborough, England), W.G.Marshall, R.Leek, T.J.Sinclair.
J. Appl. Electrochem. (GB), vol.13, no.5, p.577-86 (Sept. 1983).
Research carried out at Loughborough during the last five years of the impedance of Leclanche, alkaline Zn-MnO_2, alkaline Zn-HgO, Li-CuO, Li-SO_2, Li-$SOCl_2$ primary cells is briefly reviewed. The use of alternating current methods for the estimation of the state of charge of the cells is discussed. A search was made for properties of the impedance of each cell system which change in a marked and reliable manner when a prescribed amount of charge is withdrawn from the cell. It is concluded that simple tests based upon an assessment of these properties are adequate for the estimation of the state of charge of some of the systems studied. However, other systems are not so 'well-behaved'. The impedance of each cell changed significantly during discharge and, although making measurements of these changes would enable the state of charge to be estimated, the test techniques required would not necessarily be simple. Using the results obtained on the impedance of the cells, test sets have been constructed which provide a digital presentation of the open-circuit voltage and the state of charge of Leclanche cells (Ever Ready type SP11), mercury cells (Mallory, type RM502R) and lithium cells (Mallory, type L032S and SAFT, type LC01). The electronic techniques employed in these test sets are described in outline with reference in block-schematic diagrams. A proposal is made for the construction of a general-purpose tester for primary cells which would incorporate microprocessors and provide an indication of state of charge based upon data relating to impedance, temperature and discharge history. The tester might also be made self-calibrating for field use. (13 refs.)

109866 Corrosion and polarisation characteristics of zinc in battery electrolyte analogues and the effect of amalgamation. L.M.Baugh, F.L.Tye, N.C.White (Group Tech. Centre, Berec Group Ltd., London, England).
J. Appl. Electrochem. (GB), vol.13, no.5, p.623-35 (Sept. 1983).
The corrosion and polarization characteristics of zinc have been investigated in concentrated NH_4Cl and NaCl solutions which represent suitable electrolyte analogues for Leclanche and zinc chloride cells, respectively. The effects of zinc amalgamation in the range 0-1 mg Hg cm^{-2} have also been examined and the results compared and contrasted with those obtained in concentrated KOH solution which is a useful electrolyte analogue for alkaline cells. It is

shown that the structure of the zinc-solution interphase and the electrochemical reactions which occur are critically dependent upon the particular electrolyte considered. Despite this, the absolute corrosion rates of unamalgamated zinc are of the same order. This is an unexpected result. The effectiveness with which both dissolved zinc salts and mercury reduce the corrosion rate decreases in the electrolyte order $KOH \gtrsim NH_4Cl > NaCl$. This is explained by the increasing participation of diffusion as the factor which controls the rate of the cathodic hydrogen evolution process. Maximum effectiveness for corrosion inhibition is approached when the mercury level exceeds 100 $\mu g\ cm^{-2}$. At this concntration, coverage of the surface by a zince rich almalgam of almost constant composition is complete. (15 refs.)

109867 The impedance of the lithium-thionyl chloride primary cell. M.Hughes, S.A.G.R.Karunathilaka, N.A.Hampson (Chem. Dept., Univ. of Technol., Loughborough, England), T.J.Sinclair.
J. Appl. Electrochem. (GB), vol.13, no.5, p.669-78 (Sept. 1983).
The impedances of nominally fully charged and partially discharged $Li/SOCl_2$ cells have been measured in the frequency range 10 kHz-6 mHz. The data have been interpreted using an analogue technique in terms of the most probable cell reactions. The possibilities of state-of-charge tests based on the impedance technique are discussed. The most promising parameter for a residual capacity test in the region 100-90% is the double-layer capacitance. (18 refs.)

109868 The delayed action of magnesium anodes in primary batteries. I. Experimental studies. B.V.R.Kumar, S.Sathyanarayana (Dept. of Inorganic & Phys. Chem., Indian Inst. of Sci., Bangalore, India).
J. Power Sources (Switzerland), vol.10, no.3, p.219-41 (Aug. 1983).
Magnesium exhibits a delayed dissolution on anodic polarisation owing to a slow, field-induced breakdown of the passive film on its surface. The phenomenon depends on several factors such as the pretreatment of the anode, the composition of the solution, etc. In order to clarify the mechanism of the field-induced film-breakdown process, a detailed experimental study of the delayed action and its dependence on several experimental variables such as ageing of anode in contact with the solution, the nature of the surfactant-coating on the magnesium anode, the anodic current density, etc., has been carried out. The results of the single electrode studies have been verified with improved $Mg-MnO_2$ dry cells. Finally, a probable mechanism based on a 'metal dissolution − film dilatation − film breakdown' model has been proposed in order to explain the delayed action under various experimental conditions. (20 refs.)

109869 The delayed action of magnesium anodes in primary batteries. II. Theoretical studies. S.Sathyanarayana, B.V.R.Kumar (Dept. of Inorganic & Phys. Chem., Indian Inst. of Sci., Bangalore, India).
J. Power Sources (Switzerland), vol.10, no.3, p.243-61 (Aug. 1983).
For pt.I, see ibid., vol.10, no.3, p.219 (1983). A physical model for the field-induced breakdown of the passive film on magnesium anodes has been developed based on experimental data on the delayed action of magnesium anodes. The model essentially involves, successively, metal dissolution at the metal-film interface, film-dilatation, and film breakdown. A theoretical analysis of the model has been carried out to obtain an explicit expression for the time dependence of the electrode potential during the delayed action phenomenon. The delay-time curves obtained are compared with experimental data, especially with regard to the effects of film thickness, ageing of the anode in solution, current density, temperature, etc. Finally, possible means of reducing the delayed action of magnesium anodes are predicted from the 'metal dissolution-film dilatation-film breakdown' model. (9 refs.)

109870 Lithium/thionyl-chloride cells. M.A.Jay.
New Electron. (GB), vol.16, no.14, p.54-6 (12 July 1983).
Describes the lithium/thionyl-chloride cell specific benefits. Energy density: $Li/SOCl_2$ provides a higher energy per unit volume and energy per unit mass than most other primary cells, giving up to 420 Wh/kg and 800 mWh/cm^3. Terminal voltage: $Li/SOCl_2$ has the highest open circuit voltage (3.68 V) and working voltage (3.4 V) of any commerically available primary cell. It also exhibits a very flat discharge characteristic, maintaining this voltage at a constant level until the cell becomes exhausted. Operating temperature range: the cell has a useful temperature range of −55 to 75°C. Long-term stability: the shelf life of the cell at room temperature is beyond 10 years. (no refs.)

109871 The answer's alkaline [primary cells]. B.Russell.
New Electron. (GB), vol.16, no.14, p.59-60 (12 July 1983).
Describes the alkaline system in which the zinc anode does not serve as a cell container and can be used in a granular powder form. This results in a very large anode surface that has the effect of increasing the life and the maximum current available from a given cell size. At the other electrode, a highly active form of manganese dioxide is pelleted and pressed against the inner surface of the cell container which also serves as the cathode current collector. The electrolyte is a highly conductive solution of potassium hydroxide which provides great mobility of ions over a wide variety of current drains and at a large range of temperatures. (no refs.)

109872 Zinc-air cells have unique properties. M.A.Jay.
New Electron. (GB), vol.16, no.14, p.62-4 (12 July 1983).
Describes zinc-air cells, which give instantaneous high power output, very stable discharge voltage and a high specific energy and low weight to volume ratio. Ambient air is allowed to permeate the cell and forms the positive electrode. Using air as an electrode gives the cell its unique properties. The air penetrates a cylinder of zinc powder in order to provide a surface for chemical reaction to take place. The cathode is gelled KOH and an alkaline electrolyte separates the anode and cathode. (no refs.)

86.30F Secondary cells

109873 Two-plateau rechargeable sodium/sulfur(IV) molten chloroaluminate cell. G.Mamantov, K.Tanemoto, Y.Ogata (Dept. of Chem., Univ. of Tennessee, Knoxville, TN, USA).
J. Electrochem. Soc. (USA), vol.130, no.7, p.1528-31 (July 1983).
The behavior of the rechargeable cell Na/β''-alumina/SCl_3^+ in molten $AlCl_3$-NaCl under conditions in which S(IV) is reduced to S(−2)is described. It is shown that the use of reticulated vitreous carbon as the positive current collector and high concentrations of active material result in cells which operate at temperatures ≤220°C and have very high energy densities (>450 W-hr/kg). (12 refs.)

109874 Design and performance of a sodium/sulphur multitube cell. R.Knoedler, R.Krapf (Central Res. Lab., Brown, Boveri & Cie AG, Heidelberg, Germany).
J. Power Sources (Switzerland), vol.10, no.3, p.263-70 (Aug. 1983).
Multiplate or multitube arrangements in battery designs generally result in higher specific energy and power values. Preliminary investigations into the design and operation of a 4-tube Na/S cell with a theoretical capacity of 155 A h showed values of 100 W h/kg for the energy density at the 3 h rate and of 6 mΩ for the cell resistance, corresponding to a maximum power density of 100 W/kg. With further improvements, values of 165 W h/kg and 180 W/kg can be expected to be realized. Another advantage of this design is reduced corrosion problems because the sulphur electrode can be put inside the β-Al_2O_3 tubes. A more complex fabrication process and a higher probability of failures may be considered as drawbacks of this design. (2 refs.)

109875 In situ conductance measurements of lead accumulator negative plates. M.Calabek (Dept. of Electrotechnol., Tech. Univ., Brno, Czechoslovakia), K.Micka, J.Sandera.
J. Power Sources (Switzerland), vol.10, no.3, p.271-8 (Aug. 1983).
The electrical conductance of negative lead-acid battery plates was measured in situ by the DC method. By subtracting the conductance of the grid, the conductance of the active mass was obtained. With freshly charged plates this was appreciably lower and increased with time; this effect was attributed to adsorption of hydrogen on lead. During cycling, a decrease in the conductance was observed which is discussed in terms of recrystallization of the active mass. The conductance of dry plates was found to be appreciably lower than that of wet plates. (5 refs.)

109876 Optimization of the vanadium oxide (V_6O_{13}) electrode in a nonaqueous secondary lithium cell. S.-N.Hua, S.Phang (CSIRO, Inst. of Energy & Earth Resources, Port Melbourne, Victoria, Australia).
J. Power Sources (Switzerland), vol.10, no.3, p.279-90 (Aug. 1983).
The V_6O_{13} electrode was tested in a nonaqueous Li cell using 1M $LiAsF_6$ in propylene carbonate-acetonitrile mixture as the electrolyte. It was shown that incorporation of acetylene black in the V_6O_{13} electrodes improved cell performance in terms of active material utilisation. Also, cells using hydrophilic microporous polypropylene separators, e.g. Celgard 5511 and 3501, displayed less resistive losses enabling larger charge/discharge rates to be used. Voltage changes in the cell were shown to be controlled almost entirely by the V_6O_{13} electrode. Analysis of the exausted V_6O_{13} electrodes showed that they contained at least 4 moles of lithium per mole of V_6O_{13}. (23 refs.)

109877 The effect of current density and thickness of the active mass upon the corrosion rate of the spines of lead-acid battery plates. T.Rogatchev, G.Papazov, D.Pavlov (Central Lab. of Electrochem. Power Sources, Bulgarian Acad. of Sci., Sofia, Bulgaria).
J. Power Sources (Switzerland), vol.10, no.3, p.291-303 (Aug. 1983).
The effect of current density and the thickness of the active mass upon the corrosion of the spines of tubular Pb acid batteries has been determined by measuring the corrosion rate by the weight loss method. The presence of antimony in the alloy decreases the overvoltage of the corrosion reaction. Study of electrodes of different active mass layer thickness shows that with increase in thickness the corrosion rate decreases. If the thickness is above 3 mm, the corrosion rate remains constant, and is affected only by the nature of the alloy. The density of the active mass does not affect the corrosion behaviour of the electrodes. The experimental results confirm the validity of the oxygen corrosion model. (11 refs.)

109878 Sodium tungsten bronze thin films: variation of chemical potential with sodium concentration. M.Green, K.Kang (Dept. of Electrical Engng., Imperial Coll., London, England).
Solid State Ionics (Netherlands), vol.8, no.4, p.281-9 (July 1983).
The method of fabrication of the solid-state electrochemical cell, ITO, $WO_3|Na$-β-alumina$|Na_xWO_3$, ITO is described. The equilibrium potential of the $Na_xWO_3|Na$-β-alumina electrode versus pure sodium (via a sodium amalgam electrode) has been determined as function of x in the range 2×10^{-4} to 0.97. A simple free-electron model has been used to find a theoretical expression for the non-ideal part of the chemical potential of Na_xWO_3 up to $x \approx 1/4$: the agreement between theory and experiment is within the experimental error. (22 refs.)

109879 Intercalation electrodes in copper solid-state cells. A.Padula, M.Patriarca, B.Scrosati (Istituto di Chimica Fisica, Univ. of Rome, Rome, Italy).
Solid State Ionics (Netherlands), vol.8, no.4, p.305-10 (July 1983).
The behaviour of transition-metal dichalcogenide intercalation electrodes in copper solid-state cells have been investigated by kinetic, diffusion and thermodynamic studies. The results indicate that the copper electro-intercalation process is reversible in the compounds examined, which are TiS_2 and NbS_2. The kinetics of the process are controlled by the diffusion of the electroactive species to and from the bulk of the electrode. (8 refs.)

109880 Solid electrolyte batteries and fast ion conducting glasses. Factors affecting a proposed merger. D.R.Uhlmann, H.L.Tuller, D.P.Button, M.Valez (MIT, Cambridge, MA, USA).
Wiss. Z. Friedrich-Schiller-Univ. Jena, Math. Naturwiss. Reihe (Germany), vol.32, no.2-3, p.285-302 (1983). In English. (Otto-Schott-Colloquium on the State of Optical Glass Research 1982, Jena, Germany, 1982).
The potential uses of glasses as solid electrolytes in high performance batteries are discussed. Following an initial discussion of goals for such batteries and the design of cells employing glass electrolytes attention is directed to the phenomena which are critical in this application, electrical conductivity and corrosion behaviour. Available data on fast ion conducting glasses are reviewed and related to models for transport. The authors also review the corrosion behaviour of oxide glasses in aqueous solution and in molten alkali metals. It is concluded that glasses make attractive condidates for battery electrolytes, but that future developments will depend critically on improvements in understanding of structure and transport. (52 refs.)

Experimental study of the effect of solar radiation reflected from the earth and its cloud cover on the thermal conditions of solar batteries used in one of the satellites of the Kosmos series .... See Entry 109885

86.30G Fuel cells

109881 Aluminium-air/oxygen battery system attractive for use in electric vehicles. D.Katrynioch, J.Ruch.
Electr. Veh. Dev. (GB), no.16, p.6-7 (Spring 1983).
The fuel cell development starting in the sixties supported new interest in metal-air cells. Several problems could be solved by application of results of materials research. Today's metal-air batteries achieve higher energy and power densities than common battery systems and are of interest for use in electric vehicles. (no refs.)

109882 Strategy for European fuel cell development. J.Jensen (Odense Univ., Odense, Denmark).
Electr. Veh. Dev. (GB), no.16, p.25-7 (Spring 1983).
Electric power generation by fuel cells exhibits pollution-free, high energy density conversion. The practical efficiency of the cells is 2-3 times higher than that of a thermal engine. They are, however, plagued by problems of corrosion, contamination of the electrodes and overvoltages. The key economic problem is the need for noble metal electrocatalysts, especially at lower temperatures. These problems are entirely materials problems, which could be solved by the development of new solid state components. This paper outlines and proposes a community programme which attempts: (1) to review current

engineering developments worldwide, to define the specific technical targets for transport and stationary applications and to assess the role of advanced fuel cells throughout Europe in the coming decades; (2) to provide data allowing selection of optimum materials for critical aspects of fuel cell operation by developing solid electrolytes stable to medium temperatures (150-250°C), improved non noble metal oxygen electrodes and new metal hydrides (anodes); (3) to assess the performance of medium temperature cells based on the valuated materials and to establish a preliminary economic evaluation enabling the set-up of an R&D strategy on materials fabrication, cell engineering and energy system infrastructure. (no refs.)

86.30J Photoelectric conversion: solar cells and arrays

109883 Effect of boron compensation on the photovoltaic properties of amorphous silicon solar cells. T.D.Moustakas, H.P.Maruska, R.Friedman, M.Hicks (Corporate Res. Lab., Exxon Res. & Engng. Co., Linden, NJ, USA).
Appl. Phys. Lett. (USA), vol.43, no.4, p.368-70 (15 Aug. 1983).
Intrinsic amorphous silicon films are normally slightly *n* type. As a result, in n^+-*i*-metal and n^+-*i*-p^+ solar cell structures the major potential barrier is at the *i-m* or *i* p^+ interfaces. Low levels of boron compensation of the *i* layer move the Fermi level down to midgap. Further increases in boron render the *i* layer slightly *p* type, and move the major barrier to the *i*-n^+ interface. Therefore, it becomes possible to tailor the level of boron doping throughout the *i* layer so as to achieve high electric fields in all regions of the layer, and thus maximize the short circuit current. (4 refs.)

109884 High-efficiency (21.4%) $Ga_{0.75}In_{0.25}As$/GaAs(E_g=1.15 eV) concentrator solar cells and the influence of lattice mismatch on performance. M.J.Ludowise, W.T.Dietze, R.Boettcher, N.Kaminar (Corporate Solid State Lab., Varian Associates Inc., Palo Alto, CA, USA).
Appl. Phys. Lett. (USA), vol.43, no.5, p.468-70 (1 Sept. 1983).
High-efficiency $Ga_{0.75}In_{0.25}As$/GaAs concentrator solar cells (E_g=1.15 eV, area=0.32 cm^2) have been fabricated and tested at 21.4% efficiency under 380 AM2.4 sun. The cell performance parameters of open-circuit voltage, fill factor, and efficiency are presented as functions of concentration up to 987 sun. The spectral response, and current-voltage characteristics under concentration, of cells grown by organometallic vapor phase epitaxy on graded and ungraded lattice-constant buffer layers are compared. It is shown that a graded lattice-constant buffer layer is necessary for high-efficiency performance. In general, $Ga_{0.75}In_{0.25}As$ cells have higher efficiencies and open-circuit voltages than Si cells (E_g=1.11 eV) for concentrations in excess of about 200 sun. (8 refs.)

109885 Experimental study of the effect of solar radiation reflected from the earth and its cloud cover on the thermal conditions of solar batteries used in one of the satellites of the Kosmos series. G.S.Daletskii, V.A.Karpukhin, M.M.Koltun, V.M.Kuznetsov (All Union Sci. Res. Inst. of Current Sources, USSR).
Appl. Sol. Energy (USA), vol.18, no.5, p.1-4 (1982). Translation of: *Geliotekhnika (USSR)*, vol.18, no.5, p.3-5 (1982). [received: Aug. 1983]
The article describes experiments conducted with one of the satellites of the Kosmos series in 1981, which made possible the estimation of the flux density distribution of solar radiation reflected from the Earth and its cloud cover during orbits with minimum duration of the sunlit portion. (7 refs.)

109886 Silicon MDS and SDS solar elements. A.N.Shmyreva, L.T.Kirpatenko, Yu.I.Yakimenko (Kiev Polytech. Inst., Kiev, Ukrainian SSR).
Appl. Sol. Energy (USA), vol.18, no.5, p.1720 (1982). Translation of: *Geliotekhnika (USSR)*, vol.18, no.5, p.15-18 (1982). [received: Aug. 1983]
Investigates silicon solar elements of lattice type with metal/thin oxide/Si and SnO_2/thin oxide/Si structures, in which the thin oxide ≤20 Å was obtained by chemical oxidation in aqueous solutions of hydrogen peroxide and hydrochloric acid. The oxide is highly dense, uniform over the thickness, and has a relatively small number of defects. The initial material for preparing the solar elements was supplied by monocrystalline p-type silicon with a (III) orientation and a resistivity of 10 ohm.cm. (1 ref.)

109887 Two-layer antireflection coating for silicon photoelements. M.M.Koltun, V.P.Matveev, E.A.Agaev (All Union Sci. Res. Inst. of Current Sources, USSR).
Appl. Sol. Energy (USA), vol.18, no.5, p.43-5 (1982). Translation of: *Geliotekhnika (USSR)*, vol.18, no.5, p.36-8 (1982). [received: Aug. 1983]
The article deals with issues relating to further improvement of the properties of silicon photoelements by replacement of single-layer antireflection coatings by two-layer ones. (9 refs.)

109888 A study of built-in potential in *a*-Si solar cells by means of back-surface reflected electroabsorption. S.Nonomura, H.Okamoto, Y.Hamakawa (Faculty of Engng. Sci., Osaka Univ., Osaka, Japan).
Appl. Phys. A (Germany), vol.A32, no.1, p.31-8 (Sept. 1983).
The electroreflectance (ER) signal has been studied for the purpose of identifying the built-in field in practical amorphous silicon (*a*-Si:H) solar cells. Through both theoretical and experimental considerations, it has been confirmed that the ER signal essentially comes from the light which is reflected at the back surface and hence experiences the internal electric field within the *a*-Si:H layer. By analyzing the ER signal, which is really the back-surface reflected electroabsorption signal, the built-in potential V_b can be evaluated. This method has been applied to various types of *p-i-n* junction *a*-Si solar cells. V_b of a usual homojunction solar cell was about 0.85 V. Increases of V_b by 50~130 mV have been found in heterojunction solar cells constructed with *p*-type amorphous silicon carbide (*a*-SiC:H) and/or *n*-type microcrystalline silicon (μc-Si) as compared with homojunction *p-i-n* solar cells. Moreover, a clear dependence of V_b on the substrate materials has been observed. These experimental results are described in connection with cell performances. (12 refs.)

109889 Electroreflectance and photoinduced charge separation in electrochemically doped trans-polyacetylene liquid junction device. D.Peramunage (Dept. of Chem., Brooklyn Coll., City Univ. of New York, Brooklyn, NY, USA), W.Siripala, M.Tomkiewicz, D.S.Ginley.
Chem. Phys. Lett. (Netherlands), vol.99, no.5-6, p.479-82 (19 Aug. 1983).
Liquid junction solar cells, made from electrochemically doped p-type trans-polyacetylene in contact with aqueous solution of methyl viologen, were constructed. The turn-on potential was found to be +1.0 V versus SCE. The spectral response showed low quantum efficiency ($\approx 10^{-4}$) for photoinduced charge separation with a threshold around 1.5 eV. The electroreflectance showed the presence of two transitions at 1.45 and at 1.6 eV. A tentative assignment of these transitions is proposed. (23 refs.)

109890 Limitations on solar cell open-circuit voltage and efficiency. A.Meulenberg,Jr., R.A.Arndt (Solid State Phys. Dept., COMSAT Labs., Clarksburg, MD, USA).
COMSAT Tech. Rev. (USA), vol.13, no.1, p.57-70 (Spring 1983).
Open-circuit voltages (V_{oc}) in 0.1 Ω-cm, n^+/p type, planar surface silicon solar cells produced by diffusion techniques are presently ≤654 mV, with corresponding conversion efficiencies of about 15 percent. This is lower than has been theoretically predicted. Experimental evidence is presented to demonstrate that the emitter is the largest source of the dark current that limits the attainment of higher V_{oc} values and, hence, reduces conversion efficiency. It is also shown that junction recombination current contributes to reduced V_{oc}. Because there is a lower limit on dark current from the base, even if the emitter and junction recombination currents are reduced to zero, a maximum V_{oc} of 695 mV is predicted, with a related conversion efficiency of 16.4 percent. (11 refs.)

109891 Sprayed CdS-Cu_2S solar cells. II. Preparation of CdS by airless spray. M.Levart, B.Thiebaut, J.Vedel (Ecole Nationale Superieure de Chimie de Paris, Paris, France).
Int. J. Sol. Energy (Switzerland), vol.1, no.6, p.451-7 (1983).
Airless spray consists of strongly compressing a liquid in a cylinder fitted with a nozzle. The droplets of liquid which are ejected can be pyrolized on a heated substrate. The technique was applied to the elaboration of CdS-Cu_2S photocells. A comparison with classic spray is given. There is an important decrease in energy consumption and spray time and the photocell properties are comparable. (6 refs.)

109892 Spectral dependencies of the efficiency of solar energy conversion by means of water photolysis. Zh.R.Panosyan, V.M.Arutyunyan, A.G.Sarkisyan, V.A.Meliksetyan, H.L.Margaryan, A.A.Poghosyan.
Izv. Akad. Nauk Arm. SSR Fiz. (USSR), vol.17, no.1, p.31-6 (1982). In Russian.
Spectral dependencies of the quantum efficiency of TiO_2 and *ZnO* semiconductor photoanodes obtained at the conversion of solar energy by means of the method of water photolysis were investigated. The influence of an external bias, of doping the photoanodes with donor and acceptor impurities as well as of photoanode surface states on the spectral dependencies of the efficiency is considered and a qualitative account for the measured dependencies is given. (7 refs.)

109893 Effect of pn coupling on open-circuit photovoltage decay in a silicon pn junction solar cell. S.K.Sharma, V.K.Tewary (Birla Inst. of Technol. & Sci., Pilani, India).
J. Phys. D (GB), vol.16, no.9, p.1741-7 (14 Sept. 1983).
A theory of open-circuit photovoltage decay in a pn junction solar cell is presented which accounts for the pn coupling, i.e. the coupling between the diffused layer and the base of the solar cell. The results have been analysed in some detail which show how the voltage decay is influenced by the various parameters of the diffused layer. It is found that the decay is sensitive to pn coupling in the initial stages, particularly in those solar cells in which a heavy doping of the diffused layer may have caused sufficient band-gap narrowing. A measurement of the voltage decay in the initial stages can therefore yield the parameters of the diffused layer in a solar cell. (18 refs.)

109894 The electrical characteristics of thin film Cu_xS-CdS solar cells and their dependence on the ambient atmosphere during annealing. F.J.Bryant, A.K.Hariri, S.Salkalachen, C.G.Scott (Dept. of Phys., Univ. of Hull, Hull, England).
J. Phys. D (GB), vol.16, no.9, p.1755-60 (14 Sept. 1983).
Changes in the electrical characteristics of polycrystalline Cu_xS-CdS solar cells have been studied following annealing treatments in air, vacuum and hydrogen, together with corresponding changes in the stoichiometry of the Cu_xS layer. Vacuum and hydrogen treatments have been found to produce very similar effects markedly different to the effects of air annealing. The results are consistent with previously reported Auger spectroscopy measurements which showed the Cu_xS layer and the Cu_xS-CdS interface structure to be very unstable when heated in air in comparison with the effect of annealing in either vacuum or hydrogen. (17 refs.)

109895 Application of infrared thermography to the study of the thermal behavior of solar-powered generators. A.Simo, F.Floret, J.P.David (Univ. d'Aix-Marseille, Marseille, France), G.Labrosse, G.Destobelleire.
Qualite Rev. Prat. Controle Ind. (France), vol.22, no.120, p.86-91 (April 1983). In French.
Photovoltaic modules are liable to malfunctioning caused by hot spots; investigation of these by superposition of monochromatic radiation on the solar illumination, or by lasers, is possible but only under laboratory conditions. Measurement of the temperature distribution over the surface of the module, and application of a numerical calculation procedure described in this paper, provide a means of estimation of the temperatures of the elements themselves. Whilst accurate measurements are not practicable, the qualitative information obtained provides a means of rapid location of any defective element. (9 refs.) *N.C.*

109896 A modified shifting approximation for homojunction single crystal silicon solar cells. S.Vasile, F.Caldararu (Sci. Res. & Technol. Engng. Center for Semiconductors, Bucharest, Rumania).
Rev. Roum. Phys. (Rumania), vol.28, no.6, p.533-40 (1983).
The shifting approximation in solar cells states that the current-voltage characteristic is obtained from a dark I-V characteristic shifted downward by light generated current. Some methods used for the determination of solar cell parameters, based on the shifting approximation, are reviewed. There are some contradictory results referring to the silicon solar cell series resistance. The failure of the shifting approximation for a single crystal silicon solar cell is considered to be an input idea and, as a result, an experimental procedure for the determination of solar cell parameters is developed, without using the shifting approximation. An experimental proof of the light modulated junction parameters is provided. A modified shifting approximation is proposed. (10 refs.)

109897 Formation of nickel and palladium silicides by a short-pulse light-flash and its application in the metallization of solar cells. Juh Tzeng Lue (Dept. of Phys., Nat. Tsing Hua Univ. Hsinchu, Taiwan).
Solid-State Electron. (GB), vol.26, no.8, p.787-93 (Aug. 1983).
Silicon-rich compounds which are not producible by conventional furnace annealing can be formed by a short-pulse light-flash. Inhomogeneous reaction, cellular solidification and small diffusion depth of the metal atoms, resulting from the fast liquid-to-solid quench process, are characteristic of flash-lamp induced silicides. Electroless-nickel plated solar cells after sintering with a light-flash show comparable I-V characteristics with those obtained by the expensive Ti-Pd-Ag alloy method. (11 refs.)

109898 Plasma-enhanced CVD silicon nitride antireflection coatings for solar cells. C.C.Johnson, T.Wydeven (Ames Res. Center, NASA, Moffett Field, CA, USA), K.Donohoe.
Sol. Energy (USA), vol.31, no.4, p.355-8 (1983).
Multilayer plasma-enhanced chemical vapor deposition (PECVD) silicon nitride antireflection coatings were deposited on space quality silicon solar cells. Preliminary experiments indicated that multilayer coatings decreased the total reflectance of polished silicon from 35 per cent to less than 3 per cent over the spectral range 0.4-1.0 μm. The solar cell energy conversion efficiency was increased from an average of 8.84 per cent to an average of 12.63 per cent. (9 refs.)

109899 Optimization of static or quasi-static photovoltaic installations. A.Lopez Pinto, R.Dios (ETSIA, Univ. de Cordoba, Cordoba, Spain), A.Luque.
Sol. Energy (USA), vol.31, no.4, p.393-404 (1983).
The paper presents a computer calculation method which permits the determination of the elevation angle with respect to the equator for each position adopted by a quasi-static collector, the determination of the dates for the seasonal changes in elevation, and also the calculation of the minimum collector area to be installed to achieve the maximum agreement between the curves of energy needed and collected with no seasonal accumulation. This procedure has been used in three typical rural applications: a rural home, a dairy farm with mechanical milking and milk refrigeration, and a watering sprinkler system for 1 Ha of prairie land, all located in the Cordoba province of Spain. (18 refs.)

109900 Transparent conducting tin oxide films for application in heterojunction solar cells. N.S.Murty, S.R.Jawalekar (Dept. of Electrical Engng., Indian Inst. of Technol., Bombay, India).
Vac News (India), vol.13, no.2, p.11-14 (June 1982). [received: Aug. 1983]
The authors report the structural, electrical and optical properties of tin oxide films deposited by oxidation of stannous chloride. The objective of the work is to deposit SnO_2 films possessing low resistivity and high optical transmission for their future applications in heterojunction solar cells. The summary of the results presented is based on extensive studies reported earlier. (8 refs.)

Barrier-layer photo-EMF under conditions of heating of charge carriers by light .... See Entry 108467

Maximum statistical increase of optical absorption in textured semiconductor films .... See Entry 109031

Limit of concentration under extended nonhomogeneous light sources .... See Entry 109851

Economic comparison of solar absorption and photovoltaic-assisted vapour compression cooling systems .... See Entry 109860

86.30K Photoelectrochemical conversion

109901 Photovoltage generation in the solid phenosafranine-EDTA sandwich cell. K.K.Rohatgi-Mukherjee, M.Roy, B.B.Bhowmik (Phys. Chem. Lab., Jadavpur Univ., Calcutta, India).
Sol. Energy (USA), vol.31, no.4, p.417-19 (1983).
Recently, the authors have reported a photovoltage of 615 mV at 25°C of a redox system consisting of phenosafranine and EDTA in aqueous medium, and this value increases with increasing temperature attaining 870 mV at 49°C [1978, 1983]. In consideration of the possibility of introducing this photogalvanic cell commercially, this system has been studied in the solid polycrystalline state in a sandwich cell using illuminated semiconductor (SnO_2) and dark metal (platinum foil) electrodes. The results are reported. (8 refs.)

Numerical simulation of the long-term performance and corrosion of photoelectrochemical cells .... See Entry 109548

Iron oxide electrodes for photoelectrolysis of water .... See Entry 109755

Electroreflectance and photoinduced charge separation in electrochemically doped trans-polyacetylene liquid junction device .... See Entry 109889

86.30L Electrogasdynamic and magnetohydrodynamic conversion

(see also 52.75 Plasma devices and applications)

109902 Analysis of transverse edge effect of linear induction pump with electrically conducting side walls. S.Tado, S.Kamiyama (Inst. of High Speed Mech., Tohoku Univ., Sendai, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.5, p.279-88 (May 1983).
An analytical study is made of transverse edge effect on the flow characteristics and performance of a linear induction pump by taking into account both effects of a nonuniform velocity distribution across the duct width and an electrical conductivity of the side-walls installed in a fringing magnetic flux region. Equation of fluid motion and Maxwell's equations with a thin-plate approximation are simultaneously solved using a method of successive approximation, and the effects of the side-wall's conductivity on the distributions of magnetic field and flow velocity are determined. Pump performances such as mechanical and electrical powers, conversion efficiency and head-flow curves are also obtained. It is clearly shown that the secondary current in the fluid and hence the pump performance are significantly influenced by the side-wall's conductivity. It is also shown that the nonuniformity of the velocity distribution causes a reduction in the equivalent conductivity of the secondary which is significant in the case of low side-wall's conductivity. (16 refs.)

86.30M Thermoelectric conversion

109903 A calculation method for batteries of thermoemission converters. M.A.Mendel'baum, A.P.Savinov, V.V.Sinyavskii.
Power Eng. (J. Acad. Sci. USSR) (USA), vol.20, no.6, p.113-20 (1982). Translation of: *Izv. Akad. Nauk SSSR Energ. & Transp.*, vol.20, no.6, p.140-7 (1982).
A numerical method is proposed for calculating the characteristics of thermo-emission-converter batteries (TCB) with series-parallel connection of the elements. The method is based on successive solution of equations describing the thermal and electrical processes. The calculation algorithm has been realized as a BESM-Algol program. The possibilities of the program are indicated, calculation of the characteristics of a specific type of TCB serving as an example. The nature of the change in the thermal and electrical characteristics resulting from fluctuations in thermal power and electrical load as well as interruption of the internal electric circuit is demonstrated. (11 refs.)

109904 Studies of a thermoelectric generator operating from tubular solar collectors. T.Durst, L.B.Harris, H.J.Goldsmid.
Sol. Energy (USA), vol.31, no.4, p.421-5 (1983).
Solar energy conversion systems usually require storage of the energy that is produced. In this study the low voltage, high current characteristics of a thermoelectric generator were used to produce hydrogen gas in a practical demonstration of solar energy conversion and storage. Oil-filled evacuated glass tubes were used as concentrators of solar heat, the oil circulating through the system being the medium for transferring heat. The system had four main components: (1) A solar collector consisting of seven evacuated glass tubes. (2) A thermoelectric generator. (3) A centrifugal pump, oil reservoir, and associated piping to circulate the hot oil. (4) An electrolytic hydrogen gas generator. The results obtained and conclusions reached are presented. (5 refs.)

Tests of a module for a parabolocylindrical solar installation .... See Entry 109909

86.30N Thermionic conversion

Thermionic converter with conductive oxide covered collector .... See Entry 107446

Emission of electrons from the collector of a thermionic converter .... See Entry 107449

86.30P Photosynthesis

(see also 87.25 Cellular biophysics)

Photochemical solar collector for the photoassisted reduction of aqueous carbon dioxide .... See Entry 109906

86.30Q Chemical energy conversion

(for electrochemical conversion, see 86.30D; for photoelectrochemical conversion, see 86.30K)

109905 The measurement of light transmission through an irradiated fluidised bed. L.Rizzuti (Istituto di Ingegneria Chimica, Univ. di Palermo, Palermo, Italy), P.L.Yue.
Chem. Eng. Sci. (GB), vol.38, no.8, p.1241-9 (1983).
The transmission of light through an irradiated fluidised bed with vertical flat walls containing catalytic particles has been experimentally studied. The amount of light transmitted through the reactor was measured at different levels by a photocell. The experimental variables studied included: (i) gas flow rate, varying from 2 to more than 10 times that required for minimum fluidisation; (ii) mean particle size, ranging from 0.138 to 0.275 mm; and (iii) internal bed thickness from 2.1 to 4.9 mm. The effect of the reflectance of the particles was also examined. The amount of light transmitted through a flat fluidised bed is low. The average transmitted light has been satisfactorily correlated with average bubble voidage of the bed, particle diameter and bed thickness. (13 refs.)

109906 Photochemical solar collector for the photoassisted reduction of aqueous carbon dioxide. M.Halmann, M.Ulman, B.Aurian-Blajeni (Isotope Dept., Weizmann Inst. of Sci., Rehovot, Israel).
Sol. Energy (USA), vol.31, no.4, p.429-31 (1983).
Solar collectors are widely used for converting the radiation of sunlight into useable heat, particularly for heating water or buildings. The present study describes a modified solar collector, which uses the ultraviolet and visible spectrum of solar radiation for carrying out photochemical energy storage, by the photosynthetic conversion of carbon dioxide and water over photoactive materials into useful organic compounds, particularly formic acid, formaldehyde and methanol. This photoassisted reaction was previously carried out in several laboratory studies with artificial light. The purpose of testing these reactions in actual sunlight is to obtain direct values of solar to chemical energy conversion efficiencies, without the assumptions inherent in using artificial light sources. The photoactive agents tested are all oxide semiconductors, used as powdered polycrystalline materials. (9 refs.)

86.30R Thermal energy conversion (heat engines and heat pumps)

109907 The performance of heat pumps in service—comparison of a computer model with a real installation. J.Rosell, R.Morgan, J.T.McMullan (School of Phys. Sci., New Univ. of Ulster, Coleraine, N Ireland).
Int. J. Energy Res. (GB), vol.7, no.3, p.227-40 (July-Sept. 1983).
A comparison is made between a computer model which was developed in an earlier paper and experimental results in which a heat pump was used to heat a house during the heating season 1978-1979. The heat pump used was an air-to-water machine, and it is found that the radiator temperature in the experiment varies according to the heat demand of the house because of the effect of thermal inertia of the water and other thermal masses in the heat transfer system. The computer model simulates this effect, using hourly weather data to calculate the heat demand of the house and assuming that the radiators run at the temperature necessary to supply the heat demand during each hour. The model also calculates the coefficient of performance of the heat pump, and hence calculates the running cost in kilowatt-hours for each hour. The calculated running cost is compared with daily readings of kilowatt-hour meters. It is found that the comparison is very accurate during normal operation of the heat pump, with an accuracy of better than 1 per cent over a period of four months of the heating season, although the accuracy is not always quite so good. A comparison is also made between hourly calculated radiator temperatures and continuous recordings of flow and return temperatures. The comparison in this case is satisfactory, but there is a time lag due to the effect of thermal inertia of the building fabric which the computer model is not intended to simulate. (5 refs.)

109908 Limiting performance of vapour compression heat pumps for heating fluids. C.G.Carrington, T.C.Knopp (Dept. of Phys., Univ. of Otago, Dunedin, New Zealand).
Int. J. Energy Res. (GB), vol.7, no.3, p.255-64 (July-Sept. 1983).
When a vapour compression heat pump is used to heat a fluid over a range of temperatures the refrigerant cycle may be fundamentally different from a standard Rankine cycle which operates only between isothermal reservoirs. This paper considers two strategies for heating fluids: in one approach the fluid is heated in a single pass condenser; in the other the body of fluid is kept fully mixed at all stages of the heating process. An isothermal source reservoir is assumed and the performance of nine common refrigerants is examined. In the ideal limit the mixed fluid process has a higher COP than

the single pass method. But in practice there is likely to be no clear advantage in using a fully mixed sink fluid, especially where the temperature lift is greater than 50°C. The single pass heating process has an advantage under these conditions that lower peak condensing temperatures may generally be achieved than for the mixed fluid heating process. (9 refs.)

Regulation of daily refrigerating-capacity schedule of a solar absorption refrigerating unit ....See Entry 109911

86.30S Photothermal conversion

109909 Tests of a module for a parabolocylindrical solar installation. B.V.Tarnizhevskii, I.I.Kokhova, S.N.Aliev, V.A.Samoilov, S.F.Ergashev (Krzhizhanovskii Sci. Res. Inst. of Power Engng., USSR).
Appl. Sol. Energy (USA), vol.18, no.5, p.21-6 (1982). Translation of: *Geliotekhnika (USSR)*, vol.18, no.5, p.19-23 (1982). [received: Aug. 1983]
Describes tests of the operating conditions of a module for a parabolocylindrical solar installation with a heat-pipe heat absorber at operating temperatures up to 300°C. The basic element of the installation, namely the parabolocylindrical reflector, has dimensions $L \times B = 5000 \times 2000$ mm, a focal length $f = 850$ mm, and an aperture angle $2\alpha = 120°$. The reflecting surface of the concentrator is made of electrically polished aluminum sheet 1 mm thick, with a protective oxide film 10-12 μm thick. The integral coefficient of reflection of sunlight for the aluminum mirror surface $R_m = 0.79$-0.8. (3 refs.)

109910 Method of making heat-engineering calculations for a passive solar heating system (nonsteady conditions). R.R.Avezov, K.B.Babakulov (S.V. Starodubtsev Phys. Tech. Inst., Acad. of Sci., Uzbek SSR).
Appl. Sol. Energy (USA), vol.18, no.5, p.46-52 (1982). Translation of: *Geliotekhnika (USSR)*, vol.18, no.5, p.39-44 (1982). [received: Aug. 1983]
The authors set up and solve the balance equations that describe the thermal state of individual elements of a passive solar heating system with allowance for the nonsteady nature of solar radiation and the outer air temperature. (2 refs.)

109911 Regulation of daily refrigerating-capacity schedule of a solar absorption refrigerating unit. O.Klyshchaeva, A.Kakabaev, G.Redzhepov (Solntse Sci. & Industrial Assoc., Acad. of Sci., Ashkhabad, Turkman SSR).
Appl. Sol. Energy (USA), vol.18, no.5, p.53-60 (1982). Translation of: *Geliotekhnika (USSR)*, vol.18, no.5, p.44-50 (1982). [received: Aug. 1983]
Considers various SARU operating conditions that make it possible to extend operation into the period in which no sunshine is present. For this purpose, for the corresponding modes of SARU operation, the authors establish a relationship for water content of the solution in the system that enables them to determine the refrigerating-capacity schedule. The resultant relationships are used to obtain graphs for the characteristic operating conditions of the SARU. (4 refs.)

109912 Effect of angle of inclination on the operating efficiency of a solar radiative drying installation. G.G.Umarov, B.M.Nabikhanov, Z.Tairov (Starodubtsev Physicotech. Inst., Acad. of Sci., Uzbek SSR).
Appl. Sol. Energy (USA), vol.18, no.5, p.71-3 (1982). Translation of: *Geliotekhnika (USSR)*, vol.18, no.5, p.58-60 (1982). [received: Aug. 1983]
The article offers analytic calculations of the effect of the angle of inclination on the operating efficiency. (1 ref.)

109913 On the improvement of solar heating and cooling systems. Yu.K.Rashidov (Tashkent Zonal Sci. Res. Inst. for Experimental Design of Dwellings & Public Buildings, USSR).
Appl. Sol. Energy (USA), vol.18, no.5, p.85-9 (1982). Translation of: *Geliotekhnika (USSR)*, vol.18, no.5, p.68-73 (1982). [received: Aug. 1983]
To simplify solar heating and cooling systems, the author proposes the use of organized hydrothermal processes in their elements. Definitions and a classification of such processes are offered. (5 refs.)

109914 Simulation of behaviour of a drying system for grain. M.Hasnaoui (Lab. de Thermodynamique et Energetique, Univ. de Perpignan, Perpignan, France), G.le Palec, M.Daguenet.
Int. J. Sol. Energy (Switzerland), vol.1, no.6, p.431-40 (1983). In French.
The behavior of a maize pile that is subjected to double influence of the radiation flux and the forced convection of warm air is studied as a function of principal parameters of the system. Two possibilities of the recycling of the air in the dryer are considered. Thus, it proves that recycling is interesting while it is carried out across the collector (indirect recycling) since it permits to economize the dispensed energy in the system and reduces the drying time. If the recycling is direct, in other words if the recycled air is sent directly across the grains, there is a limit as regards the percentage of the recycled air. The improvement of the drying performances where the bed of grains is subjected simultaneously to a warm air current and direct solar radiation is not meaningful and is undue for operating such processes. The theoretical model established permits one to know the system's response due to the variation of the parameters such as the flow rate, the temperature of the entering air and the collector surface; and so can help the conception of the solar drying for cereals. (6 refs.)

109915 Reduction of surface mixing in solar ponds by floating rings. A.Akbarzadeh, R.W.G.MacDonald, Y.F.Wang (Dept. of Mech. Engng., Univ. of Melbourne, Melbourne, Australia).
Sol. Energy (USA), vol.31, no.4, p.377-80 (1983).
The phenomenon of mixing in the top region of solar ponds is investigated. The factors causing this problem are described. Effects of wind in creating the top layer convective zone are discussed. Necessary formulas for determination of amplitude and frequency of the waves generated by the winds in terms of wind velocity and fetch length are given. Also the problem of wind driven currents in solar ponds is discussed. The idea of small circular floating rings as wave suppressors is introduced and their effectiveness in decreasing the thickness of the top convective zone is discussed. It has been found that the floating ring wave suppressors can successfully decrease the depth of the top mixing layer in solar ponds. (7 refs.)

109916 Orientational relationships for optically non-symmetric solar collectors. W.R.McIntire, K.A.Reed (Solar Energy Group, Argonne Nat. Lab., Argonne, IL, USA).
Sol. Energy (USA), vol.31, no.4, p.405-10 (1983).
More details of collector orientations and incidence angle modifiers are required to specify the instantaneous optical efficiencies of optically non-symmetric solar collectors, such as those using nonimaging concentrators, than to specify the efficiencies of symmetric collectors such as flat plates. In the paper, expressions are presented for the projected incidence angles necessary for evaluating the instantaneous optical efficiencies of non-symmetric collectors. These projected angles are also used when a nearly biaxial incidence angle modifier is approximated by the product of two single-axis incidence angle modifiers. In addition, relationships for incidence angles onto an absorber tube are developed. These differ from the angle onto a cover glazing, and they effect the absorptance of the tube's coating and the transmittance of a cover tube as used in tubular evacuated collectors. (2 refs.)

109917 Prediction of heat losses by conduction and radiation from total heat loss data for degraded evacuated collectors. S.P.Chow, D.R.Mills, G.L.Harding (School of Phys., Univ. of Sydney, Sydney, NSW, Australia).
Sol. Energy (USA), vol.31, no.4, p.433-5 (1983).
The authors discuss a non-destructive means of evaluating the heat loss by radiation and conduction from the measured total heat loss for evacuated collectors containing a particular selective surface. They show that the emittance-temperature relation for various types of selective surface can be modelled by a simple empirical formula. This formula can then be used to model the radiative heat loss in a collector. If it is assumed that the conduction loss Q_c varies linearly with temperature difference between absorber and glass envelope, $(T_1 - T_2)$, computer analysis of the measured total heat loss Q_T allows determination of the constants in the empirical formula. The accuracy of results produced by this method has been investigated for 5 degraded collectors (which contain various quantities of gas) for which radiative heat loss Q_R and Q_c have been determined experimentally. (8 refs.)

Studies of a thermoelectric generator operating from tubular solar collectors ...
....See Entry 109904

Photochemical solar collector for the photoassisted reduction of aqueous carbon dioxide .... See Entry 109906

Test procedures for heat storages for solar heating systems ..See Entry 109919

86.40 ENERGY STORAGE (SECONDARY ENERGY)

86.40F Storage in thermal energy

109918 Heat-energy accumulators for solar electric power plants. V.I.Gudkov, K.N.Chakalev (Krzhizhanovskii Sci. Res. Inst. of Power Engng., USSR).
Appl. Sol. Energy (USA), vol.18, no.5, p.31-6 (1982). Translation of: *Geliotekhnika (USSR)*, vol.18, no.5, p.27-31 (1982). [received: Aug. 1983]
The article deals with heat accumulators of short-term (one-day) operation for solar electric power plants with a thermodynamic energy-conversion cycle. (10 refs.)

Economic evaluation of wind energy applications for remote location power supply. ....See Entry 109847

Problem of accumulation of solar energy in the form of heat ....
....See Entry 109857

86.40K Hydrogen storage and technology

109919 Test procedures for heat storages for solar heating systems. S.Furbo (Thermal Insulation Lab., Tech. Univ. of Denmark, Lyngby, Denmark).
Int. J. Sol. Energy (Switzerland), vol.1, no.6, p.419-29 (1983).
The Danish Government supports producers of systems for renewable energy sources (solar, wind, biomass). At present the consumer will receive 30% of the investments in the installed solar heating system. In order to participate in this arrangement it is required of the producers that the components of their solar heating systems are tested. The heat storages are tested at the Thermal Insulation Laboratory at the Technical University of Denmark. Tests of marketed heat storages for solar heating systems for domestic hot water supply started in 1979, and since then the test procedures have been changed continuously according to the experience gained. The test procedure in use now and some of the experiences gained are described. (no refs.)

109920 Status of the cadmium thermoelectrochemical hydrogen cycle. T.Whaley, B.Yudow, R.Remick, J.Pangborn, A.Sammells (Inst. of Gas Technol., IIT Center, Chicago, IL, USA).
Int. J. Hydrogen Energy (GB), vol.8, no.10, p.767-71 (1983).
The three-step cadmium thermoelectrochemical water-splitting cycle produces hydrogen by an electrochemical reaction of water with an anode of cadmium metal, which is regenerated by the thermochemical decomposition of by-product cadmium oxide at temperatures of 1200°C and higher. Work on the electrochemical step has centered on the removal of the passivating layer of cadmium hydroxide that forms on the cadmium metal anode. The high-temperature thermochemical decomposition of cadmium oxide has been carried out successfully in a solar furnace. (5 refs.)

109921 Technological aspects of sulfur dioxide depolarized electrolysis for hydrogen production. P.W.T.Lu (Advanced Energy Systems Div., Westinghouse Electric Corp., Pittsburgh, PA, USA).
Int. J. Hydrogen Energy (GB), vol.8, no.10, p.773-81 (1983).
Significant advancements in the SO_2-depolarized electrolysis technology have been obtained through a series of technical improvements in the electrode structure and cell configurations. Using carbon-supported platinum catalyst of loading 1 mg/cm^2, the currently achievable cell potentials are 680 and 910 mV at 200 and 400 mA/cm^2, respectively, in 50 w/o aqueous H_2SO_4 solution at 75°C and atmospheric pressure. To reduce further the electrical energy input for an SO_2-depolarized cell, major experimental efforts will be made to investigate the performance characteristics of pressurized electrolyzers. An advanced concept, using a solid oxide electrolyte, has been proposed for the electrochemical oxidation of gas-phase SO_2. Due to the elimination of aqueous electrolyte, this novel sulfur-based cycle is expected to result in a higher cycle efficiency and a lower corrosion environment than the conventional sulfur cycle hydrogen product process. (11 refs.)

109922 Hydrogen absorption in Mg-Ni-Fe alloys. D.Lupu, A.Biris, E.Indrea, N.Aldea, R.V.Bucur (Inst. of Isotopic & Molecular Technol., Cluj-Napoca, Rumania), M.Morariu.
Int. J. Hydrogen Energy (GB), vol.8, no.10, p.797-9 (1983).
The hydrogenation properties of the alloys of overall formula $Mg_2Ni_{1-x}Fe_x$ ($x \leq 0.37$) have been studied. In this range of composition multi-phase alloys were obtained containing Mg_2Ni, Mg and more or less finely dispersed Fe in different coordination as proved by the EXAFS technique and Mossbauer spectroscopy. There is no significant substitution of Ni by Fe atoms in the Mg_2Ni lattice. Two or three plateau-pressures are observed on the pressure-composition isotherms of the hydrides with the heats of formation in the range −18.4 to 20.4 kcal/mol H_2 (−77 to −85.4 kJ/mol H_2). The hydrides of the Fe containing alloys show higher desorption rates of hydrogen compared to the pure Mg_2Ni hydride. (17 refs.)

109923 Hydrogen sorption performance of pure magnesium during continued cycling. B.Vigeholm, J.Kjoller, B.Larsen, A.S.Pedersen (Metall. Dept., Riso Nat. Lab., Roskilde, Denmark).
Int. J. Hydrogen Energy (GB), vol.8, no.10, p.809-17 (1983).
Preliminary investigations of the hydrogen absorption-desorption by commercially pure magnesium powder under continuous operation show little or no reduction in hydrogen capacity up to 70 cycles and high temperature exposure exceeding 1200 h. Absorption was studied at 260°-425°C and hydrogen pres-

sures up to 2.0 MPa above equilibrium. Desorption was with a few exceptions done at 400°C at hydrogen pressures below 150 kPa. For practical application the hydrogen exchange may be limited to 75-90% of the complete metal to stoichiometric hydride reaction. A change of the macroscopic structure of the powder into a highly porous, sintered agglomerate did not reduce the hydrogen capacity or the reaction rate. Although this change in structure caused no deterioration of the cycling performance a further development may not be acceptable. For observation over a much larger number of cyclings a fully automated, triple line cycling facility permitting simultaneous testing under different conditions has been constructed. (5 refs.)

109924 Hydrogen safety manual. W.Balthasar, J.P.Schodel.
Report EUR 8396 EN, Comm. European Communities, Luxembourg (1983), x+522 pp. Contract 256-77 EH NL.
The objective of this manual is to facilitate safe design and operation of hydrogen handling systems. A potential user of this manual will find all necessary regulations, codes and practices needed to observe when designing or operating a hydrogen handling system. A detailed discussion for special considerations and subjects on safety are also presented. (150 refs.)

Diffusion behavior in titanium-chromium hydrides .... See Entry 108052

Diffusivity of hydrogen and deuterium at low concentration in $Fe_{0.5}Ti_{0.5}$ .... See Entry 108055

On the origin of increasing hydrogen pressures in the two solid phase regions of intermetallic compound-hydrogen systems .... See Entry 109233

Long-term corrosion tests of materials for thermal decomposition of sulphuric acid .... See Entry 109573

The testing of electrodes for alkaline solution water electrolysis .... See Entry 109754

Resource and energy management of synfuels production with hydrogen and oxygen requirements from electrolysis .... See Entry 109845

An airline view of LH2 as a fuel for commercial aircraft ..... See Entry 109846

Studies of a thermoelectric generator operating from tubular solar collectors .... See Entry 109904

86.70 ENVIRONMENTAL SCIENCE

(see also 87.60R Radioactive pollution; for oceanographic aspects, see 92.10; for hydrological aspects see 92.40; for meteorological aspects see 92.60)

Numerical model of radionuclide migration in geologic media .... See Entry 105961

86.70C Soil

Measurements of the complex refractive index of soils and airborne particles .... See Entry 105313

Migration of cesium-137 through sandy soil layer; effect of fine silt on migration .... See Entry 105962

Diffusive transport of strontium-85 in sand-bentonite mixtures .... See Entry 105982

The point of zero charge and adsorption properties of natural magnetite .... See Entry 109781

Interferences in the radiochemical determination of ^{230}Th [in soil and water] .... See Entry 109946

86.70E Water

109925 Morphological, sedimentological and chemical aspects of the sediments in the Gulf of Cagliari (Sardinia). A.Contu (Istituto di Igiene, Univ. di Cagliari, Cagliari, Italy), P.Mulas, G.Sarritzu, M.Schintu, A.Ulzega.
Boll. Oceanol. Teor. & Appl. (Italy), vol.1, no.3, p.205-13 (July 1983).
In southern Sardinia, the Gulf of Cagliari is affected by contamination due to the particular location of the urban agglomerates and industrial plants. The untreated sewage of the town of Cagliari and the suburban agglomerates converge, through the port, directly to the western side of the Gulf, between Capo S. Elia and Punta Zavorra. The sludges of a lot of industries are discharged near the port and in the wide lagoon of Santa Gilla as well. The sediments of the Gulf of Cagliari have been collected from a few stations chosen for their morphological and sedimentological characteristics of the sea bottom, in order to survey their chemical features. The levels of some metals (Pb, Hg, Cu, Cr, Zn, Fe), the organic compounds and oils accumulated on sediments are determined. (17 refs.)

109926 Dispersion and sedimentation of industrial waste of bauxite, blendes, fluorites and phosphorites dumped in the Gulf of Venice, Italy. A.Brambati, R.Marocco (Istituto di Geologia e Paleontologia, Univ. di Trieste, Trieste, Italy).
Boll. Oceanol. Teor. & Appl. (Italy), vol.1, no.3, p.215-24 (July 1983).
Reports the results of the sedimentological investigation carried out in August 1974 in the marine area of the Gulf of Venice involved in the discharge of industrial waste of bauxite, blendes, fluorites and phosphorites from Porto Marghera (Venice). On the basis of chemical and grain size analyses carried out on 35 samples of sediment collected in the Gulf of Venice, it is possible to identify the marine area involved in the discharge and define the modifications brought about on the sediments in the Gulf. (14 refs.)

109927 Anthropogenic tritium in South Atlantic bottom water. W.J.Jenkins, D.E.Lott, M.W.Pratt, R.D.Boudreau (Woods Hole Oceanographic Instn., Woods Hole, MA, USA).
Nature (GB), vol.305, no.5929, p.45-6 (1 Sept. 1983).
By increasing sample size and altering sample handling techniques, the authors have extended the tritium detection limit by more than an order of magnitude and have detected what is believed to be man-made tritium in Antartic bottom water at about 40°S in the western South Atlantic. (9 refs.)

109928 Fly-ash particles intercepted in the deep Sargasso Sea. W.G.Deuser (Woods Hole Oceanographic Instn., Woods Hole, MA, USA), K.Emeis, V.Ittekkot, E.T.Degens.
Nature (GB), vol.305, no.5931, p.216-18 (15 Sept. 1983).
Results of a continuing series of sequential sediment-trap deployments in the Sargasso Sea, covering 5 yr, suggest that an efficient mechanism exists for the removal of both biogenic and abiogenic particles from the surface layers of the ocean and for their rapid transfer to great depth. The occurrence of fly-ash particles in material collected in that experiment is reported. Available evidence indicates that these particles were carried by winds from their sources, probably located in North America, to the Sargasso Sea and subsequently transported to deep water as components of faecal pellets or other organic aggregates. (18 refs.)

109929 Anthropogenic chlorofluoromethanes in the Greenland and Norwegian Seas. J.L.Bullister, R.F.Weiss (Scripps Instn. of Oceanography, Univ. of California, San Diego, CA, USA).
Science (USA), vol.221, no.4607, p.265-7 (15 July 1983).
The concentrations of two industrially produced chlorofluoromethanes, CCl_3F(F-11) and CCl_2F_2(F-12), have been measured in the water column and in the marine atmosphere of the Greenland and Norwegian seas. Measurable concentrations of these two chlorofluoromethanes have penetrated to the deep basins of both of these regions, and the general characteristics of their vertical distributions are discussed. The data are fitted to a time-dependent box model based on deep convective mixing in the Greenland Sea and lateral exchange between the deep basins. The model calculations for the two chlorofluoromethanes in the Greenland Sea give similar results, with a time scale for deep convection of about 40 years. (15 refs.)

109930 Neptunium and americium speciation in selected basalt, granite, shale, and tuff ground waters. J.M.Cleveland, T.F.Rees, K.L.Nash (US Geological Survey, Denver, CO, USA).
Science (USA), vol.221, no.4607, p.271-3 (15 July 1983).
Neptunium and americium are relatively insoluble in ground waters containing high sulfate concentrations, particularly at 90°C. the insoluble neptunium species is Np(IV); hence reducing waters should enhance its formation. Americium can exist only in the trivalent state under these conditions, and its solubility also should be representative of that of curium. (8 refs.)

Diffusive transport of strontium-85 in sand-bentonite mixtures .... See Entry 105982

Waste management and environmental controls in the Australian uranium mining industry .... See Entry 106173

Determination of copper, cadmium and lead in seawater by atomic absorption spectrometry with electrothermal atomization .... See Entry 109945

Interferences in the radiochemical determination of ^{230}Th [in soil and water] .... See Entry 109946

Deep-ocean radioactive waste disposal: an evaluation of the seaweed critical pathway .... See Entry 110192

Oil slick drift trajectories for hypothetical spills in the Arabian Sea .... See Entry 110482

Studies for dispersion of radioactive effluents from an atomic power plant in coastal waters at Kalpakkam .... See Entry 110483

Revised parameters for modeling the transport of PCB components across an air water interface .... See Entry 110484

Palladium and nickel in north-east Pacific waters .... See Entry 110486

Variation of the microwave brightness temperature of sea surfaces covered with mineral and monomolecular oil films .... See Entry 110706

86.70G Atmosphere

109931 Optical emission from photoexcitation of aerosol particles produced by reaction of ozone with 1,3-butadiene. R.L.Day, L.C.Lee (Dept. of Electrical & Computer Engng., San Diego State Univ., San Diego, CA, USA).
Appl. Opt. (USA), vol.22, no.17, p.2546-50 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
Aerosol particles produced from the ozone and 1,3-butadiene reaction are excited by ultraviolet radiation. Optical emissions from the photoexcited aerosol particles are observed in the 300-800 nm region. The emission intensities are measured at various gas concentrations and reaction times. The aerosol formation mechanisms and the sources responsible for optical emissions are investigated. It is suggested that the small radicals adsorbed on the surface of aerosol particles are simultaneously desorbed and excited by UV photons, and the excited radicals subsequently give optical emissions. (17 refs.)

109932 An air pollution analytic transport model admitting the surface and inversion layer effect. D.L.Yordanov, K.G.Ganev, M.P.Kolarova (Geophys. Inst., Bulgarian Acad. of Sci., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.5, p.627-30 (1983).
When investigating air pollution, use is often made of the Lagrange method of a series of puffs with a Gauss distribution of the concentration in a horizontal direction, while along the vertical the semiempirical diffusion equation $\partial q/\partial t = K\partial^2 q/\partial z^2$ (1) is solved, in which q is the pollution concentration and K is the coefficient of vertical turbulent exchange. A study is made of the solution of equation (1) the layer $a \geq z \geq h$, where h is the height of the surface layer (SL) and a is the height of inversion. The diffusion of the admixtures in SL is estimated parametrically, on the assumption that sources may exist in SL. (3 refs.)

109933 Calculation of the concentration field of radioactive admixtures. T.Ts.Todorov (Geophys. Inst., Bulgarian Acad. of Sci., Sofia, Bulgaria), G.D.Djolov, D.E.Sirakov.
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.5, p.635-8 (1983).
Meteorology plays an essential role in protecting the environment from radiation. Its theoretical and practical instruments are widely used in locating, planning, building and commissioning atomic power plants, establishing their normal and average operational conditions, in closing them after expiration of the performance term, and in the treatment of radioactive waste as well as with experimental reactor accelerators of charged particles and thermonuclear reactors. The high requirements for safeguarding those at work in atomic power plants and the biosphere in the adjacent regions from radiation fall-out call for more exact modern methods of calculating the concentration field produced by sources of radioactive admixtures. Estimates of the level of the environment's radioactive pollution have been obtained by means of familiar formulas of the Gaussian type. The main shortcomings in this approach are: assumption of stationarity of the process, use of formulas for a continuous point source in case of finite release time, neglect of the interaction between radioactive pollutant and underlying surface as well as the effect of inversion layers. These shortcomings are by and large eliminated by the approach proposed by the authors. They consider the most interesting practical case: accident in the atomic reactor. (2 refs.)

109934 Air Force Rocket Propulsion Laboratory plume program: activities and plans. P.M.Saatzer (USAF Rocket Propulsion Lab., Edwards Air Force Base, CA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.366, p.148-56 (1983). (Modern Utilization of Infrared Technology VIII, San Diego, CA, USA, 26-27 Aug. 1982).
Presents the status of current phenomenological models for high altitude plume signatures. Major limitations are discussed and R&D efforts to remove these limitations are reviewed. These R&D projects are placed in two categories: fundamental properties and methodology development. Projects to

obtain fundamental properties include: theoretical predictions/measurements of collisional excitation cross sections and vibrational relaxation rates, and measurements of physical/chemical properties of propellant aerosols. Methodology development include a composite high altitude signature model and an aerosol radiation model. (22 refs.)

109935 Transition flow effects on plume radiation. J.B.Elgin (Spectral Sci. Inc., Burlington, MA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.366, p.180-7 (1983). (Modern Utilization of Infrared Technology VIII, San Diego, CA, USA, 26-27 Aug. 1982).
A calculational comparison of a free molecular plume code (HAPAIR: High Altitude Plume-Atmosphere Interaction Radiation) and a Monte-Carlo Plume Code (TRAMP: Transitional and Rarefied Axisymmetric Monte-Carlo Plume) is made for selected sequence of cases going from a free molecular ($K_n=15$) to a high transitional ($K_n=0.07$) flow regime. Results are presented which document the breakdown of free molecular flow assumptions in the transition regime and show the effect on the critical physical processes responsible for plume emission. (9 refs.)

109936 Air pollution. N.Lentin (Maharashtra State Water & Air Pollution Control Labs., Maharashtra, India).
Instrum. India, p.9-14 (July-Aug. 1982). [received: Aug. 1983]
Discusses legal problems encountered in dealing with air pollution. Standards applicable in India are compared with those in the United Kingdom and United States. (no refs.)

109937 Estimate of radon-222 concentrations in rainclouds from radioactivity of rainwater observed at ground level. S.Minato (Government Industrial Res. Inst., Nagoya, Japan).
J. Radioanal. Chem. (Switzerland), vol.78, no.1, p.199-207 (1983).
A time-independent model is presented which predicts the short-lived radon daughter activity of rainwater at ground level for unit concentration of radon (^{222}Rn) in cloud. The model incorporates the physical processes of diffusive attachment of radon daughters and impact collection for cloud droplets by raindrops. It also includes consideration of cloud droplet and raindrop size spectra. It is concluded from the results from the model that the specific activity of rainwater is not affected very much by aerosol concentration, liquid water content, average radius of raindrops and height of cloud base but is affected markedly by rainfall rate. The radon concentrations in the rainclouds are estimated from the comparison between calculation and near-ground observations carried out for a period of almost 3 years. (14 refs.)

109938 Long-range transport of air pollution. F.B.Smith (Meteorological Office, Bracknell, England).
Meteorol. Mag. (GB), vol.112, no.1333, p.237-44 (Aug. 1983).
A general review is given of the known facts on the long-range transport of air pollution and its influence on 'acid rain' and of the present state of theoretical and practical investigation of the various problems involved. These include the nature of emissions, the amount of local deposition, the estimation of trajectories and lifetimes of airborne pollutants and their chemistry, relative amounts of dry and wet deposition, and background concentration. An account is given of computer modelling and observational studies being carried out by the Meteorological Office and of possible future developments. (8 refs.)

109939 Is there any chlorine monoxide in the stratosphere?. M.J.Mumma, J.D.Rogers, T.Kostiuk, D.Deming, J.J.Hillman, D.Zipoy (Infrared & Radio Astron. Branch, NASA Goddard Space Flight Center, Greenbelt, MD, USA).
Science (USA), vol.221, no.4607, p.268-71 (15 July 1983).
A ground-based search for stratospheric chlorine monoxide was carried out during May and October 1981 with an infrared heterodyne spectrometer in the solar absorption mode. Lines due to stratospheric nitric acid and tropospheric carbonyl sulfide were detected at about 0.2 percent absorptance levels, but the expected 0.1 percent lines of chlorine monoxide in this same region were not seen. Stratospheric chlorine monoxide is less abundant by at least a factor of 7 than is indicated by in situ measurements, and the upper limit for the integrated vertical column density of chlorine monoxide is 2.3×10^{13} molecules per square centimeter at the 95 percent confidence level. These results imply that the release of chlorofluorocarbons may be significantly less important for the destruction of stratospheric ozone than is currently thought. (32 refs.)

109940 Radioactive contamination of the surface boundary layer over the territory of the USSR in 1980. K.P.Makhon'ko, V.P.Martynenko, V.B.Chumichev, F.A.Rabotnova (Inst. of Experimental Meteorology, USSR).
Sov. Meteorol. & Hydrol. (USA), no.4, p.30-4 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.4, p.38-43 (1982).
The pattern of radioactive contamination of the surface boundary layer over the USSR in 1980 by nuclear explosion products is investigated. A comparative seasonal variation of the concentration of long-lived beta activity in individual years during the past five years is given. It is shown that radioactive contamination of the surface boundary layer in the USSR was at a very low level up to October 1980. A nuclear explosion in China on 16 October 1980 is discussed. (5 refs.)

109941 Critical confrontation of standard and more sophisticated methods for modelling the dispersion in air of heavy gas clouds; Evaluation and illustration of the intrinsic limitations of both categories. M.L.Riethmuller.
Report EUR 8423 EN, Comm. European Communities, Luxembourg (1983), 48 pp.
An attempt is made to perform a critical confrontation of the sophisticated models and the more standard ones. In each of these approaches, the essential feature responsible for the quality of the prediction is put in evidence. As an example of a K-model, the VKI code is described and used to illustrate the potential of this type of approach. The examples chosen: local differential heating of the ground, complex topography and variability in the wind direction, have shown that although K-models can deal with more complex situations, the uncertainty in the results is not lower than with other types of approaches. Results of predictions are given in terms of the probability of concentration in the case of variations in wind angle. It is shown that such an approach gives better indication of the ratio between mean and maximum concentrations. (13 refs.)

Third Joint Conference on Applications of Air Pollution Meteorology .... See Entry 105036

Development and testing of prototype alpha waste incinerator off-gas systems .... See Entry 105988

Waste management and environmental controls in the Australian uranium mining industry .... See Entry 106173

Anthropogenic chlorofluoromethanes in the Greenland and Norwegian Seas .... See Entry 109929

Comparative determination of bromine and iodine in three air sampling media via instrumental thermal and epithermal neutron activation analysis .... See Entry 109948

Revised parameters for modeling the transport of PCB components across an air water interface .... See Entry 110484

The occurrence of lead in Antarctic recent snow, firn deposited over the last two centuries and prehistoric ice .... See Entry 110494

Observations of plume trajectories in the initial momentum influenced phase and parameterization of entrainment .... See Entry 110510

A mesoscale atmospheric dispersion model for predicting ambient air concentration and deposition patterns for single and multiple sources .... See Entry 110511

Evaluation of an episodic regional transport model for a multi-day sulfate episode .... See Entry 110512

Atmospheric pollution studies at Kanpur—suspended particulate matter .... See Entry 110513

Modeling of multiphase atmospheric aerosols .... See Entry 110514

Some environmental effects of forest fires in interior Alaska .... See Entry 110515

Modelling of mesometeorological transfer of pollution in SL while recording the interaction effect of admixture with underlying surface ... See Entry 110521

SO_2 and $SO_4^=$ in the arctic: interpretation of observations at three Norwegian arctic-subarctic stations .... See Entry 110534

Atmospheric chloroform ($CHCl_3$): ocean-air exchange and global mass balance .... See Entry 110535

Atmospheric-pollution monitoring through conductivity measurements. .... See Entry 110574

Dispersion limitations of oxidation in power plant plumes during long-range transport .... See Entry 110578

A study of meteorological patterns associated with a lake confined by mountains—the Dead Sea case .... See Entry 110584

Organic material in the global troposphere .... See Entry 110597

The current status of the knowledge of stratospheric ozone .. See Entry 110599

Measurement of minor constituents in the middle atmosphere from IR limb emission spectra: a feasibility study .... See Entry 110662

Radiometric sensing of the atmospheric boundary layer .... See Entry 110736

86.70J Noise

(see also 43.50 Noise, its effects and control)

109942 Noise—The deadline approaches. D.Woolley.
Interavia (Engl. Ed.) (Switzerland), vol.38, no.8, p.843-6 (Aug. 1983).
The author discusses noise limits imposed on aircraft in the United States and most European countries and looks at their implications for airlines. Compliance by various countries with Annex 16 Chapter 2 requirements of the Chicago Convention are tabulated. (no refs.)

109943 The Fifteenth Sir Richard Fairey Memorial Lecture: The quieter airport. N.J.Payne (British Airports Authority, Gatwick Airport, Gatwick, England).
J. Sound & Vib. (GB), vol.89, no.4, p.533-40 (22 Aug. 1983).
Aircraft noise as a social problem arrived less than a quarter of a century ago with the jets and has been a significant factor in airport planning and the development of air transport ever since. This paper explains how the industry has responded, with the introduction of operating techniques, and how Governments have introduced control, both designed to mitigate the effects of aircraft noise as far as possible, for people living near major airports. It shows that considerable success has been achieved and expresses the belief that as a result the worst is passed. The author also demonstrates that there are two sides to airport operation, noise nuisance, the main effects of which are confined to a relatively small area around the airport, is more than balanced by the environs of the airport and spread widely to the region in which it is located and ultimately to the nation as a whole.

109944 A new on-line estimation method of representative statistics of environmental random noise and vibration based on actual digital measurement. M.Ohta, S.Yamaguchi, Y.Mitani (Faculty of Engng., Hiroshima Univ., Higashihiroshima, Japan).
J. Acoust. Soc. Jpn. (Japan), vol.39, no.6, p.361-6 (June 1983). In Japanese.
It is obvious that a strictly stationary random process seldom exists in practical random phenomena such as urban noise and vibration. In the actual observation of random noise and vibration environment, it occurs very often that the level data of random noise and vibration are sampled in digital form at discrete time intervals by use of a sound level meter and vibration meter. Hereupon, the use of digital computer is essential for various types of statistical evaluation (e.g., median, mean value, variance, L_x, etc.) on the above random noise and vibration data. From these practical points of view, a unified expression of random noise and vibration level distribution which is applicable to arbitrary types of distribution form and nonstationary characteristics is newly established in this paper. More concretely, the explicit expression for the probability function for random noise and vibration level fluctuation is derived in the general form of a statistical orthogonal expansion series. Next, based on the above unified expression, a new algorithm estimating the representative statistics such as the L_x level is theoretically proposed, in the sequential form of on-line treatment. Finally, the actual effectiveness of the proposed on-line estimation method is experimentally confirmed by applying it to the experimentally observed road traffic noise data in the city. (6 refs.)

A halt to sound pollution! .... See Entry 106928

Prediction of the noise propagation in a city area composed of randomly distributed buildings .... See Entry 106931

The spectral factor in noise-induced hearing loss: a case for retaining the A-weighting .... See Entry 110056

86.70L Measurement techniques in environmental science

109945 Determination of copper, cadmium and lead in seawater by atomic absorption spectrometry with electrothermal atomization. P.Scarazzato (Osservatorio Geofisico Sperimentale, Trieste, Italy).
Boll. Oceanol. Teor. & Appl. (Italy), vol.1, no.3, p.187-91 (July 1983).
A method is presented to determine copper, cadmium and lead in seawater by complexation with a mixture of ammonium pyrrolidinedithiocarbamate (APDC) and diethylammonium diethyl dithiocarbamate (DDDC), extraction

by carbon tetrachloride and subsequent analysis by flameless atomic absorption spectrometry. (8 refs.)

109946 Interferences in the radiochemical determination of ^{230}Th [in soil and water]. R.C.Burk, I.G.de Jong, D.R.Wiles (Dept. of Chem., Carleton Univ., Ottawa, Ontario, Canada).
J. Radioanal. Chem. (Switzerland), vol.78, no.1, p.81-5 (1983).
Earlier work on the coprecipitation of ^{230}Th and ^{234}Th with $BaSO_4$ has been confirmed and in particular the influence of other ions was investigated. Potassium ions, both in the solution and in the crystals, promote the coprecipitation, while polyvalent cations tend to prevent it. It is shown that increased concentration of K^+ causes a marked change in the $BaSO_4$ crystal form, with a concomitant increase in surface area. At the same time, the rate of exchange of $^{133}Ba^{2+}$ with the $BaSO_4$ surface is also increased. This can be roughly accounted for by the change in surface area. It is conjectured that an equilibrium occurs involving foreign cations in the lattice. (8 refs.)

109947 Enriched uranium as an activatable tracer in environmental research. E.S.Gladney, M.K.Wallwork-Barber, R.W.Ferenbaugh (Los Alamos Nat. Lab., Los Alamos, NM, USA).
J. Radioanal. Chem. (Switzerland), vol.78, no.1, p.209-12 (1983).
Isotopically enriched uranium and delayed neutron assay have been employed to study uranium dynamics within bee colonies. Preliminary data demonstrating the advantages of this activatable tracer method are presented. (14 refs.)

109948 Comparative determination of bromine and iodine in three air sampling media via instrumental thermal and epithermal neutron activation analysis. E.S.Gladney, W.A.Sedlacek (Los Alamos Nat. Lab., Los Alamos, NM, USA), W.W.Berg.
J. Radioanal. Chem. (Switzerland), vol.78, no.1, p.213-25 (1983).
A comparative determination of bromine and iodine in three distinct air sampling media by instrumental thermal and epithermal neutron activation analysis is presented. Open ocean air samples from the mid-Atlantic region were collected on ultra-pure nylon, Nuclepore, and activated charcoal substrates. The bromine and iodine content of each substrate was determined by both epithermal and thermal activation techniques. Good agreement was found within most thermal-epithermal pairs. Relative to the thermal activation procedure, the epithermal technique yields peak/background ratio improvements ranging from a factor of 1.30 to 9.5. Nylon substrates showed the smallest improvement at 1.30 and both Nuclepore and activated charcoal substrates showed improvement factors of 6.7 and 9.5 for bromine and iodine respectively. (20 refs.)

Trace elements in Turkish tobacco determined by instrumental neutron activation analysis ....See Entry 109835

Atmospheric-pollution monitoring through conductivity measurements. ....See Entry 110574

Measurement of minor constituents in the middle atmosphere from IR limb emission spectra: a feasibility study ....See Entry 110662

Variation of the microwave brightness temperature of sea surfaces covered with mineral and monomolecular oil films ....See Entry 110706

86.70Z Other topics

Modelling the effect of diffusion into the rock matrix on radionuclide migration ....See Entry 105958

87.00 BIOPHYSICS, MEDICAL PHYSICS, AND BIOMEDICAL ENGINEERING

Yamada Conference VI on Neutron Scattering in Condensed Matter ....See Entry 105020

87.10 GENERAL, THEORETICAL, AND MATHEMATICAL BIOPHYSICS

(inc. logic of biosystems, quantum biology, and relevant aspects of thermodynamics, information theory, cybernetics, and bionics)

109949 A computer model for the study of left ventricular wall contributions to the first heart sound. L.-G.Durand, R.Guardo (Inst. de Recherches Cliniques de Montreal, Montreal, Quebec, Canada).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.445-8
A numerical model of the heart-thorax acoustic system has been developed to study the transmission of intracardiac sounds through the cardiac muscles and the chest wall. The input signal to the system is the left ventricular PCG and the output is the apical PCG. Changes in the transmission path characteristics are modelled by varying the frequency response of an equivalent acoustic system throughout the cardiac cycle. The model is used to measure the influence of myocardial contractility on the left ventricular and thoracic first sounds, as well as the properties of the heart-thorax acoustic system. A method is described for determining the transfer and coherence functions of the system for each cardiac sound. The coherence function provides an estimate of the power contributed by each frequency component of the left ventricular sound to the total power of the apical sound. (5 refs.)

Stochastic models for cell kinetics ....See Entry 109983

Fibrillation recognition using autocorrelation analysis ....See Entry 110013

Biostereometric data processing in ERGODATA: choice of human body models ....See Entry 110214

87.15 MOLECULAR BIOPHYSICS

(see also 36.20 Macromolecules and polymer molecules)

109950 Concentration (Co) dependence of the thermal stability of DNA duplexes. D.R.Bachvarov, I.G.Ivanov, G.G.Markov (Inst. of Molecular Biology, Bulgarian Acad. of Sci., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.5, p.667-70 (1983).
DNA reassociation is a widely used method to studying the evolutionary relationship between different organisms. This approach is especially advantageous for the taxonomy of prokaryotes where precise information derived from fossil records is not available. In a previous paper (1978) the authors showed that the thermal stability of the duplexes of a DNA giving mismatches upon reassociation under open experimental criterion strongly depends on Co*t* (Co is the concentration of single-stranded DNA and *t*—the time of incubation). The process of increase in the perfectness of the DNA duplexes accompanying the increase in Co*t* was termed 'maturation'. The present study aims to demonstrate that even these two parameters (Co and *t*) may affect the thermal stability of the DNA duplexes obtained upon reassociation to one and the same Co*t* value. (5 refs.)

109951 A new hypothesis on the mechanism of muscular contraction. N.S.Miroshnichenko (T.G. Shevchenko Kiev State Univ., Kiev, Ukrainian SSR).
Dokl. Biophys. (USA), vol.265-267 (July-Dec. 1982)., p.124-5
The basic idea of the proposed hypothesis on the contraction of cross-striated muscle is the screwlike motion of the thick protofibril inside the six hexagonally arranged thin protofibrils, like the movement of a screw and nut. The thick protofibril, the 'screw', rotates as a result of which the six thin protofibrils—the 'nut'—are wound onto the 'screw'. (7 refs.)

109952 An investigation of the interaction of liposomes with cytoplasmic brain proteins by small-angle X-ray scattering. N.I.Mishchenko, M.K.Malysheva, V.A.Zhukareva, A.F.Shryshevskii (T.G. Shevchenko Kiev State Univ., Kiev, Ukrainian SSR).
Dokl. Biophys. (USA), vol.265-267 (July-Dec. 1982)., p.168-71
For the experiments reported the authors used unoriented polydisperse liposomes composed of total cattle brain lipid, which were modified by soluble cytoplasmic proteins. Using small-angle X-ray scattering, the authors showed that integration of proteins with liposomes is accompanied by a change in the electron density profile of their wall. Hence, such a method can be used to investigate protein-lipid interactions. (12 refs.)

109953 Equilibrium species in cobalt(II) carbonic anhydrase. I.Bertini, G.Lanini, C.Luchinat (Inst. of General & Inorganic Chem., Univ. of Florence, Florence, Italy).
J. Am. Chem. Soc. (USA), vol.105, no.15, p.5116-18 (27 July 1983).
By measurement of the ^{1}H NMR T_1 values of the 4 H proton of the coordinated histidine-119 of cobalt(II)-substituted human carbonic anhydrase B and bovine carbonic anhydrase B as a function of pH, it is proposed that the coordination number around the cobalt(II) ion in bovine carbonic anhydrase B is always four, whereas it is largely five in human carbonic anhydrase B in the low pH limit. This hypothesis is consistent with the different spectral properties and pK_a values of the two isoenzymes. (22 refs.)

109954 Spectroscopic study of the interaction of 1-anilinonaphthalene-8-sulfonate and 2-toluidinoaphthalene-6-sulfonate with human blood plasma lipoproteins. V.I.Yuzhakov, S.El'Karadagi, O.V.Martsenyuk, L.V.Levshin, V.A.Tverdislov.
J. Appl. Spectrosc. (USA), vol.37, no.5, p.1261-5 (Nov. 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.5, p.771-5 (Nov. 1982). [received: Sept. 1983]
Blood plasma lipoproteins (LP) transport lipids between cells of various tissues in organisms. According to their specific density, the LP particles are subdivided into the following main classes: very low density (VLDL), low density (LDL), and high density (HDL). The latter in turn are subdivided into two subclasses: HDL_2 and HDL_3. The LP of different classes differ in their apoprotein composition, in their content of phospholipids, cholesterol, cholesterol esters, and triglycerides; they have different sizes and surface charge densities. In movement in the blood vessels, LP undergo a complex series of interconversions, accompanied by exchange of apoproteins between particles, exchange of lipids with the membranes of the cells of the vascular wall, and introduction of LP particles into cells. According to the existing concepts, VLDL and LDL transport lipids into the vascular wall, and they are classified as atherogenic, while HDL 'carry off' cholesterol and therefore possess antiatherogenic properties. The present work was conducted to determine the peculiarities of the interaction of fluorescent probes 1-anilinonaphthalene-8-sulfonate (ANS) and 2-toluidinonaphthalene-6-sulfone (TNS) with LP of different classes, the role of proteins in this interaction, and the possibility of using these probes to study protein-lipid interactions in LP particles. An investigation was made of the intrinsic tryptophan fluorescence of apoproteins, isolated with VLDL (apo-VLDL) and from (apo-HDL) in their interaction with LP of different classes. (10 refs.)

Secondary isotope multiplet NMR spectroscopy of partially labeled entities. Carbon-13 SIMPLE NMR of carbohydrates ....See Entry 106451

Spectral properties of flavins in hydrophilic matrices ....See Entry 109777

On the binding of ligands to macromolecules: an accurate procedure ....See Entry 109786

Theory of cooperative transitions in protein globules ....See Entry 109958

Conformation and dynamics of carcinogenic N-substituted 2-aminofluorene compounds studied by nuclear magnetic resonance spectroscopy ....See Entry 109959

512-channel X-ray DARK-2.0 diffractometer with a mosaic detector for investigating protein single crystals ....See Entry 110256

87.15B Structure, configuration, conformation, and active sites at the biomolecular level

109955 Conformation of purine mononucleotides by H{H} and P{H} nuclear Overhauser effects. H.Santos, A.V.Xavier (Centro de Quimica Estrutural, Univ. Nova de Lisboa, Lisboa, Portugal), C.F.G.C.Geraldes.
Can. J. Chem. (Canada), vol.61, no.7, p.1456-64 (July 1983).
The proton-proton and phosphorus-proton nuclear Overhauser effect (nOe) of guanosine 5′-monophosphate (5′-GMP) was measured in aqueous solution at different pH values and in the presence of excess La^{III} at acid pH. These data and nOe data from the literature for other mononucleotides were used together with vicinal proton-proton coupling constants to investigate the conformations of mononucleotides in aqueous solution, especially their rotational state about the glycosidic bond. Comparison of observed and calculated enhancements using various conformational models for the glycosidic bond gave predominantly anti conformations for 5′-AMP and 5′-GMP and a mixture of syn and anti conformations for 2′-AMP, 2′-GMP, 3′-AMP, and 3′-GMP. Protonation of 5′-GMP at N-7 of the guanine base alters the amplitude of its torsion angle within the anti range. (42 refs.)

109956 The structure of psoluthurin A, the major triterpene glycoside of the sea cucumber Psolus fabricii. F.-X.Garneau, J.-L.Simard, O.Harvey (Univ. du Quebec, Chicoutimi, Canada), J.W.ApSimon, M.Girard.
Can. J. Chem. (Canada), vol.61, no.7, p.1465-71 (July 1983).
The isolation of the major triterpene glycoside from the sea cucumber Psolus fabricii obtained from the north shore of the St. Lawrence estuary is described. Versatile extraction and purification procedures were used and physico-chemical data are presented in support of structure **1** for psoluthurin A. (32 refs.)

109957 Discovery of periodicity in structure of melanoprotein granules of eye pigment epithelium cell (small-angle X-ray investigation). Yu.M.L'vov, A.V.Krivandin, I.B.Fedorovich, M.A.Ostrovskii (A.V. Shubnikov Inst. of Crystallography, Acad. of Sci., USSR).
Dokl. Biophys. (USA), vol.265-267 (July-Dec. 1982)., p.114-16
An X-ray structural analysis of a pure suspension of granules obtained from the eye of a dark-adapted frog (Rana temporaria) is reported. The authors have obtained the first X-ray diagrams of melanoprotein granules from eye pigment epithelium cells. The X-ray diagrams contain four reflections, which indicate an ordered internal structure of the granules. The mean repetition period is about 60 Å. The repeating subunits are probably protein granules with a liquid-type packing. The relation between the detected structure of the melanoprotein granule and its photophysical properties is of considerable interest. (8 refs.)

109958 Theory of cooperative transitions in protein globules. E.I.Shakhnovich, A.V.Finkel'shtein (Inst. of Protein, Acad. of Sci., Pushchino, USSR).
Dokl. Biophys. (USA), vol.265-267 (July-Dec. 1982)., p.175-8
Short-lived interactions of side groups with one another and with the main chain are discussed. Hydrophobic and electrostatic interactions are considered. It is shown that the melting of the protein globule is not necessarily accompanied by complete unfolding of the molecule. (8 refs.)

109959 Conformation and dynamics of carcinogenic N-substituted 2-aminofluorene compounds studied by nuclear magnetic resonance spectroscopy. F.E.Evans, D.W.Miller (Div. of Chem., Nat. Center for Toxicological Res., Food & Drug Administration, Jefferson, AR, USA).
J. Am. Chem. Soc. (USA), vol.105, no.15, p.4863-8 (27 July 1983).
The conformation and dynamics associated with the aryl-nitrogen bond and the amide bond of 2-(acetylamino)fluorene (AAF) as well as the *N*-hydroxy, *N*-acetoxy, and *N*-sulfate derivatives were investigated as an initial step toward analysis of the orientation of AAF in modified nucleic acids. ^{1}H, ^{13}C, and ^{15}N nuclear magnetic resonance spectroscopic data at low temperatures were obtained for each compound. The equilibrium distribution of conformers about the amide bond in temperatures were obtained for each compound. The equilibrium distribution of conformers about the amide bond in *N*-hydroxy-AAF and *N*-acetoxy-AAF, which was unusually favorable for aryl amides, enabled a detailed structural study. A barrier to internal rotation about the amide bond of 14.4 and 13.7 kcal/mol was computed for *N*-hydroxy-AAF and *N*-acetoxy-AAF, respectively. There was rapid rotation about the aryl-nitrogen bond, with the preferred torsion angle about the aryl-nitrogen bond being interrelated to the conformation with the amide bond and the nature of the N substituent. (30 refs.)

109960 EPR evidence on the structure of the copper(II)-bacitracin A complex. E.G.Seebauer, E.P.Duliba, D.A.Scogin, R.B.Gennis, R.L.Belford (School of Chem. Sci., Univ. of Illinois, Urbana, IL, USA).
J. Am. Chem. Soc. (USA), vol.105, no.15, p.4926-9 (27 July 1983).
Bacitracin is an antibiotic that is effective only in the presence of divalent metal cations. The possible sites for the binding of divalent transition metal ions to bacitracin A are investigated by electron paramagnetic resonance. Manganese(II) shows only the characteristics of the aqueous ion. High-spin cobalt, suggesting distorted octahedral coordination, is indicated from the cobalt(II) EPR spectra. The copper(II) complex yields a rich spectrum and detailed structural information. The electronic Zeeman, hyperfine, and nuclear quadrupole coupling parameters show that copper is most probably square planar, coordinated to the glutamate γ-carboxyl, the histidine imidazole, the aspartate β-carboxyl, and the thiazoline nitrogen. (21 refs.)

109961 Determination of the absolute handedness of knots and catenanes of DNA. M.A.Krasnow (Dept. of Molecular Biology, Univ. of California, Berkeley, CA, USA), A.Stasiak, S.J.Spengler, F.Dean, T.Koller, N.R.Cozzarelli.
Nature (GB), vol.304, no.5926, p.559-60 (11 Aug. 1983).
DNA winds about itself in a right-handed or left-handed fashion at several structural levels. The double helix is generally right-handed and is given a (+) sign by convention, whereas supercoiling of the helix axis is always (−) in the cell. The winding in higher-order forms such as knots and catenanes is unknown, and this has impeded elucidation of the mechanisms of their formation and resolution by replication, recombination and topoisomerase action. The authors introduce a procedure for determining the handedness of DNA winding by inspection of electron micrographs of DNA molecules coated with Escherichia coli RecA protein. They demonstrate the validity of the method and show that DNA topoisomerase I of *E. coli* generates an equal mixture of (+) and (−) duplex DNA knots, and that one product of recombination by resolvase of transposon Tn*3* is a catenane of uniquely (+) sign. (17 refs.)

109962 Dependence of DNA helix flexibility on base composition. M.Hogan, J.LeGrange (Dept. of Biochem. Sci., Princeton Univ., Princeton, NJ, USA), B.Austin.
Nature (GB), vol.304, no.5928, p.752-4 (25 Aug. 1983).
The authors have used triplet anisotropy decay techniques to study the flexibility of synthetic DNA fragments with different base pair compositions. They have found major differences in the torsional and bending stiffness of poly(dG).poly(dC), poly(dA).poly(dT) and poly(dA-dC).poly(dT-dG). Poly(dG).poly(dC) has a torsional modulus more than 40 times larger than poly(dA-dC).poly(dT-dG), and approximately 20 times larger than poly(dA).poly(dT). These differences imply that the torsional stiffness of DNA can vary greatly with base composition. The Young's modulus (bending stiffness) measured by the authors for poly(dG).poly(dC) is at least twice that of poly(dA-dC).poly(dT-dG) or random sequence DNA, and is at least threefold greater than that of poly(dA).poly(dT). This implies that the bending stiffness of DNA is also strongly dependent on base composition. In light of this dramatic base composition dependence, the authors suggest that such stiffness variation may lead to local variations in the stability of chromatin or other protein complexes that require bending or twisting of the DNA helix. (19 refs.)

109963 Shapes of and distances between components within the large (50S) subunit of *E.* coli ribosomes. K.H.Nierhaus (Max-Planck-Inst. fur Molekulare Genetik, Berlin-Dahlem, Germany), R.Lietzke, V.Nowotny, H.Schulze, P.Wurmbach, H.B.Stuhrmann, R.P.May.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.426-35 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The large (50S) subunit of *E.* coli ribosomes consists of 32 different proteins and two RNA molecules. Ribosomes are heterogeneous towards neutrons, since RNA and proteins hve different neutron scattering densities. This obstacle for shape determinations of single ribosomal components within the ribosome could be overcome by homogenizing (matching) the neutron scattering densities of RNA and proteins. Model calculations demonstrated that the direct determination of radii of gyration should be experimentally feasible. RNA from the large ribosomal subunit was isolated from cells grown in a medium containing 76% D_2O, the total protein fraction of that from cells grown in 84% D_2O. 50S subunits reconstituted from both constituents match near 100% D_2O. Experiments with single protonated proteins within the deuterated, matched ribosome proved the feasibility of the biochemical strategy outlined above. The shape determinations of ribosomal proteins in situ revealed radii of gyration for L1, L2, L3, L4, and L23 of 26±2, 22±2, 22±2, 20±2, and 13±2 Å, respectively. (17 refs.)

109964 Small angle neutron scattering studies of the structure of nucleosome cores at low ionic strength. K.Mita (Div. of Chem., Nat. Inst. of Radiological Sci., Chiba, Japan), M.Zama, S.Ichimura, N.Niimura, K.Kaji, M.Hirai, Y.Ishikawa.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.436-9 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
The structure of the nucleosome core particle at low ionic strength (10-0.04 mM Na^+) has been studied by small angle neutron scattering in various H_2O/D_2O mixtures. At 0.04 mM Na^+, the radius of gyration obtained at 39% of D_2O where scattering from the DNA dominates was 32 Å, and at 65% D_2O where scattering from the histones dominates, 40 Å. An abrupt increase in the radius of gyration from 35 to 40 Å was observed at about 1 mM ionic strength at 65% D_2O, with decreasing the ionic strength from 10 mM. No loss of the histone secondary structure was detected by circular dichroism over the range of the ionic strength examined. These results suggest that at low ionic strength ($\lesssim$1 mM) the histones are located outside of the nucleosome core particle accompanied by an alteration of the tertiary and/or quaternary structure of the histone octamer, with the DNA in a folded conformation. (26 refs.)

109965 Folding-unfolding of α-lactalbumin. Y.Izumi, Y.Miyake, K.Kuwajima, S.Sugai (Faculty of Sci., Hokkaido Univ., Sapporo, Japan), K.Inoue, M.Iizumi, S.Katano.
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.444-8 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
X-ray and neutron small-angle scattering and quasi-elastic neutron scattering measurements are reported for bovine α-lactalbumin. The conformation at the native (N), the stable intermediate (A), and the fully unfolded (D) states and transition processes among them are examined on the basis of a phase diagram. The conformation of the A state at acid pH is typical of a globular protein. The conformation at the A state has a more or less expanded form than that at the N state. Preliminary analysis and discussion based on the Gaussian approximation are well explained by the model of folding previously presented. (8 refs.)

109966 Direct visualization of unstained nucleic acids on a metal substrate. J.A.Panitz (Sandia Nat. Lab., Albuquerque, NM, USA).
Ultramicroscopy (Netherlands), vol.11, no.2-3, p.161-6 (1983). (Surface Imaging and Analysis with High Spatial Resolution, Wickenburg Inn, AZ, USA, 12-15 Jan. 1983).
Unstained DNA has been directly imaged for the first time on a metallic substrate. Reproducible, three-dimensional images of molecular morphology following aqueous deposition onto tungsten have been obtained. The images confirm the importance of reducing surface tension forces during drying. Preadsorption of poly-1-lysine seems to improve image quality although optimum conditions are quite different than those reported in the TEM literature for insulating substrates. The results suggest that poly-1-lysine should be preadsorbed as a neutral molecule at high pH. Following adsorption, the pH should be reduced in order to establish a net positive surface charge density. The presence of positive charges on a tungsten surface helps to preserve DNA morphology following adsorption from aqueous solution. (16 refs.)

The 1-1 hard pulse: a simple and effective method of water resonance suppression in FT ^{1}H NMR ....See Entry 106458

Crystalline conformation and structure of lichenan and barley β-glucan ....See Entry 107659

Improving the resolution of electron density maps of proteins by refining the model structure. I. Numerical experiments ....See Entry 107664

Photoselection of conformational substrates and the hyposochromic photoproduct of rhodopsin ....See Entry 109780

Numerical averaging of electron micrographs of the 50S subunits of ribosomes ....See Entry 109988

Basic principles of structural organization of ionic channels responsible for depolarization of excitable cell membranes ....See Entry 109990

Determination of twist and handedness of a 39-base pair segment of DNA in solution ....See Entry 110268

87.15M Interactions with radiations at the biomolecular level

109967 Quasi-elastic light scattering studies on T7 DNA in the presence of a sinusoidal electric field. K.S.Schmitz (Dept. of Chem., Univ. of Missouri, Kansas City, MO, USA).
Chem. Phys. (Netherlands), vol.79, no.2, p.297-305 (1 Sept. 1983).
Quasi-elastic light scattering studies on T7 DNA were performed with a sinusoidal electric field applied across the sample. The resulting spectral densities exhibited several peaks whose number and magnitude depended upon the parameter z ($=\mu EK\cos(\theta/2)/2\pi\nu'$, where μ is the apparent electrophoretic mobility, E is the magnitude of the applied electric field of frequency ν', K is the scattering vector, and θ is the scattering angle). These data suggest two asymptotic values for the electrophoretic mobility, the high-frequency limit being associated with the center-of-mass motion of the T7 DNA and the low-frequency limit being identified with small-ion polyion coupled motions. (40 refs.)

109968 NMR of water in biological systems. I. Theoretical considerations. M.Villa, L.Borghi, A.De Ambrosis, S.Aldrovandi (Istituto di Fisica, Pavia, Italy).
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.1019-32 (July-Aug. 1983).
A simple relationship has been thought to exist between the dynamics of water in heterogeneous (liquid-solid) systems and the NMR response. This relationship is usually expressed by the Bloembergen-Purcel-Pound (BPP) equations for relaxation and the phase model. However, a requirement for the use of the BPP theory is that motions take place in an isotropic, infinite and three-dimensional space. It is shown that the mere presence of solid surfaces causes the appearance of solid like features in the NMR response of the liquid even if its dynamics is directly affected by the surfaces. Some of these 'topological' or 'indirect' surface effects are of the same kind as the low-dimensionality effects. Their order of magnitude is estimated for simple geometries and by treating the liquid motion in a hydrodynamic approximation. Comparison with the experiment is carried on in a companion paper. (21 refs.)

109969 NMR of water in biological systems. II. Comparison with the experiments. L.Borghi, A.De Ambrosis, S.Aldrovandi, M.Villa (Istituto di Fisica, Pavia, Italy).
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.1033-49 (July-Aug. 1983).
For pt.I see ibid., vol.2, p.1019 (1983). An extensive investigation of water NMR response in the muscular tissue (frog gastrocnemius) is presented. The authors' data are compared with the predictions of the 'cage models' (discussed in a companion paper), which envisions a single water phase subjected to topological constraints. Several features of the NMR response are easily accounted for by the cage models. Instead, other features give clear evidence for the existence of different phases of water. They performed also an analysis of NMR data for biological and model systems studied in the literature. They suggest that, in most cases, it is more appropriate to interpret NMR data in terms of a single water phase with an average mobility somewhat reduced with respect to that of free water, rather than in terms of several ill-characterized phases. (24 refs.)

109970 Solvent-peak-suppressed NMR: correction of baseline distortions and use of strong-pulse excitation. P.Plateau, C.Dumas, M.Gueron (Groupe de Biophys., Ecole Polytech., Palaiseau, France).
J. Magn. Resonance (USA), vol.54, no.1, p.46-53 (Aug. 1983).
Pulse excitation sequences which involve time delays lead to spectra suffering from so-called frequency-dependent phase shifts. The phenomenon is analyzed in a model case, and the above description is shown to be somewhat improper. Rather, the spectrum should be described as a sum of Lorentzian lines, each of which has its own, frequency-independent, phase shift. The analysis leads to procedures for correcting the baseline distortions of solvent-suppressed NMR based on the Redfield 2-1-4 sequence, or on analogous strong-pulse sequences which are described. Goals and methods of solvent-signal suppression are discussed in this context. (10 refs.)

A simple two-dimensional measurement of the decoupler power during continuous homonuclear irradiation for the correction of Bloch-Siegert shifts .... See Entry 106456

The 1-1 hard pulse: a simple and effective method of water resonance suppression in FT ^{1}H NMR .... See Entry 106458

Photoselection of conformational substrates and the hyposochromic photoproduct of rhodopsin .... See Entry 109780

An investigation of the interaction of liposomes with cytoplasmic brain proteins by small-angle X-ray scattering .... See Entry 109952

Spectroscopic study of the interaction of 1-anilinonaphthalene-8-sulfonate and 2-toluidinoaphthalene-6-sulfonate with human blood plasma lipoproteins .... See Entry 109954

Discovery of periodicity in structure of melanoprotein granules of eye pigment epithelium cell (small-angle X-ray investigation) .... See Entry 109957

Excitation energy transfer from light-harvesting antenna to reaction center in Rhodospirillum rubrum chromatophores from data of selective picosecond spectroscopy .... See Entry 109986

Targeted mutagenesis of SV40 DNA induced by UV light .... See Entry 110089

87.16 BIOTHERMICS

109971 Non-linear effects in the electromagnetic heating of living tissues. F.Bardati, G.Gerosa (Dipartimento di Elettronica, Univ. di Roma, Roma, Italy).
Alta Freq. (Italy), vol.52, no.3, p.170-2 (May-June 1983). (4th Italian National Meeting on Applied Electromagnetics, Florence, Italy, 4-6 Oct. 1982).
With reference to local microwave induced hyperthermia for cancer therapy, the problem of the electromagnetic heating of living tissues has been considered. In order to take into account local thermoregulating effects, a nonlinear model of the thermal behaviour of the biological tissue has been assumed. The temperature distribution induced by exposure to electromagnetic fields has been obtained by using the iterative Newton method. With reference to a particular case, a numerical analysis has been carried out for various values of the nonlinear coefficients of the model, in order to evaluate the matching between the assumed mathematical model and the true biological phenomena. (6 refs.)

109972 Pseudo-critical heat capacity of single lipid bilayers. I.Hatta, K.Suzuki (Dept. of Appl. Phys., Nagoya Univ., Nagoya, Japan), S.Imaizumi.
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2790-7 (Aug. 1983).
By an AC calorimeter the heat capacity of aqueous suspensions of dipalmitoylphosphatidylcholine has been measured near the pretransition and main transition. The anomaly at the main transition exhibits a sharp divergence, i.e. the fluctuation at the transition is certainly dominant, although they undergo first-order transition. The pseudo-critical behavior is analyzed in terms of critical-exponent expressions: α and α' are 0.40 ± 0.05 and 0.4 ± 0.1 respectively. Using Pipard's relations, the dependence of the transition temperature on pressure is discussed, which is almost consistent with that of the direct experiments. The anomaly at the pretransition observed by a differential scanning calorimeter is extremely reduced in AC calorimetry. This is due to the frequency dispersion of the heat capacity, since the relaxation at this transition is very long. (18 refs.)

109973 Coaxial nonmetallic thermocouple with electronic ice point for dosimetric use in electromagnetic environments. R.G.Olsen, W.C.Hammer, J.C.Taylor (Aerospace Medical Res. Lab., Pensacola, FL, USA).
J. Microwave Power (Canada), vol.17, no.2, p.137-43 (June 1982).
A refined version of the nonmetallic thermocouple (NMT) is presented along with results of microwave dosimetric testing of the device in a practical laboratory environment. A smaller device was achieved by using coaxial conductors of a dissimilar nature, and a slightly modified, commercially available electronic ice point provided temperature compensation of the secondary junctions adequate for normal laboratory use. Results of practical dosimetric comparisons in tissue-equivalent material between the coaxial NMT and a widely used, more sophisticated temperature probe showed mean specific absorption rate to vary between 13.6% and 31%, but no statistically significant difference was observed in instances where the probes were compared at identical locations during irradiation. (11 refs.)

109974 Heat-stress proteins and thermal resistance in rat mammary tumor cells. S.P.Tomasovic, P.A.Steck, D.Heitzman (Dept. of Tumor Biology, Univ. of Texas, Houston, TX, USA).
Radiat. Res. (USA), vol.95, no.2, p.399-413 (Aug. 1983).
Exposure of clone MTC rat 13672NF mammary adenocarcinoma cells to continuous heating at 42°C or to heating for 20 min at 45°C followed by incubation at 37°C induced or enhanced synthesis of several heat-stress proteins (HSP) detectable by $[^3$H]leucine pulse labeling, gel electrophoresis, and fluorography. HSP synthesis occurred during development and expression of thermal resistance. For example, continuous heating of MTC cells at 42°C after a rapid temperature transient (about 4 min) produced thermal resistance within 4 to 5 hr of initiation of heating. HSP synthesis was observed within 2 hr of the cells reaching 42°C and continued throughout 8 hr of heating; four major HSP appeared at nominal molecular weights of 112, 90, 70, and 22 kDa. A slow temperature transient from 37° to 42°C over a 3-hr period increased thermal resistance by a factor of about 2 relative to a rapid transient or 'shock' to 42°C. However, HSP synthesis was not significant during the slow heat transient and was either reduced (at 70 and 22 kDa) or not increased (at 112 and 90 kDa) compared with the rates of HSP synthesis at the same time intervals after the rapid transient to 42°C. In these mammary tumor cells, no differences in the number of HSP were detected during heating at 42°C or after 45°C heating. (58 refs.)

Cold stress at high altitudes .... See Entry 106974

Heat flow in laser-irradiated biological systems: some experimental considerations .... See Entry 110081

Observations of Syrian hamster features after exposure to 2450-MHz microwaves .... See Entry 110083

Assessment of immune function development in mice irradiated in utero with 2450-MHz microwaves .... See Entry 110084

Effects of ambient temperature and exposure to 2450-MHz microwave radiation on evaporative heat loss in the mouse .... See Entry 110085

Hyperthermic potentiation of unrejoined DNA strand breaks following irradiation .... See Entry 110094

Experimental condition and the acute reaction of mouse skin to ionizing radiation .... See Entry 110099

Experimental techiques for direct-contact applicators for microwave hyperthermia .... See Entry 110112

Apparatus for RF and microwave hyperthermia .... See Entry 110113

Microwave thermography—characteristics of waveguide applicators and signatures of thermal structures .... See Entry 110139

The role of thermal imaging in the diagnosis, treatment and prognosis of pain .... See Entry 110140

Radiofrequency-induced hyperthermia: computer simulation of specific absorption rate distributions using realistic anatomical models .... See Entry 110143

True r.m.s. volt/ammeters for surgical diathermy measurements during an operation .... See Entry 110238

87.20 MEMBRANE BIOPHYSICS

109975 Stochastic problems in information transfer across the plasma membrane. C.DeLisi (Lab. of Math. Biology, National Cancer Inst., Bethesda, MD, USA).
Bull. Math. Biol. (GB), vol.45, no.4, p.467-82 (1983).
The surfaces of many cells are viscous fluids; consequently, most membrane proteins are able to diffuse laterally in a more or less random fashion, with diffusion coefficients typically of order 10^{-10} cm^2/sec. Evidence from a variety of systems indicates that such receptor clustering plays a role in the sequence of events leading to cellular activity. The paper describes a number of mathematical problems that arise in the analysis of experiments in which clustering occurs. The author begins by reviewing methods for finding the time evolution of the cluster size distribution function in terms of reaction rate constants. The methods solve an essentially infinite system of coupled nonlinear differential equations. Next, the rate constants are analyzed, the Brownian motion problems that arise in attempting to understand ligand recognition are described and relevant experimental systems are discussed. Finally the notion of ligand as a signal amplifier is introduced—an idea that emerges naturally from the requirement that receptors be clustered for a finite amount of time before a signal can be transmitted. (27 refs.)

109976 Application of hybrid image processing for the determination of the optical properties of cellular membranes. M.Chevalier (Dept. de Fisica Medica, Facultad de Medicina, Univ. Complutense, Madrid, Spain), M.L.Calvo.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.59-66 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
A biological cell is considered as a bidimensional phase object. As the different parts of the cell have not the same optical density, it has a density profile corresponding to an inhomogeneous object. That means that, in spatial frequencies, it is possible to identify the different contributions to the morphology of the cell. The methods used are complementaries: (1) numerical simulation; (2) digitalisation of the Fourier spectrum; (3) optical-non-destructive methods: obtention of the optical Fourier spectrum. The possibilities of obtaining information using spatial frequency filtering techniques are discussed. (8 refs.)

109977 Spin exchange in nitroxide-charged membrane models: an ESR method for detecting photodynamic effects. C.Emiliani, S.Cannistraro (Dipartimento di Fisica, Univ. di Perugia, Perugia, Italy).
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.1203-12 (July-Aug. 1983).
An electron spin resonance (ESR) method for detecting the photodynamic effects induced in membrane models is described. The method is based on the study of the spin exchange line broadening occurring in nitroxide-charged lipsomes before and after visible irradiation in the presence of various photosensitizing molecules. (17 refs.)

109978 Possibility of ferroelectricity in biomembranes. L.A.Beresnev, L.M.Blinov, E.I.Kovshev (Sci.-Res. Inst. of Organic Intermediates & Dyes, Moscow, USSR).
Dokl. Biophys. (USA), vol.265-267 (July-Dec. 1982)., p.111-14
It is shown that, first biological membranes of animal origin may provide all the essential symmetric conditions for ferroelectricity and, secondly that the spontaneous polarization, due to the presence of cholesterol, may be sufficiently high. The close similarity between biomembranes and ferroelectric liquid crystals is considered. (11 refs.)

109979 The ATP receptor in the membrane of sensory neurons. O.A.Kryshtal', S.M.Marchenko, V.I.Pidoplichko (A.A. Bogomolets Inst. of Physiology, Acad. of Sci., Kiev, Ukrainian SSR).
Dokl. Biophys. (USA), vol.265-267 (July-Dec. 1982)., p.172-5
Reports experiments conducted on neurons isolated from various sensory ganglia (ganglia nodosum, vestibulare, semilunare, spinale) of rats 4 to 25 days old. The results show that the membranes of sensory neurons have ionic channels that are activated by ATP. (4 refs.)

109980 Computer simulation of the main gel-fluid phase transition of lipid bilayers. O.G.Mouritsen (Dept. of Phys. Chem., Univ. of Aarhus, Aarhus, Denmark), A.Boothroyd, R.Harris, N.Jan, T.Lookman, L.MacDonald, D.A.Pink, M.J.Zuckermann.
J. Chem. Phys. (USA), vol.79, no.4, p.2027-41 (15 Aug. 1983).
Monte Carlo techniques have been applied to a study of two related quasi-two-dimensional microscopic interaction models which describe the phase behavior of phospholipid bilayers. The two models are Ising-like lattice models in which (a) the acyl chains of the phospholipids interact via anisotropic van der Waals forces and (b) the rotational isomerism of the chains is accounted for by two and ten selected conformational states, and (b) the rotational isomerism of the chains is accounted for by two and ten selected conformational states, respectively. Monte Carlo experiments are performed on both models so as to determine whether the static thermodynamic properties of lipid bilayers are most accurately represented by a simple two state gel-fluid concept or whether a more complicated melting process involving intermediate states takes place. The temperature dependence of several static thermodynamic properties has been calculated for both models. This includes the chain cross-sectional area, the internal and free energies, the coherence length, the lateral compressibility, and the specific heat. The comparison between the Monte Carlo results for the two models demonstrates that, whereas the two-state model has a first-order transition with jumplike behavior in the transition region the ten-state model exhibits a first-order transition associated with a closed hysteresis loop. Next, the Monte Carlo results for cross-sectional areas per lipid chain, coherence lengths and lateral compressibilities are discussed in the context of experimental results for dipalmitoyl phosphatidylcholine (DPPC). A Monte Carlo analysis of bilayers composed of both DPPC and cholesterol shows that a two-state model does not adequately describe the thermodynamic behavior of lipid-cholesterol mixtures implying that intermediate states have to be introduced to account for the experimental data. (59 refs.)

109981 On defects in different phases of two-dimensional lipid bilayers. D.Ruppel, E.Sackmann (Phys. Dept., Tech. Univ. Munchen, Munchen, Germany).
J. Phys. (France), vol.44, no.9, p.1025-34 (Sept. 1983).
The phospholipid bilayer is the basic structure of biological membranes as well as a suitable model of a two-dimensional system. Defects within these bilayers are studied electron microscopically by application of the freeze fracture method. Topological and non-topological defects can be distinguished. The first type is analysed in terms of the homotopy theory. Two defect systems, an Abelian and a non-Abelian, are found which are a consequence of a symmetry breaking. The effect of small amounts of impurities on the defect structure is studied. An outline of the possible biological relevance of defects is given in the last part. (23 refs.)

109982 Some aspects of the structure change of lipid bilayers associated with the thermotropic phase transition. Miscibility of different lipids in liposome bilayers. Y.Toyoshima, T.Takeda, K.Akabori, S.Komura (Faculty of Integrated Arts & Sci., Hiroshima Univ., Hiroshima, Japan).
Physica B & C (Netherlands), vol.120B+C, no.1-3, p.440-3 (May 1983). (Yamada Conference VI on Neutron Scattering in Condensed Matter, Hakone, Japan, 1-4 Sept. 1982).
Dipalmitoylphosphatidylcholine with completely deuterized acyl chains (DDPPC) was synthesized to examine the temperature dependence of miscibility of two lipids in liposomes, which differ only by two methylene units in the lengths of their acyl chains by means of neutron small angle scattering. The initiation and completion temperatures, T_h and T_l ($T_h > T_l$), of the phase change with regard to the chain ordering of the lipids were determined by the fluorescence method for the equimolar mixture of DDPPC and non-deuterized dimyristoylphosphatidylcholine (DMPC) and that of DDPPC and non-deuterized distearoylphosphatidylcholine (DSPC). Complete mixing of two lipids was observed by neutron small angle scattering only at a temperature above T_h for DDPPC/DMPC, but was not observed for DDPPC/DSPC over the temperature range examined. (16 refs.)

Pseudo-critical heat capacity of single lipid bilayers .... See Entry 109972

Physical properties of pathological human erythrocytes. II. A comparative electron spin resonance study of erythrocyte membrane in homozygous β-thalassemia .... See Entry 109985

Surface potential of thylakoid membrane, photoinduced absorption of protons, and photophosphorylation in chloroplasts .... See Entry 109987

Basic principles of structural organization of ionic channels responsible for depolarization of excitable cell membranes .... See Entry 109990

Analysis of the safety levels for impulsive electromagnetic fields .... See Entry 110080

87.25 CELLULAR BIOPHYSICS

109983 Stochastic models for cell kinetics. P.Jagers (Chalmers Univ. of Technol., Gothenburg, Sweden).
Bull. Math. Biol. (GB), vol.45, no.4, p.507-19 (1983).
A survey is given of branching process type methods in cell kinetics. Some results are given that allow circadian rhythm and do not require complete independence between cells. Some more classical results on balanced exponential growth are given and some comments are made on flow microfluorometry. (10 refs.)

109984 Physical properties of pathological human erythrocytes. I. A spin label study on the internal microviscosity of homozygous β-thalassemic erythrocytes. L.Sportelli (Dipartimento di Fisica, Univ. della Calabria, Calabria, Italy), A.Rosi, P.L.Indovina, C.Brancati, A.Tagarelli.
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.993-1004 (July-Aug. 1983).
A contribution to the study of physical properties of pathological human erythrocytes has been obtained by applying the electron spin resonance spectroscopy with spin labels. The rotational correlation time, τ_c, of the spin label tempamine has been used for a comparative study of internal microviscosity in normal and in homozygous β-thalassemic erythrocytes. Results claim for a decreased microviscosity in pathological erythrocytes as compared with normal ones. These findings suggest the hypothesis of a different water structuring process in the physiological and pathological situation inside red blood cells. (17 refs.)

109985 Physical properties of pathological human erythrocytes. II. A comparative electron spin resonance study of erythrocyte membrane in homozygous β-thalassemia. L.Sportelli (Dipartimento di Fisica, Univ. della Calabria, Calabria, Italy), A.Rosi, P.L.Indovina, C.Brancati, A.Tagarelli.
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.1005-13 (July-Aug. 1983).
For pt.I see ibid., vol.2, p.993 (1983). A contribution to the study of the physical properties of the human-erythrocyte membrane has been obtained by applying electron spin resonance spectroscopy with three spin labels at different penetration levels in the membrane. The order parameter S as a measure of the membrane fluidity and the hyperfine coupling constant a_N' as a measure of the membrane polarity have been determined. A comparative study of S and a_N' between normal and homozygous β-thalassemic erythrocytes has been performed. Results showed as increased polarity and a decreased fluidity in the pathological erythrocyte membrane as compared to the normal one. A model for understanding these differences has been proposed. (22 refs.)

109986 Excitation energy transfer from light-harvesting antenna to reaction center in Rhodospirillum rubrum chromatophores from data of selective picosecond spectroscopy. A.Yu.Borisov, R.A.Gadonas, R.V.Danelyus, V.S.Kozlovskii, A.S.Piskarskas, A.P.Razzhivin, S.G.Kharchenko (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Dokl. Biophys. (USA), vol.265-267 (July-Dec. 1982)., p.129-32
Presents the results of direct measurements of the kinetics of disappearance of excitations from the light harvesting antenna and subsequent oxidation of the RC in native chromatophores from the purple bacterium Rhodospirillum rubrum on the first differential picosecond absorption spectrometer, which was built at Vilnius State University. It is concluded that: 1. The B905 complexes are located in the immediate vicinity of the RC. The equality of the decay time of excitations in B905 and the rise time of RC photooxidation shows that RC traps capture excitons from B905. In other words, the B905 form acts as an effective coupling link between the main antenna pigment and the RC; 2. The energy gap between the B880 and B905 forms is 39 meV, which corresponds to upward and downward energy transfer rates in the ratio 1:5. However, taking into account that in Rh. rubrum there are 3-5 B905 molecules to approximately 50 B880 molecules, one can conclude that the quasi-steady ratio of excitations in the B880 and B905 forms will be 3:1. (15 refs.)

109987 Surface potential of thylakoid membrane, photoinduced absorption of protons, and photophosphorylation in chloroplasts. A.N.Tikhonov, A.A.Timoshin, E.K.Ruuge, L.A.Blyumenfel'd (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Dokl. Biophys. (USA), vol.265-267 (July-Dec. 1982)., p.136-8
It is known that illumination of coupled chloroplasts is accompanied by a change in potential on the outer surface of the thylakoid membrane. The results of investigations on pea seedlings, given in this paper, indicate the absence of a simple correlation between photoinduced changes in surface potential and the phosphorylation rate in chloroplasts. (11 refs.)

109988 Numerical averaging of electron micrographs of the 50S subunits of ribosomes. N.A.Kiselev, E.V.Orlova, V.Ya.Stel'mashchuk, V.D.Vasil'ev, O.M.Selivanova, V.P.Kosykh, A.I.Pustovskikh, V.S.Kirichuk (A.V. Shubnikov Inst. of Crystallography, Acad. of Sci., Moscow, USSR).
Dokl. Biophys. (USA), vol.265-267 (July-Dec. 1982)., p.182-5
The main result of this work is the confirmation by numerical methods of the results of visual examination and optical averaging of the large ribosomal subunits. The observed 'fine structure' is one of the projections of the three-dimensional structure of the ribosomal subunits revealed by negative contrasting with uranyl acetate. When data for other projections of this subunit have been collected and information obtained about the position of the protein molecules by immune electron microscopy and other techniques has been taken into account. It will be possible to establish the quaternary structure of ribosomes. (9 refs.)

Discovery of periodicity in structure of melanoprotein granules of eye pigment epithelium cell (small-angle X-ray investigation) .... See Entry 109957

Heat-stress proteins and thermal resistance in rat mammary tumor cells .... See Entry 109974

Application of hybrid image processing for the determination of the optical properties of cellular membranes .... See Entry 109976

Some aspects of the structure change of lipid bilayers associated with the thermotropic phase transition. Miscibility of different lipids in liposome bilayers .... See Entry 109982

Basic principles of structural organization of ionic channels responsible for depolarization of excitable cell membranes .... See Entry 109990

ATP-regulated K^+ channels in cardiac muscle .... See Entry 109993

The spatial frequency sensitivity of bipolar cells .... See Entry 110023

Two late response components in on-off ganglion cells of the frog retina: the delayed response—generated by red rods; the second off-response—generated by green rods .... See Entry 110033

Microwave effects on cell cultures .... See Entry 110079

Analysis of the safety levels for impulsive electromagnetic fields .... See Entry 110080

Stimulation of E. coli growth by laser and incoherent red light .... See Entry 110082

Response of a human colon adenocarcinoma (DLD-1) to X-irradiation and mitomycin C in vivo .... See Entry 110087

Recombination of parent and daughter strand DNA after UV-irradiation in mammalian cells .... See Entry 110088

Targeted mutagenesis of SV40 DNA induced by UV light .... See Entry 110089

Resistance of human erythrocytes containing elevated levels of vitamin E to radiation-induced hemolysis .... See Entry 110092

DNA damage in irradiated endothelial cells of the rat cerebral cortex. Protective action of cysteamine in vivo .... See Entry 110093

Hyperthermic potentiation of unrejoined DNA strand breaks following irradiation .... See Entry 110094

A comparison of the lethal effects of intracellular radionuclides in human and rodent cells .... See Entry 110095

The repair of sublethal damage in diploid human fibroblasts: a comparison between human and rodent cell lines .... See Entry 110096

Are lesions induced by ionizing radiation direct blocks to DNA chain elongation? .... See Entry 110098

A combined light and scanning electron microscopy on human urinary cytology .... See Entry 110138

Prospects of autotrophic link functioning in biological life-support systems based on cell biology studies .... See Entry 110194

Somatic embryogenesis in anise (Pimpinella anisum L.) cell cultures in microgravity environment .... See Entry 110199

Effects of microgravity on the mechanisms for genetic recombination .... See Entry 110201

The possible involvement of gravitational forces in the topological distribution of cytoplasmic determinants in Drosophila melanogaster embryos .... See Entry 110203

The clinostat—a tool for analysing the influence of acceleration on solid-liquid systems .... See Entry 110206

Problems of 0-g simulation with the fast-running clinostat (for cellular study) .... See Entry 110207

The use of horizontal clinostats in plant physiology .... See Entry 110208

Influence of gravity on cell growth and migration .... See Entry 110209

Rotating microscope for Landsat photography of vertebrate embryos .... See Entry 110246

A new conductive substrate for preparing cells in suspension for scanning electron microscopy .... See Entry 110258

Estimation of the mean size of spheres from the profiles in ulthrathin sections: a stereological method .... See Entry 110259

Quality improvement of white blood cell images by using a 2-D digital filter .... See Entry 110270

87.25D Biological transport; cellular and subcellular transmembrane physics

109989 Diffusional resistances to oxygen transfer in whole blood. J.C.Merchuk, Z.Tzur (Dept. of Chem. Engng., Ben Gurion Univ. of the Negev, Beer-Sheva, Israel), E.N.Lightfoot.
Chem. Eng. Sci. (GB), vol.38, no.8, p.1315-21 (1983).
The authors investigate the resistance to oxygen transfer from the red blood cell by a modified rapid flow technique. It is found that the transfer of oxygen in the boundary layer surrounding the red blood cell can account for all of the transport resistance found in these experiments. (23 refs.)

109990 Basic principles of structural organization of ionic channels responsible for depolarization of excitable cell membranes. P.G.Kostyuk (A.A. Bogomolets Inst. of Physiology, Acad. of Sci., Kiev, Ukrainian SSR).
Dokl. Biophys. (USA), vol.265-267 (July-Dec. 1982)., p.143-5
The very complex problem of separating mono- and divalent cations and producing the corresponding specific ionic currents in the excitable neuronal membrane may be solved by recourse to at least three different physicochemical mechanisms, the carrier of each of which is probably a special structural part of the corresponding ionic channels. These structural parts can function in different combinations in different types of ionic channels and are possibly synthesized by the cell as separate subunits, which are then combined when they are built into a single molecular structure—the ionic channel—in the membrane. (12 refs.)

109991 Oscillations of intracellular Ca^{2+} in mammalian cardiac muscle. C.H.Orchard, D.A.Eisner, D.G.Allen (Dept. of Physiology, Univ. Coll. London, London, England).
Nature (GB), vol.304, no.5928, p.735-8 (25 Aug. 1983).
In certain conditions of Ca^{2+}-loading the normal cardiac contraction is followed by an aftercontraction. The rise of intracellular calcium concentration ($[Ca^{2+}]$i) which is thought to underlie the aftercontraction also produces a transient inward current. This current, which probably results from a Ca^{2+}-activated nonspecific cation conductance, has been implicated in the genesis of various cardiac arrhythmias. However, despite the potential importance of such fluctuations of $[Ca^{2+}]$i their existence has, so far, only been inferred from tension measurements. Here the authors present direct measurements of such oscillations of $[Ca^{2+}]$i based on experiments on ferret papillary muscles. (20 refs.)

109992 Ligand-induced rapid redistribution of lysosomes is temporally distinct from endosome translocation. B.Herman, D.F.Albertini (Dept. of Anatomy, Harvard Medical School, Boston, MA, USA).
Nature (GB), vol.304, no.5928, p.738-40 (25 Aug. 1983).
Although the translocation of endosomes to the Golgi region in the cell centre seems to be a general phenomenon presumably coupled to ligand degradation by lysosomes, and endosomes and lysosomes undergo saltatory movements within the cytoplasm, the spatial control of interaction between the two structures is not understood. To address this problem the authors have begun to examine the spatial and temporal intracellular distribution of endosomes and lysosomes. Utilizing a new fluorescent microscopic approach, they have now been able simultaneously to visualize endosome and lysosome populations in living cells. The results suggest that a specific relocation of lysosomes is rapidly induced upon binding of different types of ligands to the cell surface; this migration of lysosomes to the Golgi region of the cell precedes the translocation of endosomes into the same area. (28 refs.)

109993 ATP-regulated K^+ channels in cardiac muscle. A.Noma (Nat. Inst. for Physiological Sci., Okazaki, Japan).
Nature (GB), vol.305, no.5930, p.147-8 (8 Sept. 1983).
An outward current of unknown nature increases significantly when cardiac cells are treated with cyanide or subjected to hypoxia, and decreases on intracellular injection of ATP. The author reports that application of the patch-clamp technique to CN-treated mammalian heart cells reveals specific K^+ channels which are depressed by intracellular ATP (ATP_i) at levels greater than 1 mM. For these channels, conductance in the outward direction is much larger than the inward rectifier K^+ channel which is insensitive to ATP. AMP had no effect on the ATP-sensitive K^+ channel, and ADP was less effective than ATP. Thus, the ATP-sensitive K^+ channel seems to be important for regulation of cellular energy metabolism in the control of membrane excitability. (18 refs.)

109994 Quantification of Ca^{2+}-activated K^+ channels under hormonal control in pig pancreas acinar cells. Y.Maruyama, O.H.Peterson, P.Flanagan, G.T.Pearson (Physiological Lab., Univ. of Liverpool, Liverpool, England).
Nature (GB), vol.305, no.5931, p.228-32 (15 Sept. 1983).
Using patch-clamp methods to record single-channel currents from excised fragments of baso-lateral acinar cell membranes in combination with current recordings from isolated single acinar cells and two- and three-cell clusters, the authors have for the first time characterized K^+ channels quantitatively. In pig pancreatic acini there are 25-60 K^+ channels per cell with a maximal single channel conductance of about 200 pS. The authors have quantified the relationship between internal ionized Ca^{2+} concentration ($[Ca^{2+}]_i$) membrane potential and open-state probability (p) of the K^+ channel. By comparing curves obtained from excised patches relating membrane potential to p, at different levels of $[Ca^{2+}]_i$, with similar curves obtained from intact cells, $[Ca^{2+}]_i$ in resting acinar cells was found to be between 10^{-8} and 10^{-7} M. In microelectrode experiments acetylcholine, gastrin-cholecystokinin as well as bombesin peptides evoked Ca^{2+}-dependent opening of the K^+ conductance pathway, resulting in membrane hyperpolarization. (12 refs.)

Stochastic problems in information transfer across the plasma membrane .... See Entry 109975

Effect of calcium ions on inactivation of inward current of dialyzed Helix pomatia neurons .... See Entry 110000

Passage of manganese and zinc ions through the calcium channel of mollusc neurons .... See Entry 110001

Voltage- and ion-dependent conductances in solitary vertebrate hair cells .... See Entry 110059

87.30 BIOPHYSICS OF NEUROPHYSIOLOGICAL PROCESSES

(exc. perception processes and speech)

109995 Motor unit activity and muscle strength development. G.A.Wood, R.J.Lockwood, A.G.Creswell, J.Henstridge (Dept. of Human Movement & Recreation Studies & Biometrics, Univ. of Western Australia, Nedlands, Australia).
Australas. Phys. & Eng. Sci. Med. (Australia), vol.6, no.2, p.71-5 (April-June 1983). [received: Aug. 1983]
Neural factors have been found to play a significant role in human muscular strength development, as evidenced by quantitative changes in electromyographic activity recorded during maximum voluntary contractions. These changes are suggestive of an altered pattern of motor unit firing in that the coincidence of several motor units firing at one and the same time is greater than could be accounted for by chance alone. Further, the authors' experiments have shown that this altered pattern of firing is not commensurate with the electromyographic pattern associated with muscular fatigue. Whereas altered spinal reflex activity accounts for much of the fatigue pattern, long loop reflexes appear to be an important factor in strength adaptation. These findings are based on a series of studies in which young adult subjects were trained on an isokinetic dynamometer for 4-6 weeks. Electromyographic signals were subjected to power spectral analysis and examined for significant shifts in the spectrum. (16 refs.)

109996 Stochastic processes in neurophysiology: transformation from point to continuous processes. A.V.Holden (Dept. of Physiology, Univ. of Leeds, Leeds, England).
Bull. Math. Biol. (GB), vol.45, no.4, p.443-65 (1983).
The spike train activity of neurones is considered as a point process, and methods of analysing and interpreting recorded spike trains are considered. The generation of a continuous process (membrane noise) from interacting point processes is described. (63 refs.)

109997 A note on the sample serial autocorrelation function of stationary spike trains. D.Schild (Zentrum Physiologie und Pathophysiologie, Univ. Gottingen, Gottingen, Germany).
Biol. Cybern. (Germany), vol.47, no.2, p.147-8 (1983).
The computation of the sample serial autocorrelation of a spike train is reasonable under the condition that the underlying process is stationary and linear. If these conditions are not fulfilled, the sample serial autocorrelation is random and any interpretation of it is erroneous. On the other hand, if the conditions are proved to hold, there is little need for the computation of the sample serial correlation, since in nearly all practical cases the stationarity is approximated by stationarity in the wide sense, which means that the deterministic autocorrelation of the process is already known. (7 refs.)

109998 Equalization of the coherence of rhythms in EEG and its functional significance. N.D.Nikolov (Central Lab. for Brain Res., Bulgaria Acad. of Sci., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.5, p.659-62 (1983).
The coherent function (CF) shows the interconnection between two signals by investigating the frequency components contained in them. It offers a number of advantages in studying the interrelations between rhythms in the bioelectric activity of two formations (the so-called spatial synchronization) over their power spectra or the cross-correlation function between them. In processing experimental data for studying spatial synchronization by means of CF the author obtained certain results which may be regarded as the correlate of improved functional state of the central nervous system (CNS). What he had in mind is a process of equalization of the coherences between the individual pairs of brain structures (i.e. changes in intercoherent relations). The experiments were carried out with male adult rats with implanted electrodes in the visual (V) cortex, in the sensomotory (M) cortex, in the hippocampus (H) and in the mesencephalic locomotory zone (F). Two groups of 4 animals each were investigated: at one and the same state (wakeful, calm) a control group and a group which had gone through motor loading over a period of 25 months. (8 refs.)

109999 Anaesthesia. Anaesthetic effects of inert gases in relation to the biomedium structure. G.F.Cerofolini (Istituto di Chimica Fisica, Politecnico di Milano, Milano, Italy).
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.1156-62 (July-Aug. 1983).
A new theory of anaesthesia is proposed. This theory is based on the hypothesis that the narcotic gas displaces water-structure-disordering ions from the cells, thus forbidding nerve excitation. (8 refs.)

110000 Effect of calcium ions on inactivation of inward current of dialyzed Helix pomatia neurons. E.V.Narushyavichus, M.Sh.Rapoport (Kaunas Medical Inst., Kaunas, USSR).
Dokl. Biophys. (USA), vol.265-267 (July-Dec. 1982)., p.117-19
The experiments reported were conducted by intracellular dialysis of isolated Helix pomatia neurons and voltage clamping on their somatic membrane. The authors investigated the inward ion current conveyed through the membrane calcium channel. The inward current inactivation time constant (τ_n) was determined directly from the experimental traces by the straightening method. The free-calcium concentration in the dialyzing solution was altered by the addition of Ca-EGTA buffer. It was found that a change in free-calcium concentration inside the cell ($[Ca^{2+}]_i$), also in the membrane potential, caused a change in the time characteristics of the Ca and Sr inward currents. With increase in positive potential inside the cell the values of τ_n, and also the increase in $[Ca^{2+}]_i$, were reduced. A change in extracellular Ca^{2+} or Sr^{2+} concentration had no effect on τ_n of the inward current. (9 refs.)

110001 Passage of manganese and zinc ions through the calcium channel of mollusc neurons. V.N.Ponomarev, D.Zablotskaite, E.V.Narushyavichyus (Kaunas Medical Inst., Kaunas, USSR).
Dokl. Biophys. (USA), vol.265-267 (July-Dec. 1982)., p.119-21
The aim of the work reported was to investigate the possible passage of divalent Co, Ni, Cd, Mg, Mn, and Zn ions, which are known to be calcium-current blockers through the calcium channel of isolated neurons of the edible snail Helix pomatia and the pond snail Limnaea stagnalis. The experiments were conducted in voltage-clamp conditions in conjunction with intracellular dialysis of neurons on a pore. The experiments showed that when the initial external solution was replaced by a solution with cobalt (2 mM), nickel (2 mM), or cadmium (1 mM) ions the inward current was reduced to zero in 5-10 sec. On change back to the initial solution the inward current usually returned to its previous value. The addition of cadmium ions (1 mM) to an external solution containing 5 mM $MnCl_2$ or 10 mM $ZnCl_2$ completely

blocked the inward current. The authors conclude that the calcium channel in isolated neurons of the edible snail is permeable to manganese and zinc ions, as well as to calcium, strontium, and barium ions. (9 refs.)

110002 Cyclic variation of integrated delta components during nocturnal sleep in mentally retarded children. M.Shibagaki, S.Kiyono (Dept. of Physiology, Inst. for Dev. Res., Aichi Prefectural Colony, Kasugai, Aichi, Japan).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.2, p.190-3 (Aug. 1983).
The cyclic variation of the integrated delta component in 80 mentally retarded children (from 2 months to 12 years of age) was studied throughout nocturnal sleep, and the following results were obtained. In 62 out of 80 subjects the high integrated delta rhythm power was noted in sleep EEG. In 11 out of the 80, low integrated delta rhythm power was found. In the remaining 7 subjects, no integrated delta rhythm power was found throughout nocturnal sleep. A significant increase in abnormal clinical EEG was found in subjects without delta rhythm power as compared to those with high delta rhythm power. A significant decrease in DQ was found in the subjects without delta rhythm power as compared to those with high and low delta rhythm powers. (9 refs.)

110003 Propagation of seizure activity in kindled dogs. N.J.I.Mars (Section Medical Informatics, Univ. of Leiden, Leiden, Netherlands), F.Lopes Da Silva.
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.2, p.194-209 (Aug. 1983).
The problem of determining the location of epileptogenic foci has been studied by means of a new analysis technique, the AAMI method. The spread of seizure activity in several seizures of 3 dogs, made epileptic by the kindling process, has been analyzed, using depth recording. The focus was located in the prepyriform cortex (PPC). The spread of activity from there to the amygdala was observed. It was found that seizures can be divided into 3 phases. In the first phase (lasting up to 5 sec after the kindling stimulus) no relationship between PPC and amygdala was found. In the second phase (5-13 sec) a strong relationship between these areas was found, with consistent delay times which decreased during this interval from 19.1 to 23.6 msec at the beginning to 11.3 to 16.0 msec at the end of the interval. In the third phase of the seizures (after about 13 sec post kindling) activity in the reported areas was found to be independent again. A possible neurophysiological interpretation of these findings is given. (23 refs.)

110004 Relationship between the surface e.m.g. and muscular force. G.C.Ray (Dept. of Electrical Engng., Panjab Engng. Coll., Chandigarh, India), S.K.Guha.
Med. & Biol. Eng. & Comput. (GB), vol.21, no.5, p.579-86 (Sept. 1983).
Most of the theoretical studies relating the surface electromyogram (s.e.m.g.) to muscular force suggest that the amplitude of the e.m.g. should increase proportionately with the square root of the tension. However, direct experiments have shown a linear relationship. The reasons for this difference are the oversimplified assumptions adopted in the various models. These models assume that all the motor units are the same size. Also, variations in action potential magnitudes and firing frequency have not been taken into account. Recent physiological experiments have contradicted these assumptions and the various parameters have now been mathematically correlated. If these mathematical correlations are incorporated in a model, the linearity between the s.e.m.g. and the muscular force is greatly improved. (14 refs.)

110005 Conductance and dye permeability of a rectifying electrical synapse. J.F.Margiotta, B.Walcott (Dept. of Anatomical Sci., State Univ. of New York, Stony Brook, NY, USA).
Nature (GB), vol.305, no.5929, p.52-5 (1 Sept. 1983).
Giant motor synapse (GMS) conductance and dye permeability were examined at thoracic and abdominal levels of the crayfish nerve cord. At both levels, values of GMS chord conductance fit a simple Boltzmann model in which the conductance of individual synaptic channels is assumed to be voltage dependent. Moreover, thoracic synapses display higher limiting conductances than do those at an abdominal level, apparently as a result of their larger size. The authors also find that synapses at both locations are permeable to the fluorescent dye Lucifer yellow, even in conditions where electrical conductance is low. These results provide a framework for understanding the operation and functional limits of rectifying electrical synapses, and illustrate that dye permeability can be associated even with their relatively low conductance condition. (22 refs.)

110006 Sustained rise in ACh sensitivity of a sympathetic ganglion cell induced by postsynaptic electrical activities. E.Kumamoto, K.Kuba (Dept. of Physiology, Saga Medical School, Saga, Japan).
Nature (GB), vol.305, no.5930, p.145-6 (8 Sept. 1983).
Long-term alteration in synaptic efficacy found in several neurones of both vertebrates and invertebrates has been suggested as an important mechanism for learning and memory. In bullfrog sympathetic ganglia, acetylcholine (ACh) release from presynaptic nerve terminals is potentiated for a long time by adrenaline through a cyclic AMP system. The authors report a new form of mechanism for long-term synaptic potentiation in sympathetic ganglia, which occurs postsynaptically in a Ca^{2+}-dependent manner. Their results suggest that Ca^{2+} entry into a ganglion cell during repeated action potentials initiates a long-lasting mechanism for the enhancement of a nicotinic ACh action on the subsynaptic membrane. This, as well as the presynaptic mechanism, may contribute to neuronal plasticity in the peripheral autonomic nervous system. (23 refs.)

110007 Hyperpolarization following activation of K^+ channels by excitatory postsynaptic potentials. T.Tosaka, J.Tasaka, T.Miyazaki (Dept. of Physiology, Tokyo Medical Coll., Tokyo, Japan), B.Libet.
Nature (GB), vol.305, no.5930, p.148-50 (8 Sept. 1983).
Reports experiments on the 9th or 10th ganglion in the isolated sympathetic chain of the bullfrog (Rana catesbiana) both with intracellular electrodes (3 M KCl) and with extracellular ones (surface Ag-AgCl wires in an air-gap chamber). The evidence obtained supports the proposal that the post-excitatory postsynaptic potential (e.p.s.p.) hyperpolarization is a voltage-activated response; it is induced when the e.p.s.p. sufficiently depolarizes the membrane, and it can thus 'contaminate' the e.p.s.p. response. The dependence of post-e.p.s.p. hyperpolarization on the amplitude of the e.p.s.p. further indicates that it is a true afterhyperpolarization rather than a separate, transmitter-induced postsynaptic potential; the relationship was seen whether the amplitude of the e.p.s.p. was varied by repetition of input or by curarization. (7 refs.)

110008 Electrical synapse formation depends on interaction of mutually growing neurites. R.D.Hadley, S.B.Kater, C.S.Cohan (Dept. of Zoology, Univ. of Iowa, IA, USA).
Science (USA), vol.221, no.4609, p.466-8 (29 July 1983).
A neuron's competence to form electrical synapses depends on its growth status. Experiments in situ and in cell culture with identified neurons of the snail Helisoma demonstrate that active neurite outgrowth from both potential partners must be spatially and temporally coincident for electrical synapse formation to occur. (14 refs.)

110009 Managing evoked potential data in clinical research. J.R.Boston, B.L.Grundy, E.Doyle (Dept. of Anesthesiology/CCM, Univ. of Pittsburgh School of Medicine, Pittsburgh, PA, USA).
Proceedings of the Fifteenth Hawaii International Conference on System Sciences 1982, Honolulu, HI, USA, 6-8 Jan. 1982 (HI, USA: Hawaii Int. Conference Syst. Sci. 1982), p.254-63 vol.2
During monitoring of sensory evoked potentials, a large number of average potentials are recorded, typically one to ten per hour over a period of several hours. For clinical research, it is necessary to study the sequence of responses retrospectively, extracting a number of parameters from each response that characterize that response and statistically analyzing the changes in the parameters over time. Because of the large number of responses involved, manual analysis of the data is extremely difficult and prone to error. This paper describes a data system developed to eliminate as much manual manipulation and processing of data as possible. A key feature of the system is the definition of data file structures that provide a means of communication within the system, allowing the analysis of the evoked potentials to be implemented as a series of independent modules. (8 refs.)

110010 Linear and nonlinear frequency domain analysis of sensory transduction in an insect mechanoreceptor. A.S.French (Dept. of Physiology, Univ. of Alberta, Edmonton, Alberta, Canada).
Proceedings of the Fifteenth Hawaii International Conference on System Sciences 1982, Honolulu, HI, USA, 6-8 Jan. 1982 (HI, USA: Hawaii Int. Conference Syst. Sci. 1982), p.327-36 vol.2
Coding of information by nerve cells and the relaxed problem of sensory transduction can be investigated by linear and nonlinear systems analysis techniques. An examination of sensory transduction in an insect mechanoreceptor by the measurement of first and second order frequency response functions is described. The results are discussed in light of some current models of mechanotransduction. (34 refs.)

110011 Use of pseudorandom noise in studies of the dynamic properties of the linear part of a sensory neural system. A.R.Moller (Dept. of Otolaryngology, Univ. of Pittsburgh School of Medicine, Pittsburgh, PA, USA).
Proceedings of the Fifteenth Hawaii International Conference on System Sciences 1982, Honolulu, HI, USA, 6-8 Jan. 1982 (HI, USA: Hawaii Int. Conference Syst. Sci. 1982), p.337-51 vol.2
The accuracy in determining the bandwidth and the center frequency of a linear bandpass filter followed by a rectifier using pseudorandom noise is investigated. The noise is based on ternary m-sequences. Results obtained using different noise sequences of the same length and sequences of different length were compared. Examples of neurophysiological results on the frequency selectivity of single fibers of the auditory nerve of the rat obtained using pseudorandom noise as stimulus are shown. (13 refs.)

110012 Statistical and dimensional analysis of the neural representation of the acoustic biotope of the frog. P.Johannesma, A.Aertsen (Dept. of Medical Phys. & Biophys., Univ. of Nijmegen, Nijmegen, Netherlands).
Proceedings of the Fifteenth Hawaii International Conference on System Sciences 1982, Honolulu, HI, USA, 6-8 Jan. 1982 (HI, USA: Hawaii Int. Conference Syst. Sci. 1982), p.352-68 vol.2
The field of investigation is the neural representation of acoustic stimuli occurring in the natural environment of the frog. The point of departure is the description of a stimulus ensemble consisting of natural sounds: the acoustic biotope. A relation of statistical and dimensional structure of the acoustic biotope is indicated. The animal used in the neurophysiological experiments is the grass-frog, Rana temporaria L.; micro-electrode recordings are made in the auditory midbrain. A method is described to determine the existence of a relation between acoustic stimulus and neural events. The form of this relation has been investigated by first and second order stimulus-event correlation. While the first one does not give significant results, the second one leads to the spectro-temporal receptive field of the neuron for natural stimuli. Questions are formulated to estimate the value of this receptive field as a functional descriptor of the neuron. Finally an outline is sketched for a synthetic construction of the bio-acoustic space from neuro-acoustic sub-spaces. (42 refs.)

110013 Fibrillation recognition using autocorrelation analysis. A.E.Aubert, B.G.Denys, H.Ector, H.De Geest (Div. of Cardiology, Katholieke Univ. Leuven, Leuven, Belgium).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.477-80
Correlation analysis is a powerful technique to determine the similarity between events and to distinguish signal and noise in a composite waveform. The autocorrelation function gives information on typical periods or frequencies present in the time history records. These characteristics were used for ECG analysis in the control situation and during the onset of ventricular fibrillation. (14 refs.)

Possibility of ferroelectricity in biomembranes ....See Entry 109978

Surface potential of thylakoid membrane, photoinduced absorption of protons, and photophosphorylation in chloroplasts ....See Entry 109987

Basic principles of structural organization of ionic channels responsible for depolarization of excitable cell membranes ....See Entry 109990

Oscillations of intracellular Ca^{2+} in mammalian cardiac muscle ....See Entry 109991

Quantification of Ca^{2+}-activated K^+ channels under hormonal control in pig pancreas acinar cells ....See Entry 109994

Comparison of means and medians in the reduction of visual evoked potential data ....See Entry 110039

Dielectric properties of ocular tissues at 374°C ....See Entry 110078

DNA damage in irradiated endothelial cells of the rat cerebral cortex. Protective action of cysteamine in vivo ....See Entry 110093

Stereotactic implantation of radioactive sources for the treatment of brain tumours ....See Entry 110145

Relationship between regional pertechnetate cerebral circulation time and EEG in patients with cerebral infarction ....See Entry 110158

Visual and spectral EEG analysis in the evaluation of the outcome in patients with ischemic brain infarction ....See Entry 110215

Improved telemetric EEG monitoring in epileptic patients ......See Entry 110216

Delineation of the QRS complex using the envelope of the e.c.g. ....See Entry 110220

Ensemble averaging of locomotor electromyographic patterns using interpolation ....See Entry 110222

CARRES: system for monitoring cardio-respiratory rhythms and the acquisition of electrophysiological data from the infant, application to the study of sudden infant death syndrome ......See Entry 110223

The basic principles for acquiring an amplified signal from the His bundle by statistical filtering ......See Entry 110225

Real time signal processing of the exercise electrocardiogram ......See Entry 110226

QT interval measurements of long-term ECG recordings. Application of an automatic Holter analysis system ......See Entry 110227

Application of identification and linear filtering algorithms to the R-R interval measurements ......See Entry 110228

The importance of measuring couplet frequency in the ambulatory electrocardiogram: correlation with invasive electrophysiologic studies ..See Entry 110229

HIS-bundle electrogram interpretation system ......See Entry 110230

Detection of fluid entry into the urethra by electric impedance measurement: electric fluid bridge test ......See Entry 110233

Cardiac electrophysiological studies: computer analysis using a digitiser and interactive visual display unit ......See Entry 110234

Improvement of the detectability of simulated pathological tremour e.m.g.s. by means of demodulation and spectral analysis ......See Entry 110236

Three-dimensional perspective display for chicken brain autoradiographs ......See Entry 110253

Fiber microelectrodes for electrophysiological recordings ......See Entry 110263

The development of linear sweep voltammetry with carbon paste electrodes in vivo ......See Entry 110264

Multioscillator simulator for gastrointestinal electrical activity modelling ......See Entry 110265

A context-sensitive approach to long-term ECG arrhythmia analysis ......See Entry 110272

87.32 PHYSIOLOGICAL OPTICS, VISION

110014 Does reduction of intraocular pressure (IOP) prevent visual field loss in glaucoma?. D.M.Cockburn (Dept. of Optometry, Univ. of Melbourne, Parkville, Victoria, Australia).
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.8, p.705-11 (Aug. 1983).
The visual fields of 54 eyes (27 patients) having a medical diagnosis of open-angle glaucoma and receiving treatment were compared with the visual fields recorded at the time of diagnosis of the disease. Visual fields remained stable in 34 (62%) of the glaucomatous eyes. However, reduction of the intraocular pressure (IOP) did not prevent the progression of existing field defects in 16 of 21 eyes nor prevent field damage from occurring in 4 of 33 eyes which had normal visual fields at the commencement of treatment. The presence of a visual field defect at the time of diagnosis was clearly associated with a high risk of continued field decay during treatment. Intraocular pressure at the time of diagnosis did not identify which eyes would develop visual field loss or suffer further loss despite hypotensive treatment. Likewise, the extent to which the IOP was reduced by treatment did not appear to be related to the decay of visual field. (16 refs.)

110015 Concepts of biostereometrics applied to robotics. A.Filo (Cyberanimation Inc., Akron, OH, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.346-52 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
By examining the concepts of natural vision, a noncomputer image processor was developed. This device uses a cellular contrast pattern matching and searching technique to define elements of the image. Coupling the pattern matching and searching technique with a stereometric capability provides considerable information about the shape, size, orientation, depth and location of a subject. This type of information is very useful in machines and robots that must acquire objects in unpredictable orientations or in unknown environments. (7 refs.)

Discovery of periodicity in structure of melanoprotein granules of eye pigment epithelium cell (small-angle X-ray investigation) ......See Entry 109957

Dielectric properties of ocular tissues at 374°C ......See Entry 110078

87.32C Anatomy and optics of the eye

110016 Progression of myopia in youth: age of cessation. D.A.Goss (Coll. of Optometry, Northeastern State Univ., Tahlequah, OK, USA), R.L.Winkler.
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.8, p.651-8 (Aug. 1983).
Patient records of young myopes were collected from three optometry practices. An index of the age at which increases of myopia in young people cease was derived using four different graphical and statistical methods. The results suggest that myopia stops increasing earlier in females than in males. There is, however, a great deal of individual variability in cessation age. Some implications for clinical practice and clinical research are discussed. (13 refs.)

Orthoptic treatment of subjects showing slow accommodative responses ......See Entry 110017

Evoked potential estimates of visual accommodation in infants ......See Entry 110029

Electrophysiological determination of the refractive state of the eye of the opossum ......See Entry 110030

Contour photography of the optic nerve head: stereometric basis ......See Entry 110134

Stereo measurement of the ocular fundus in ophthalmology ...See Entry 110135

Impact resistance of variously mounted ophthalmic lenses .....See Entry 110239

87.32E Physiology of the eye; nerve structure and function

110017 Orthoptic treatment of subjects showing slow accommodative responses. W.R.Bobier, J.G.Sivak (School of Optometry, Univ. of Waterloo, Waterloo, Ontario, Canada).
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.8, p.678-87 (Aug. 1983).
Five subjects showing slow accommodative responses were given orthoptic treatment. Speed of accommodative response improved after 3 to 6 weeks. No regressions were evident 18 weeks after the cessation of training. Slow accommodative responses were found in subjects with normal phorias and fusion limits. The technique of dynamic photorefraction is introduced for the clinical measurement of accommodative time characteristics. (8 refs.)

110018 Clinical evaluation of vertical fixation disparity. I. R.P.Rutstein, J.B.Eskridge (School of Optometry, Univ. of Alabama, Medical Center, Birmingham, AL, USA).
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.8, p.688-93 (Aug. 1983).
The successful prescribing of vertical prism for the individual patient requires that (1) the deviation be measured in the presence of horizontal fusion, (2) the deviation be determined with distance and near fixation in the straight ahead and down-gaze positions, and (3) the ability to adapt to the prism be assessed. This study addresses the first requirement by evaluating the measurement of fixation disparity of asymptomatic patients using a readily available clinical procedure. The results indicate that the vertical fixation disparity varies directly and in a consistent manner with forced vertical vergence in patients with no vertical fixation disparity as well as in those with a vertical fixation disparity with zero forced vertical vergence. The implication of this information for the prescription of vertical prism is discussed. (13 refs.)

110019 Amplitude variability of the steady-state visual evoked response (VER). R.L.Yolton (Pacific Univ., Coll. of Optometry, Forest Grove, OR, USA), R.G.Allen, R.A.Goodson, D.L.Schafer, W.D.Decker.
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.8, p.694-704 (Aug. 1983).
The reliability of steady-state VERs was determined for nine normal subjects using Fourier analyses with 1.0 and 0.25 Hz bin resolutions. No correlations were found between VER amplitudes and subjects' reports of attention, accommodation, fixation, or perceived organization of the stimulus. Across subjects, there was also no sustained amplitude modulation of the VER by any frequency (including alpha), and frequency drift of the VER did not contribute significantly to its amplitude variability. Modeling, using mixed sine waves to simulate different signal/noise ratios, established that a significant portion of VER amplitude variability can be accounted for by noise which occurs at the same frequency as the VER and which is not removed by ensemble averaging. (40 refs.)

110020 Dynamics of cover test eye movements. E.Peli, G.McCormack (New England Coll. of Optometry, Boston, MA, USA).
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.8, p.712-24 (Aug. 1983).
The dynamics of unilateral cover test eye movements, never before systematically investigated with an objective recording system, are shown to be more complex than textbook accounts of them. The authors administered the cover test to nine heterophoric subjects by means of electromechanical occluders. Eye movements were recorded using the infrared photoelectric technique. Saccadic and vergence movements of the fixating eye were observed in almost all records when the occluded eye was uncovered. These movements were found in esophores and exophores and in both large and small phoria cases. Such movements were previously described in other asymmetric vergence tasks and appear to obey Hering's law of equal innervation. Uncovering the dominant eye, in cases of clear dominancy, resulted in shorter latency and larger amplitude saccades than did uncovering the nondominant eye. (18 refs.)

110021 An analogue simulation of the luminosity-channel in the vertebrate cone retina. II. Frequency analysis. R.Siminoff (Inst. fur Physiologie, Freien Univ. Berlin, Berlin, Germany).
Biol. Cybern. (Germany), vol.47, no.2, p.71-6 (1983).
For pt.I see ibid., vol.46, no.2, p.101 (1983). A frequency analysis was performed on an analogue model of the vertebrate cone retina. Bode plots of magnitude and phase angle shifts were obtained from the various stages of the model. While the cones were nonlinear, the rest of the model was linear and results could be explained by cascading of lowpass filters with linear summation of antagonistic inputs of differing time constants. The cut-off frequency of the model was determined by the first stage, which was the cone pedicle, while the slope of the db magnitude versus frequency curve increased for each 'synaptic delay' in the pathway. An initial increase in the magnitude of the output voltage at any given stage occurred up to the cut-off frequency and was due to the antagonistic input voltages of differing time courses. Physiological data are discussed in terms of the model. (8 refs.)

110022 An analogue model of the luminosity-channel in the vertebrate cone retina. III. Physiological correlates. R.Siminoff (Inst. fur Physiologie, Freien Univ. Berlin, Berlin, Germany).
Biol. Cybern. (Germany), vol.47, no.2, p.77-85 (1983).
For pt.II see ibid., vol.47, no.2, p.71-6 (1983). A model of the vertebrate cone retina was tested with physiological stimuli. Results confirm previous findings that, except for photoreceptors, the spatial and temporal properties of simulated retinal elements conform to a linear system. The model is consistent with known physiological correlates. Tonic units detect intensity when the light spot is within the center field, while phasic units detect movement across borders of contrast. There is a dynamic balance between the tonic and phasic channels: the tonic channel is favored by a center field input voltage, while the phasic channel is favored by a surround field input voltage to bipolar cells. The ON discharge of the phasic ganglion cell is developed by the excitatory center field input to the depolarizing-center bipolar cell, which has the shortest delay, while the OFF discharge is the result of the excitatory surround field input voltage to the hyperpolarizing-center bipolar cell, which has the longest delay. (35 refs.)

110023 The spatial frequency sensitivity of bipolar cells. D.Attwell (Dept. of Physiology, Univ. Coll. London, London, England), M.Wilson.
Biol. Cybern. (Germany), vol.47, no.2, p.131-40 (1983).
Retinal bipolar cells constitute the output stage of the outer layer of the retina. There are several constraints on the ability of the bipolar cell array to respond to the different spatial frequency components of the visual image, including (i) electrical coupling in the dendritic tree receiving receptor input; (iii) the 'lateral inhibition' mediated by horizontal cells. Using simple mathematical models, the authors derive analytical expressions for the spatial frequency response of the bipolar cell array for the case in which horizontal cells are presynaptic to bipolar cells (feedforward model) and also for the case in which horizontal cells are presynaptic to receptors (feedback model). The results illustrate the importance of the three factors mentioned in determining the bipolar cells' properties. The optimal spatial frequency for stimulating the bipolar cell array, and the range of spatial frequencies transmitted onward to the inner plexiform layer, are thus related to the anatomical and electrical properties of the cells in the outer plexiform layer. (25 refs.)

110024 Event-related potentials during naming and mental rotation. D.T.Stuss, F.F.Sarazin, E.E.Leech, T.W.Picton (Schools of Medicine & Psychology, Univ. of Ottawa, Ottawa General Hospital, Ottawa, Ontario, Canada).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.2, p.133-46 (Aug. 1983).
The biphasic late negative wave (Nx-Ny) evoked during the naming of pictures of objects was investigated in a series of experiments. The monitoring of several possible non-cerebral generators indicated that these components were probably cerebral in origin. The Ny wave differed in scalp distribution from

the preceding CNV. It was unaffected by stimulus duration or by stimulus repetition. The Nx-Ny complex occurred in both a naming task and a mental rotation task. The slow waves following the biphasic negative wave differed significantly between these two tasks. In the mental rotation task, there was a large prolonged negativity in both parietal regions. The Nx wave (at approximately 250 msec) of the biphasic complex may represent the initial registration of the stimulus. The Ny wave (at approximately 420 msec) does not appear to be specifically related to semantic processing. Rather it may index some process involved in initiating the further evaluation of a complex stimulus. The slow waves that follow the biphasic negative complex may reflect the actual perceptual processing of the stimulus. (54 refs.)

110025 Transient visually evoked potentials to the pattern reversal and onset of sinusoidal gratings. G.T.Plant, R.L.Zimmern, K.Durden (Dept. of Neurological Surgery & Neurology, Addenbrooke's Hospital, Cambridge, England).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.2, p.147-58 (Aug. 1983).
Transient visually evoked potentials (VEPs) recorded in response to the contrast reversal and onset of spatially sinusoidal gratings have been investigated. Previous reports of an increase in the latency of the response at higher spatial frequencies have been confirmed but only for spatial frequencies higher than 2 c/deg. At lower spatial frequencies it is suggested that two positive components interact resulting in a departure from a monotonic relationship between latency and spatial frequency. Below 1 c/deg pattern reversal and pattern onset modes of stimulation produced VEPs of similar amplitude and wave form. Above 1 c/deg the amplitude of the pattern onset response peaked at a higher spatial frequency than the response to pattern reversal, and the response was dominated by a negative (N_1) rather than a positive component (P_1). This distinction has been corroborated by investigating the effect of field size variation. The peak amplitudes shifted to a lower spatial frequency with increase in field size but at all field sizes the N_1 component of the pattern onset response peaked at a higher spatial frequency than the other components measured. (33 refs.)

110026 Interocular suppression in adults and infants using anaglyphic stimuli: visually evoked potential measures. J.V.Odom (Dept. of Ophthalmology, West Virginia Univ., Morgantown, WV, USA), M.R.Harter.
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.2, p.232-43 (Aug. 1983).
Interocular suppression, assessed by monocular VEP amplitude reduction, was investigated in 3 infants, average age of 3 months, and 8 adults. A dichoptic simultaneous masking paradigm was employed, the two eyes being disassociated by red and green filters which transmitted nonoverlapping wave lengths of light (anaglyphic method). One eye was continuously presented with either darkness, a diffuse green light, or two green dot patterns, containing either 20′ or 80′ dots. The other eye was flashed with either red diffuse light, a red 20′ dot pattern, or a red 80′ dot pattern. In both adults and infants, monocular VEP amplitude was reduced as the size of the continuously presented dots increased (pattern suppression) and a smaller amplitude response occurred when dots of equal size were presented (size-specific suppression). The relative and absolute magnitudes of interocular pattern suppression were similar for adults and infants. However, the relative and absolute magnitudes of size-specific suppression were larger for adults than for infants. Pattern interocular suppression was inferred to be relatively more mature in 3 month olds than size-specific suppression. The relative lack of size-specific suppression suggests a relative immaturity of binocular spatial frequency or size channels. (46 refs.)

110027 Specificity of cortico-cortical connections in monkey visual system. M.S.Livingstone, D.H.Hubel (Dept. of Neurobiology, Harvard Medical School, Boston, MA, USA).
Nature (GB), vol.304, no.5926, p.531-4 (11 Aug. 1983).
When the primate primary visual cortex, area 17, is stained for the mitochondrial enzyme cytochrome oxidase, it shows a striking polka-dot pattern (cytochrome oxidase blobs). Area 18, the second visual area, shows a cytochrome-oxidase pattern of coarse alternating thick and thin stripes running perpendicular to the 17-18 border and separated by lighter (interstripe) regions. The authors show that the thin cytochrome oxidase stripes, and possibly also the thick stripes, in area 18 receive projections specifically from the blobs in area 17, and that the interstripe regions of 18 receive projections from the interblob matrix of area 17. This indicates a specificity of cortico-cortical connections far exceeding the demands of topographical mapping. Together with the authors' physiological results, it suggests that within the pathway from area 17 to area 18 different kinds of information may be handled separately and in parallel. (34 refs.)

110028 Very brief visual experience eliminates plasticity in the cat visual cortex. G.D.Mower, W.G.Christen, C.J.Caplan (Dept. of Neurology, Children's Hospital Medical Center, Boston, MA, USA).
Science (USA), vol.221, no.4606, p.178-80 (8 July 1983).
Rearing cats in the dark extends the critical period for development of visual cortical neurons, which indicates that the experience of visual input is necessary to begin the development process. A single brief pulse of visual input (6 hours) during a period of dark-rearing eliminates delayed development in the visual cortex. Light therefore seems to rapidly trigger the developmental process, and once triggered, that process runs to completion in the absence of further input. (10 refs.)

110029 Evoked potential estimates of visual accommodation in infants. S.Sokol, A.Moskowitz, A.Paul (Dept. of Ophthalmology, Tufts Univ. School of Medicine, Boston, MA, USA).
Vision Res. (GB), vol.23, no.9, p.851-60 (1983).
Pattern reversal visually evoked potentials (VEPs) were recorded from infants between 2 and 5 months of age in order to measure their accommodative performance over a 9 diopter range (10-150 cm). Accommodation was stimulated by placing minus spherical lenses of increasing power in front of the infant's eyes and by changing the infant's distance from the stimulus. VEP latency measurements indicated that the infant's ability to maintain a zone of clear vision changes with age and pattern element size. For large checks (60 min arc), most 2- to 4-month old infants were able to maintain clear vision over the range of 9 diopters. When small checks (15 min arc) were used, the majority of 4- to 5-month old infants were unable by VEP measures to accommodate beyond 5-6 diopters. This decline in the infant's zone of clear vision with decreasing check size is due primarily to the relatively large depth of focus and poor visual resolution of the infant eye. In a small group of infants, accommodation was assessed both electrophysiologically by VEP recording and behaviorally using a preferential looking technique. Results indicated better accommodation by VEP estimates than by behavioral measures. (27 refs.)

110030 Electrophysiological determination of the refractive state of the eye of the opossum. C.W.Picanco-Diniz, L.C.L.Silveira (Dept. of Physiology, Federal Univ. of Para, Rio de Janeiro, Brazil), E.Oswaldo-Cruz.
Vision Res. (GB), vol.23, no.9, p.867-72 (1983).
The refractive state of the eye of the South American opossum Didelphis marsupialis aurita was investigated with electrophysiological techniques. Using adult specimens, trapped from the wild, averaged cortical evoked responses were recorded from the region of projection of the central visual field. Stimuli consisted of a phase reversal of a square wave grating generated on a CRO screen, with luminance of $2.4\ \mathrm{cd/m^2}$ and contrast 0.84. The refractive state of the eye was altered by means of trial lenses and the amplitude of the cortical responses thus obtained compared to those obtained with no lens (control values). Refraction 'tuning curves' were determined for each animal. The average refractive state was found to be -2.27 D indicating that this species when raised in its habitat shows, at low ambient luminosity, some degree of myopia. Determination of the contrast sensitivity function indicate that induced ametropias lead to a reduction of the cut-off value of the spatial frequency and a loss of contrast sensitivity. (36 refs.)

110031 Spatial frequency tuning of orientation selective units estimated by oblique masking. H.R.Wilson, D.K.McFarlane, G.C.Phillips (Dept. of Biophys. & Theoretical Biology, Univ. of Chicago, Chicago, IL, USA).
Vision Res. (GB), vol.23, no.9, p.873-82 (1983).
Threshold elevations were measured as a function of the spatial frequency of high contrast cosine masks using spatially localized test stimuli with a 1.0 octave bandwidth. The cosine masks were oriented at 14.5° relative to the vertical test patterns in order to average out spatial phase effects. The experiment was repeated for each of 14 test frequencies spanning the range 0.25-22.0 c/deg in 0.5 octave steps. The resulting threshold elevation curves fell into a small number of distinct groups, suggesting the existence of discrete spatial frequency mechanisms in human central vision. The data are shown to be consistent with a model having just six distinct classes of spatial frequency mechanisms in the fovea. Spatial frequency bandwidths of these mechanisms ranged from 2.5 octaves at low frequencies to as narrow as 1.25 octaves at high spatial frequencies. These results require revision of the Wilson and Bergen model for spatial vision (see ibid., vol.19, p.19-32, 1979). (38 refs.)

110032 Neural interactions of two slits in the orientation domain in the visual cortical units of the cat. S.Kaji, S.Yamane, N.Kawabata (Electrotech. Lab., Ibaraki-ken, Japan).
Vision Res. (GB), vol.23, no.9, p.883-6 (1983).
The responses of the cat's visual cortical cells to an optimally oriented (O-) and to an inclined (θ-) slit have been studied. Cellular responses to the simultaneous presentation, in simple cells, are similar to those to the θ-slit alone, but in complex cells, are remarkably decreased at an orientation difference of about 45°. In the sequential presentation, the effects of preceding the θ-slit on the responses to the following O-slit decrease as the orientation difference increases. This suggests that neural interactions of simultaneous and sequential presentation of two slits are caused by different mechanisms. (8 refs.)

110033 Two late response components in on-off ganglion cells of the frog retina: the delayed response—generated by red rods; the second off-response—generated by green rods. M.L.Zeise, K.Hamdorf (Lehrstuhl fur Tierphysiologie, Ruhr-Univ., Bochum, Germany).
Vision Res. (GB), vol.23, no.9, p.887-93 (1983).
Frog on-off retinal ganglion cells react to diffuse, large-sized stimuli not only with an 'early response' and a 'delayed response' but also with a 'second off-response'. The intensity at which the delayed response becomes visible coincides with the quantum amount necessary for saturating the red rod response. The spectral sensitivity of the delayed response fits the nomogram for the 502 nm pigment. Unlike the delayed response, the second off-response appears earlier with increasing stimulus intensity and follows the 433 nm nomogram. Therefore, it is most probably generated by the green rods. (20 refs.)

110034 Mode of origin of large extracellular photovoltages from the retinal rods of the frog. W.Ehrhardt, C.Baumann (Physiologisches Inst., Justus Liebig-Univ., Giessen, Germany).
Vision Res. (GB), vol.23, no.9, p.895-902 (1983).
Arrays of extracellular microelectrodes were advanced into the receptor layer of isolated frog retinae to measure interstitial voltage and resistance. In addition, current was locally injected through one of the micro-electrodes and spatial profiles of local resistance were recorded. A large increase of local resistance in the proximal half of the receptor layer was frequently associated with the occurrence of large extracellular voltages arising from rods. The large responses presumably occur at sites where the micropipette tip makes tight contact with membrane processes of the rod inner segment and a quasi-intracellular mode of recording results. (18 refs.)

Processing of polarized light by squid photoreceptors ....See Entry 110036

Inhibitory influence of unstimulated rods in the human retina: evidence provided by examining cone flicker ....See Entry 110037

Microcomputer system for electro-oculography ....See Entry 110231

Accurate measurement of flash-evoked alpha attenuation ....See Entry 110254

An eye movement recording method operating with a closed eye ....See Entry 110266

87.32L Light detection; adaptation and discrimination

110035 Dark adaptation and the acuity/luminance response in senile macular degeneration (SMD). B.Brown (Smith-Kettlewell Inst. of Visual Sci., San Francisco, CA, USA), J.L.Kitchin.
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.8, p.645-50 (Aug. 1983).
Patients with SMD often complain of problems with adaptation and have best acuity under a restricted range of lighting conditions. The authors investigated dark adaptation and acuity over a wide range of luminances in eight SMD patients and six age-matched controls. Some patients showed evidence of altered dark adaptation, with a much longer time required to reach asymptotic sensitivity levels than shown by normals; others had difficulty with spatial resolution at different light levels. There was good correlation between symptoms and test findings; all but one patient who reported difficulties with adaptation demonstrated either retarded adaptation, aberrant acuity/luminance response, or both. These data provide evidence that the processes which adjust the sensitivity of the retina and the spatial summation properties of the retina are disrupted in SMD. (12 refs.)

110036 Processing of polarized light by squid photoreceptors. W.M.Saidel (Dept. of Anatomy, Georgetown Univ., Washington, DC, USA), J.Y.Lettvin, E.F.MacNichol,Jr..
Nature (GB), vol.304, no.5926, p.534-6 (11 Aug. 1983).
Behavioural tests have demonstrated that cephalopods can discriminate light polarized in different planes, and the receptors have been localized by electro-

physiological studies of the eye. Discrimination of the plane of polarization is a consequence of both the structure of the microvilli in the outer segments of the photoreceptors and the orientation of the photosensitive chromophore on these membranes. However, between the depolarizing receptor response resulting from photoreception and the behaviour of the animal, nothing is known about neuronal processing of polarized light by cephalopods. The authors show that some squid photoreceptors discriminate the plane of polarization within the spike train, and that any particular plane is seen as a variable intensity. Given the well known orthogonal orientation of microvilli in outer segments of adjacent photoreceptors and the physiological preference for one of two mutually perpendicular planes of polarization by single photoreceptors, the authors conclude that cephalopod vision is based on two complementary views of the world, each determined by the transformation of polarization-sensitive receptors into complementary intensity scales. A visual system based on this transformation would lead to enhanced contrast underwater and visualization of object details obscured by confounding highlights. (31 refs.)

110037 Inhibitory influence of unstimulated rods in the human retina: evidence provided by examining cone flicker. S.H.Goldberg, T.E.Frumkes, R.W.Nygaard (Dept. of Psychology, Queens Coll., City Univ. of New York, Flushing, NY, USA).
Science (USA), vol.221, no.4606, p.s180-2 (8 July 1983).
In the parafoveal retina of human observers, cone-mediated sensitivity to flicker decreases as rods become progressively more dark-adapted. This effect is greatest when a rod response to flicker is precluded. These results indicate that rods tonically inhibit cone pathways in the dark. (24 refs.)

110038 Flicker fusion characteristics of rod photoreceptors in the toad. L.M.Nowak, D.G.Green (Neuroscience Lab., Univ. of Michigan, Ann Arbor, MI, USA).
Vision Res. (GB), vol.23, no.9, p.845-9 (1983).
Critical fusion frequency (CFF) of toad rods was examined at various intensities using intracellular recordings. Data were compared to CFF measurements (as a function of intensity) obtained with the electroretinogram (ERG) and with a horizontal cell. In all instances the rod (and rod mediated) responses produced a curve which increased monotonically to a high frequency asymptote at about 6 Hz. The curves obtained with the ERG and the horizontal cell were double branched. The upper branch exhibited a Purkinje shift and thus must have been produced by cones. Even when using a red background to suppress cone sensitivity, there was no sign of a second rod mediated branch in the CFF curves from this retina. (15 refs.)

110039 Comparison of means and medians in the reduction of visual evoked potential data. J.A.Comis,Jr. (Dept. of Electrical Engng. & Computer Sci., Univ. of California, Berkeley, CA, USA), E.Marg, D.R.Brillinger, D.P.Rudiak, E.L.Keller.
Proceedings of the Fifteenth Hawaii International Conference on System Sciences 1982, Honolulu, HI, USA, 6-8 Jan. 1982 (HI, USA: Hawaii Int. Conference Syst. Sci. 1982), p.242-53 vol.2
Means and medians of visual evoked potentials were compared to determine if the medians would provide less noisy results than the means or require fewer samples for the same noise. The means and medians of a 100 onset-offset checkerboard VEPs were computed and plotted for (1) the full sample, (2) the first and second 50, and (3) the first 25. In addition, running means were examined. Comparable means showed less scatter than the medians. A N_{340} wave was seen in the mean of the second 50 VEPs not observable in the first 50. A running mean of 3 gives a curve as useful as the mean of 100 with only 50 VEPs within the first 250 msec. Samples of 25 VEPs are not adequate to provide a useful waveform but may be used to determine economically the peak amplitude with a potential error of less than 4%. This can be useful in the objective measurement of visual acuity. (10 refs.)

Photoselection of conformational substrates and the hyposochromic photoproduct of rhodopsin ....See Entry 109780

Mode of origin of large extracellular photovoltages from the retinal rods of the frog ....See Entry 110034

A new photographic method for mapping spatio-temporal receptive field using television snow stimulation ....See Entry 110262

87.32N Colour detection; adaptation and discrimination

110040 Macular pigment difference spectrum from sensitivity measures of a single cone mechanism. P.L.Pease (Coll. of Optometry, Univ. of Houston, Houston, TX, USA), A.J.Adams.
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.8, p.667-72 (Aug. 1983).
The authors have obtained the difference spectrum for the macular pigment by comparing the spectral sensitivity of the 'green-sensitive' or G cone mechanism in the foveal and parafoveal region. The method overcomes objections to previous attempts to obtain a difference spectrum from the spectral sensitivities by isolating a single receptor mechanism; it also provides a relatively easy approach for obtaining a reliable measure of the optical density of the macular pigment for individual subjects. The results using this method suggest a higher optical density for the macular pigment than that obtained from data where more than one cone type influenced the difference spectrum. (20 refs.)

110041 Quantum optimality of day vision and photocolorimetry. M.P.Filippov, A.A.Ovchinnikov (L.Ya. Karpov Sci.-Res. Physicochem. Inst., Moscow, USSR).
Dokl. Biophys. (USA), vol.265-267 (July-Dec. 1982)., p.146-9
The quantum optimality of day vision, a feature that the authors have discovered, has the nature of an extreme biological principle and can be used to replace the classical energy-based concepts of contemporary photocolorimetry by new quantum concepts in this field. The authors discuss the evidence supporting their ideas. (7 refs.)

110042 Leaf color used by cabbage root files to distinguish among host plants. R.J.Prokopy, R.H.Collier, S.Finch (Nat. Vegetable Res. Station, Wellesbourne, England).
Science (USA), vol.221, no.4606, p.190-2 (8 July 1983).
In experiments in which spectrophotometric reflectance patterns of real leaves were mimicked with mixtures of artists' pigments, leaf color was shown to be a character used by cabbage root flies, before landing on leaves, to discriminate among the host plant cultivars radish, green cabbage, and red cabbage. It may be possible to take advantage of factors that affect leaf color, such as epicuticular bloom, pubescence, and masking of chlorophyll by other pigments, to decrease the attraction of certain pest insects to plants. (22 refs.)

110043 Dark adaptation of the long-wavelength sensitive cones. A.M.Brown (Vision Res. Lab., Univ. of Michigan, Ann Arbor, MI, USA).
Vision Res. (GB), vol.23, no.9, p.837-43 (1983).
Long-wavelength sensitive (L) cone dark adaptation curves were measured with a 10-msec, 20′ v.a., 650 nm test flash and a moderate intensity adapting field. When the 650 nm and 500 nm fields were equated for the L cones, the dark adaptation curve fell faster for the 500 nm field than for the 650 nm field. Over the range of adapting lights used, no adjustment of the intensities of the two fields made their dark adaptation curves similar. When 500 nm light was added to the 650 nm field, dark adaptation was faster. Visual sensitivity is not regulated by any single photoreceptor type in this experiment. (16 refs.)

Interocular suppression in adults and infants using anaglyphic stimuli: visually evoked potential measures ....See Entry 110026

Two late response components in on-off ganglion cells of the frog retina: the delayed response—generated by red rods; the second off-response—generated by green rods ....See Entry 110033

Sleep and the McCollough Effect ....See Entry 110049

87.32S Psychophysics of vision, visual perception, binocular vision

110044 Perceptual organization in moving patterns. V.S.Ramachandran (Dept. of Psychology, Univ. of California, San Diego, La Jolla, CA, USA), S.M.Anstis.
Nature (GB), vol.304, no.5926, p.529-31 (11 Aug. 1983).
Is human motion perception based on a local piecemeal analysis of the image or do global effects play an important role? The authors used metastable apparent motion displays to try to answer this question. Two spots were flashed simultaneously on diagonally opposite corners of a square and then switched off and replaced by two spots appearing on the remaining corners. One could either see vertical or horizontal oscillation of the spots and the display was bistable just as a Necker cube is. The authors found that if several such bistable figures were randomly scattered on the screen, and presented simultaneously, then one always saw the same motion-axis in all of them, suggesting the presence of global field-like effects for resolving ambiguity in apparent motion. Surprisingly, the appearance of these displays could not be influenced by voluntary effort unless the speed of alternation was very slow. (Less than 3 frames per second.) It may be that if the events in the module that computes apparent motion are too rapid then it cannot be coupled with the 'will' mechanism, which may have a long time constant. (11 refs.)

110045 Added noise restores recognizability of coarse quantized images. M.C.Morrone, D.C.Burr, J.Ross (Dept. of Psychology, Univ. of Western Australia, Nedlands, Australia).
Nature (GB), vol.305, no.5931, p.226-8 (15 Sept. 1983).
When a portrait is coarsely quantized into blocks, the block structure hides the face, although lower spatial frequencies of the original image sufficient by themselves for recognition are preserved. Recognition can be recovered by blurring the image, or otherwise attenuating the spurious higher spatial frequency components. Harmon and Julesz (1973) claim that high spatial frequencies introduced by quantized blocking mask the lower spatial frequencies which convey information about the face, preventing recognition. Here the authors show that recognition can be enhanced, without decreasing the amplitude of these spurious higher frequencies, by adding further high-frequency noise to the quantized image. This result is clearly at odds with a theory of high-frequency (or critical band) masking. The authors suggest that the added noise mutes mechanisms which would otherwise impose a block structure on the image, allowing the alternative perceptual organization of the hidden face to reemerge. (11 refs.)

110046 Accurate visual measurement of three-dimensional moving patterns. J.S.Lappin, M.A.Fuqua (Dept. of Psychology, Vanderbilt Univ., Nashville, TN, USA).
Science (USA), vol.221, no.4609, p.480-2 (29 July 1983).
Human observers discriminated relative three-dimensional distances in simple patterns of motion parallax with an acuity similar to vernier acuity under comparable conditions. Accurate visual measures of three-dimensional distance can be derived from the structural invariance of patterns undergoing perspective transformations. (8 refs.)

110047 Contrast sensitivity for vertically and obliquely oriented gratings as a function of grating area. J.S.Tootle, M.A.Berkley (Dept. of Psychology, Florida State Univ., Tallahassee, FL, USA).
Vision Res. (GB), vol.23, no.9, p.907-10 (1983).
Contrast sensitivity for both vertically and obliquely oriented gratings increased with increases in stimulus area to an asymptotic value. Sensitivity grew more slowly for oblique gratings and reached an asymptotic value at a larger area than for vertical gratings. For equal areas, oblique gratings always yielded poorer sensitivity. The results suggest a larger spatial summation area for obliquely oriented gratings. (12 refs.)

110048 Inhibition and facilitation of apparent motion by real motion. M.Green (Neurologische Klinik mit Abteilung Fur Neurophysiologie, Albert Ludwig Univ., Freiburg, Germany).
Vision Res. (GB), vol.23, no.9, p.861-5 (1983).
Observers viewed a CRT display which contained both real and apparent motion. When the apparent motion was in the same direction as the real motion, the strength of the apparent motion was enhanced. Real motion in the opposite direction completely cancelled apparent motion. However, the appearance of the real motion was not affected by apparent motion. (18 refs.)

110049 Sleep and the McCollough Effect. N.J.Lund, D.M.MacKay (Dept. of Communication & Neurosci., Univ. of Keele, Keele, England).
Vision Res. (GB), vol.23, no.9, p.903-6 (1983).
Orientation-contingent chromatic ('McCollough') aftereffects (OCCAs) were induced under carefully standardised conditions, in subjects suffering from varying degrees of sleep deprivation. The initial OCCA strength was found to vary systematically with the prior sleep pattern of the subject. In subjects whose sleep normally lasted 7-8 hr, loss of 3 or 4 hr of the previous night's sleep could reduce initial strength by a much as 50%; no further reduction was observed with still shorter sleep durations. Keeping the eye in darkness while awake had in this respect no comparable effects to those of sleep, and sleeping in a lighted room made no difference. The results suggested that the McCollough Effect depends on a form of neural plasticity which requires a normal sleep cycle for its maintenance. (12 refs.)

110050 The retinal binocular field of he pigeon (Columba livia: English Racing Homer). G.R.Martin, S.R.Young (Dept. of Zoology & Comparative Physiology, Univ. of Birmingham, Birmingham, England).
Vision Res. (GB), vol.23, no.9, p.911-15 (1983).
An ophthalmoscopic reflex technique has shown that in sedated pigeons maximum retinal binocular field width occurs approximately 20° above the bill. The binocular field has a maximum width of 27° and extends vertically by 130° (90° above the bill, 40° below it). Both the bill and cere intrude into the binocular field. Maximum optical binocularity also occurs approximately

20° above the bill. The plane containing the optic axes of each eye coincides with the bill. (14 refs.)

110051 The meaning of non-monotonic psychometric functions in the assessment of infant preferential looking acuity. A reply to Banks et al. (1982) and Teller et al. (1982). J.M.Wolfe, J.Gwiazda, R.Held (MIT, Cambridge, MA, USA).
Vision Res. (GB), vol.23, no.9, p.917-20 (1983).
The authors' version of preferential looking (PL) reliably produces steep, non-monotonic psychometric functions in infants up to 1 year of age. The methods of Banks et al. (see ibid., vol.22, p.1025-32, 1982) and Teller at al. (see ibid., vol.22, p.1017-24, 1982) reliably produce shallower but monotonic functions in infants up to six months of age. All methods so far used document the increase in PL acuity with age and all can be used to give an estimate of the PL acuity of an infant. The choice of psychophysical methodology is constrained by knowledge or lack of knowlege about the shape of the underlying psychometric function. If one knows the function is monotonic, standard staircase methods work well. If one knows there is a dip, the method proposed in Gwiazda et al. (1980) is appropriate. If one knows nothing, the method of constant stimuli is probably the safest course. Finally, the existence of reliable negative preferences in the authors' data demonstrates that PL, though exceedingly useful, must be used with care. One is inferring the properties of infant vision by observing infant behavior. One should not fall into the trap of presuming to know the nature of infant preferences for a set of stimuli before one has examined those preferences. (11 refs.)

Event-related potentials during naming and mental rotation .. See Entry 110024

On the landing response of the blowfly, Calliphora erythrocephala ....See Entry 110065

87.34 AUDITION

110052 Use of pseudorandom noise in studies of frequency selectivity: the periphery of the auditory system. A.R.Moller (Dept. of Otolaryngology, Univ. of Pittsburgh School of Medicine, Pittsburgh, PA, USA).
Biol. Cybern. (Germany), vol.47, no.2, p.95-102 (1983).
Frequency selectivity of single auditory nerve fibers in the rat are studied using pseudorandom noise based on ternary *m*-sequences as the stimulus, and the results are compared to those of earlier studies in which noise based on binary *m*-sequences was used. Pseudorandom noise based on ternary *m*-sequences has fewer anomalies than noise based on binary *m*-sequences. Detailed tests using linear and nonlinear filters show that the present method provides accurate measures of bandwidth and center frequency. Period histograms of the response, locked to the periodicity of the noise, are cross-correlated with one period of the noise to obtain estimates of the impulse response function of the peripheral auditory system. Fourier transforms of these cross-correlograms used as estimates of the filter function of single auditory nerve fibers. The results obtained using ternary noise are not different from previous results showing a downward shift in center frequency and increase in bandwidth with increasing stimulus intensity for fibers with center frequencies between 1000 and 5000 Hz. The difference between spectral selectivity based on discharge rate is discussed. (39 refs.)

110053 Stimulus dependent neural correlations in the auditory midbrain of the grassfrog (Rana temporaria L). J.J.Eggermont, W.J.M.Epping, A.M.H.J.Aertsen (Dept. of Medical Phys. & Biophys., Univ. of Nijmegen, Nijmegen, Netherlands).
Biol. Cybern. (Germany), vol.47, no.2, p.103-17 (1983).
Few-unit recordings were obtained using metal microelectrodes. Separation into single-unit spike trains was based on differences in spike amplitude and spike waveform. For that purpose a hardware microprocessor based spike waveform analyser was designed and built. Spikes are filtered by four matched filters and filter outputs at the moments of spike occurrence are read by a computer and used for off-line separation and spike waveform reconstruction. Thirty-one double unit recordings were obtained and correlation between the separated spike trains was determined. After stimulus correction correlation remained in only 8 of the double unit records. It appeared that in most cases this neural correlation was stimulus dependent. Continuous noise stimulation resulted in the strongest neural correlation remaining after correction for stimulus coupling, stimulation with 48 ms duration tonepips presented once per second generally did not result in a significant neural correlation after the correction procedure for stimulus lock. The usefulness of the additive model for neural correlation and the correction procedure based thereupon is discussed. (41 refs.)

110054 Maturation of the auditory brain stem response in rhesus monkeys (Macaca mulatta). W.J.Doyle, M.M.Saad, T.J.Fria (Dept. of Otolaryngology, Univ. of Pittsburgh School of Medicine, Pittsburgh, PA, USA).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.2, p.210-23 (Aug. 1983).
To document the maturational changes in the auditory brain stem response (ABR) of the rhesus monkey, longitudinal and cross-sectional data were collected on a panel of 31 animals during the first year of life. Each ABR test consisted of averaging 2048 responses to click stimuli delivered at a rate of 21 clicks/sec and elicited at 60, 40, 20 and 10 dB HL intensities in accordance with procedures described previously. The morphology of the ABR wave form recorded at birth was similar to that at 12 months of age and the latencies of the component waves decreased exponentially over this period. The magnitude of decrease in latency was greatest for wave IV and least for wave I. The changes were similar in pattern to those reported for human data and suggest that the rhesus monkey may serve as an appropriate model of auditory development in man. (14 refs.)

110055 Comparison of the latencies between bone and air conduction in the auditory brain stem evoked potential. E.H.J.F.Boezeman (Dept. of Clinical Neurophysiology, Valeriuskliniek & Academic Hospital, Free Univ., Amsterdam, Netherlands), T.S.Kapteyn, S.L.Visser, A.M.Snel.
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.2, p.244-7 (Aug. 1983).
Brain stem auditory evoked potentials obtained by air and bone conduction were investigated in 22 subjects. The necessity for a carefully selected stimulus being presented to the headphone and the bone vibrator is discussed. Latency values of both responses are presented for wave V. Bone conduction showed latencies which were longer than those obtained by air conduction (about 0.9 msec). Possible mechanisms for this delay are discussed. (9 refs.)

110056 The spectral factor in noise-induced hearing loss: a case for retaining the A-weighting. D.W.Robinson (Inst. of Sound & Vibration Res., Univ. of Southampton, Southampton, England).
J. Sound & Vib. (GB), vol.90, no.1, p.103-27 (8 Sept. 1983).
For the measurement of industrial noise in hearing conservation, majority usage including international standard practice favours the A-weighting. Any change would have important practical consequences and wide administrative repercussions, but direct validation of this frequency weighting through comparisons of persistent threshold shift (PTS) is lacking. Data from the study of hearing and noise in industry by Burns and Robinson (1970) are re-examined, paying particular attention to the age and noise exposure equivalence of groups of subjects classified by spectrum slope and shape. The results for 101 subjects exposed to 47 different noises fail to reveal significant advantage of the A-weighting over other standardized frequency weightings, a conclusion which may be read as a justification for continued use of the former. The real lesson to be learnt from this analysis is that the possibility of clear-cut determination of an optimum frequency weighting is remote. It would be attainable only through a more extensive bank of data of high reliabiity covering a wider spectral range, and this does not appear to exist at present. (18 refs.)

110057 Relation between cross-correlation coefficient of two-channel acoustic signals and sound image quality.. K.Kurozumi, K.Ohgushi (NHK Broadcasting Sci. Res. Labs., Tokyo, Japan).
J. Acoust. Soc. Jpn. (Japan), vol.39, no.4, p.253-60 (April 1983). In Japanese.
In order to investigate sound image quality, white or band-limited noises with various degrees of the cross-correlation coefficient are reproduced from two loudspeakers placed in anechoic or echoic chambers. Subjects are asked to make similarity judgments and some subjective evaluations of pairs of the noises. The experimental data are analyzed by Kruskal's multidimensional scaling (MDS) program (1964). The analysis of the experimental data shows the following: (1) sound image quality depends mostly on the width and distance of sound image; (2) the width of sound image depends on the absolute value of the cross-correlation coefficient; (3) the distance of sound image depends on the value itself of the cross-correlation coefficent; and (4) with respect to physical and physical and psychological factors governing sound image quality, there is no fundamental difference between anechoic and echoic chambers. (20 refs.)

110058 Frequency tuning in a frog vestibular organ. J.F.Ashmore (School of Biological Sci., Univ. of Sussex, Brighton, England).
Nature (GB), vol.304, no.5926, p.536-8 (11 Aug. 1983).
Reports that in the frog saccule, a vestibular organ apparently constructed for the detection of vibratory accelerations, frequency tuning may arise from an electrical resonance intrinsic to the hair cells. The mechanism is similar to that found in turtle and ensures that a stimulus with frequency corresponding to the membrane resonant frequency will produce the largest signal in the cell. This type of tuning may thus be quite widespread. Oscillatory mechanisms have been reported in sensory cells of other modalities in several lower vertebrates, and may even contribute to their sensitivity, although such mechanisms do imply that the signal-to-noise ratio is degraded near threshold. (21 refs.)

110059 Voltage- and ion-dependent conductances in solitary vertebrate hair cells. R.S.Lewis, A.J.Hudspeth (Div. of Biology, California Inst. of Technol., Pasadena, CA, USA).
Nature (GB), vol.304, no.5926, p.538-41 (11 Aug. 1983).
An important function of the peripheral auditory system is the resolution of complex sounds into their constituent frequency components. In at least one auditory organ, the turtle cochlea, frequency tuning is greatly enhanced by the electrical properties of the hair-cell membrane; each cell in this organ behaves as an electrical resonator tuned to a narrow band of frequencies. Using the 'Gigaseal', whole-cell recording technique, the authors have investigated the biophysical basis of similar resonant behaviour in enzymatically isolated hair cells from the bullfrog sacculus. They report the identification of three voltage- and ion-dependent conductances which may contribute to the electrical tuning mechanism: a non-inactivating calcium conductance, an A-type K^+ conductance, and a Ca^{2+}-activated K^+ conductance. (24 refs.)

A halt to sound pollution! .... See Entry 106928

Hearing aids ....See Entry 110240

87.36 SPEECH

(see also 43.70 Speech communication)

110060 On semantic information in a speech recognition system for Japanese sentences. Y.Sekiguchi, M.Shigenaga (Faculty of Engng., Yamanashi Univ., Kofu, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part D (Japan), vol.J66D, no.6, p.629-36 (June 1983). In Japanese.
Semantic information in a speech recognition system for continuously spoken Japanese sentences is described. A case structure is used to represent meaning of each verb, and words with similar semantic features are bundled into each specified group in every part of speech. The effectiveness of use of semantic information for prediction of candidate words has been confirmed. The system constructs a semantic network of episode combining recognized sentences successively. The system can successfully recognize 34 and 30 sentences out of 44 sentences, which describe four Japanese fairy tales, for each case with vocabularies of 204 and 503 words respectively. (14 refs.)

A connected spoken word or syllable recognition algorithm by pattern matching ....See Entry 106936

Experiments in automatic classification of laryngeal pathology ....See Entry 110109

Examination of vocal fold movement by ultra-short pulse X-radiography ....See Entry 110146

87.38 MECHANO- AND CHEMIO-CEPTIONS

(inc. biosonic generation, detection and guidance)

110061 Scalp recorded somatosensory evoked potentials to posterior tibial nerve stimulation in humans. C.L.Vera, P.L.Perot,Jr., E.L.Fountain (Dept. of Neurological Surgery, Medical Univ. of South Carolina, Charleston, SC, USA).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.2, p.159-68 (Aug. 1983).
The somatosensory evoked potentials (SEPs) produced by stimulation of the right and left posterior tibial nerves individually and also by their simultaneous stimulation were recorded in 84 adult normal subjects up to 150 msec after the stimulus by electrodes placed on the cranial vertex and by rows of electrodes over the sagittal and coronal lines using references on the ear or in the nasopharynx. The statistical distribution of the latencies of their different peaks was established. The effect of simultaneous stimulation of right and left posterior tibial nerves on the early SEP components was described. Some details of the anatomy of the rolandic sulcus were inferred from the amplitude distribution of these potentials. (42 refs.)

110062 Median nerve evoked potential changes in an acute carpal tunnel syndrome model in Macaca mulatta. R.J.Schneider, A.L.Dellon (Lab. of Neurosci., Maryland Inst. for Emergency Medical Services Systems, Baltimore, MD, USA).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.2, p.224-31 (Aug. 1983).
The authors devised an acute, carpal tunnel syndrome (CTS) model in rhesus monkey, Macaca mulatta. This model was used to observe the relationship between increases in compartmental pressure and nerve function as reflected in the electrophysiologically generated, averaged evoke potential recorded from the skin superficial to the median nerve at the elbow. Two waves, an Aβ and Aδ were monitored. Increased carpal tunnel pressure produced a decrease in the Aβ wave amplitude which was occasionally preceded by a slight elevation, but which eventually resulted in Aβ wave abolition with pressures ≥ 31 mm Hg. The Aδ wave showed an initial increase in amplitude followed by a decline and abolition. Recovery rate from increased pressure for the Aβ wave was directly proportional to the rate of abolition of that wave. The implications of these data are discussed in the context of CTS neuropathology and diagnosis. (43 refs.)

The influence of near weightlessness conditions on the development of the vertebrate gravity sensing system—Statex experiment Spacelab Mission D1 ....See Entry 110200

The use of fluorescent tracers in the peripheral sensory nervous system ....See Entry 110261

87.40 BIOMAGNETISM

(inc. magnetocardiography)

110063 High-resolution recordings of the magnetic activity of the His-bundle in man. S.N.Erne, R.R.Fenici, H.D.Hahlbohm, H.P.Lehmann, Z.Trontelj (Physikalisch-Tech. Bundesanstalt, Inst.-Berlin, Berlin, Germany).
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.1110-18 (July-Aug. 1983).
The activity of the His-Purkinje system (HPS) in man has been measured magnetically with a SQUID magnetometer in the Berlin magnetically shielded room (BMSR) by using in addition band pass filtering (band width 0.5 Hz to 300 Hz) and averaging. The MBSR reduces the background noise level to less than $4\ \mathrm{fT}/\sqrt{\mathrm{Hz}}$ in the region of white noise. Within the *PR* interval a ramp pattern was observed, changing its slope when crossing the median line of the heart. In addition, definite signals were recorded approximately 40 ms before the onset of ventricular activation. (13 refs.)

110064 Biomagnetic geomagnetism. J.L.Kirschvink (Div. of Geological & Planetary Sci., California Inst. of Technol., Pasadena, CA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.672-5 (April 1983).
Discusses magnetite biomineralisation, rock magnetism, palaeomagnetism, geomagnetism and animal behaviour. (65 refs.)

NMR of water in biological systems. I. Theoretical considerations ....See Entry 109968

NMR of water in biological systems. II. Comparison with the experiments ....See Entry 109969

A NMR tomograph electromagnet design ....See Entry 110137

87.45 BIOMECHANICS, BIORHEOLOGY, BIOLOGICAL FLUID DYNAMICS

110065 On the landing response of the blowfly, Calliphora erythrocephala. H.Eckert (Philipps-Univ. Marburg, Marburg, Germany).
Biol. Cybern. (Germany), vol.47, no.2, p.119-30 (1983).
The dependence of the landing response on the direction of moving stimuli (periodic gratings, single or double stripes) was studied in blowflies, Calliphora erythrocephala, of both sexes. Directions of motion eliciting maximally strong responses (preference direction) vary with the eye region stimulated: they are distributed radially from a common origin forming a flow-field. This origin lies at the intersection of the eye equators with the median plane of the animal. By changing its body posture relative to the direction of flight, the fly may align the pole of this flow field with its direction of flight thus maximizing signal flow for the landing approach. Sex-specific differences were found for dorsal eye regions in which the shift of preference directions from vertical to obliquely inclined directions of motion (against the median plane) could only be determined for male flies. (41 refs.)

110066 Bladder stretch during increase in abdominal pressure. S.Plevnik (Inst. 'J. Stefan', Univ. 'E. Kardelj', Ljubljana, Yugoslavia).
Clin. Phys. & Physiol. Meas. (GB), vol.4, no.3, p.315-20 (Aug. 1983).
The circumference of single bladder projections (CBP) was estimated from oblique and lateral cystographs obtained in the supine and erect positions during both rest and straining, with and without electrical stimulation of the pelvic floor. The results obtained indicate an increase of CBP and a flattening of the bladder during an increase of abdominal pressure, and a decrease of CBP during electrical stimulation. Increase of CBP means an increase in the stretching of the bladder wall, which may produce an increase in the forces in the bladder wall and hence act to open the bladder neck. The decrease of the CBP during electrical stimulation of the pelvic floor indicates that the pelvic floor support reduces flattening of the bladder and hence limits the development of the bladder wall stretch. (no refs.)

110067 Importance of biostereometrical techniques in analyzing the gestures performed in two distinct environments: air and water. G.Ignazi, R.Mollard, J.C.Pineau (Lab. d'Anthropologie Appliquee, Univ. Rene Descartes, Paris, France).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.267-74 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
A biostereometric method for analysis of gestures has been developed to study the influence of an aqueous environment on the biomechanical behaviour of man. Developed power and time of execution data were collected for different test conditions, in air and water. By 3-D analysis, the phases of movement (flexion-extension of the upper limb) were reconstituted and the displacements of each segment were calculated. The influence of the aqueous environment on the execution of gesture and the effect of thrust and ballast in water are described. (7 refs.)

110068 Temporal resolution requirements for the double stance period of human gait [high speed cinematography]. J.U.Baumann, P.Procter, A.Schaer (Dept. of Surgery, Univ. of Basel, Children's Hospital, Basel, Switzerland).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.288-92 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
Study of transient force phenomena in the double stance period of normal gait suggests that high temporal resolution is required in concommittant movement analysis. The study described concludes that at least 300 pictures per second are necessary to resolve kinematic transients associated with heel strike. (13 refs.)

110069 Moments about body centered coordinate axes at limb joints from force plate and biplane photography measurements. S.Balakrishnan, A.B.Thornton-Trump, G.W.Brodland (Dept. of Mech. Engng., Univ. of Manitoba, Winnipeg, Manitoba, Canada).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.293-301 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
Traditional locomotion analysis considers motion in a translating coordinate frame and the analysis is performed primarily in the sagittal plane. The results of several studies by the authors described here, have shown that the aspect of symmetry is rarely present in pathological gait. The work described illustrates the use of biplane photography for displacement measurement in human movement. Transformations based on Eulerian angle rotations are derived based on biplane measurements. From the three dimensional ground reaction forces measured by a force plate, moments about the moving upper body coordinate axes are computed through a three dimensional mathematical model. (12 refs.)

110070 Variations in gait patterns of runners: relationship to anthropometric measurements. S.Adelsberg, C.Tauber, J.Au, J.Pugh (Dept. of Orthopaedics, Hospital for Joint Diseases Orthopaedic Inst., New York, NY, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.302-6 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
High-speed computerized motion analysis was used to assess the running parameters of a group of runners. Anthropometric measurements were taken on the group of runners in an effort to provide possible correlations between running style, speed, and anthropometry. The most consistent correlation was between speed and stride length. Femur length and stride length was only highly correlated for the runners at the fastest speeds. The faster runners also had a gait pattern characterized by significantly lower ground contact time than that of the slower runners. Of prime importance in running is behaviour of the body during float phase, and mediated by anthropometry and the biomechanical characteristics of the stance phase. (2 refs.)

110071 Orthopaedic application of spatio temporal analysis of body form and function. C.Tauber, J.Au, S.Bernstein, A.Grant, J.Pugh (Dept. of Orthopaedics, Hospital for Joint Diseases Orthopaedic Inst., New York, NY, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.307-13 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
Spatial and temporal analysis of walking provides the orthopaedist with objective evidence of functional ability and improvement in a patient. Patients with orthopaedic problems experiencing extreme pain and, consequently, irregularities in joint motions on weightbearing are videorecorded before, during and after a course of rehabilitative treatment and/or surgical correction of their disability. A specially-programmed computer analyzes these tapes for the parameters of walking by locating reflective spots which indicate the centers of the lower limb joints. The following parameters of gait are then generated: dynamic hip, knee and foot angles at various intervals during walking; vertical, horizontal and lateral displacements of each joint at various time intervals; linear and angular velocities of each joint; and the relationships between the joints during various phases of the gait cycle. (2 refs.)

110072 A large deformation analysis for aortic walls under a physiological loading. J.C.Misra, S.I.Singh (Dept. of Math., Indian Inst. of Technol., Kharagpur, India).
Int. J. Eng. Sci. (GB), vol.21, no.10, p.1193-202 (1983).
An analytical study for the large deformation of aortic walls, based on the theory of nonlinear viscoelasticity, treating the wall tissue as orthotropic and incompressible, is presented. The aorta is considered as a long and thick-walled cylindrical vessel. The effect of the surrounding tissues which are assumed to be isotropic and incompressible, is incorporated in the analysis. Also the effects of the inertial force for the motion of the wall and the longitudinal extension experienced by blood vessels under a physiological loading, are accounted for. By using additive forms of the stress relaxation functions characterizing the viscoelastic behaviour of wall tissues, the applicability of the mathematical analysis is illustrated through numerical computation of the strain- and stress-fields in the walls of middle descending thoracic aorta. (22 refs.)

110073 Apparant depression of right ventricular function after selective reduction of left ventricular inotropy: an interpretation of experimental data utilising a computer-based circulatory model. H.Piene, O.A.Smiseth (Dept. of Physiology, Univ. of Tromso, Tromso, Norway), H.Refsum, J.V.Tyberg.
Med. & Biol. Eng. & Comput. (GB), vol.21, no.5, p.548-56 (Sept. 1983).
Consequences of ventricular interations upon commonly used descriptions of ventricular diastolic and systolic properties were inferred from a circulatory model. The model included active heart compartments, vascular interconnections and the pericardium and was adapted on a digital computer. Numerical values assigned to model parameters were such as to resemble the circulatory system of the dog. Model predictions were utilised to analyse experimental observations in a dog preparation with closed chest and pericardium. Dog ventricular and pericardial pressures (P) and volumes (V) were measured in a control situation and after ischaemic depression of left ventricular function. Model predictions and experiment observations were qualitatively identical. The findings imply that the diastolic P-V relationship of one heart compartment cannot be assessed by measurements in this compartment alone, and that function curves of one ventricle are affected by ventricular interactions which cannot be separated from true alterations in the inotropic state. (11 refs.)

110074 The role of calcium in the mechanical behaviour of bone. R.J.Minns (Regional Medical Phys. Dept., Dryburn Hospital, Durham, England), A.Atkinson, F.S.Steven.
Phys. Med. & Biol. (GB), vol.28, no.9, p.1057-66 (Sept. 1983).
Plugs of fresh post mortem human patellar subchondral bone were soaked for three weeks in an organic solvent (ethanol) which contained a chelating agent (EDTA). This technique selectively removes the calcified inorganic component without disrupting the structure of the remaining bone matrix. These plugs, together with untreated plugs as controls, were treated in unconfined compression at a fixed strain rate and allowed to relax to evaluate the contribution made by the calcium component to the physical and time-dependent properties of subchondral bone. (27 refs.)

110075 Computerized model of coronary-pulmonary circulation. L.R.Low, J.P.Windham (Dept. of Radiology, Medical Coll. of Ohio, Toledo, OH, USA).
23rd Midwest Symposium on Circuits and Systems, Toledo, OH, USA, 4-5 Aug. 1980 (North Hollywood, CA, USA: Western Periodicals 1980), p.547-51
A mathematical model of the human cardio-pulmonary circulation has been developed. A method has been devised of optimally matching this model to simulated data generated by a model program, in the presence of simulated

noise and an arbitrary, (known), input function. A sensitivity analysis has given a qualitative measure of the relative reliability of the estimates of the heart transfer constants. The technique has been applied to clinical data obtained from a cardiac first pass radionuclide study. (6 refs.)

Physical properties of pathological human erythrocytes. I. A spin label study on the internal microviscosity of homozygous β-thalassemic erythrocytes .... See Entry 109984

Motor unit activity and muscle strength development .... See Entry 109995

Relationship between the surface e.m.g. and muscular force .. See Entry 110004

Dynamics of cover test eye movements .... See Entry 110020

Semireal time monitoring of the functional movements of the mandible .... See Entry 110104

Transverse forces on a finger tendon analyzed using transmission ultrasound imaging .... See Entry 110105

Television scanning technique for topographic body measurements .... See Entry 110132

Algorithms for two-camera video motion analysis .... See Entry 110133

Microprocessor-based image processing system for dynamic foot pressure studies .... See Entry 110141

Examination of vocal fold movement by ultra-short pulse X-radiography .... See Entry 110146

Relationship between regional pertechnetate cerebral circulation time and EEG in patients with cerebral infarction .... See Entry 110158

An instrument for measuring small flows during biliary tract surgery .... See Entry 110210

Efficient, inexpensive rapid cuff inflator for venous occlusion plethysmography .... See Entry 110211

A technique for the measurement of 'sucking' in bottle fed infants .... See Entry 110212

Biostereometric data processing in ERGODATA: choice of human body models .... See Entry 110214

The use of strain gauges for biometrics in Europe .... See Entry 110217

Noninvasive automatic monitoring of instantaneous arterial blood pressure using the vascular unloading technique .... See Entry 110221

Three-dimensional anthropometric measurement .... See Entry 110235

A study of antero-posterior load transfer in total hip replacement using a modelling technique .... See Entry 110241

A new approach to the fixation of a metacarpophalangeal joint prosthesis .... See Entry 110242

Pulsatile flow experiments on heart valve prostheses .... See Entry 110243

An in vivo method of measurement of the mechanical properties of vascular prostheses: the mechanical properties of saphenous vein bypass grafts .... See Entry 110244

Measurement of reach envelopes with a four-camera selective spot recognition (SELSPOT) system [astronaut application] .... See Entry 110248

Cinephotogrammetric evaluation of thoracic deformation due to safety belt action during a crash test .... See Entry 110249

Analysis and display of human wrist motion .... See Entry 110250

Detection of reaction time by an adaptive filter based on the least squares fit .... See Entry 110255

Identification of r.e.m. sleep in the mouse by measuring the body movements .... See Entry 110267

87.50 BIOLOGICAL EFFECTS OF RADIATIONS

(inc. effects of fields)

110076 Short- and long-term effects of whole-body irradiation with fission neutrons or X-rays on the thymus in CBA mice. R.Huiskamp, J.A.G.Davids (Netherlands Energy Res. Found. ECN, Petten, Netherlands), O.Vos.
Radiat. Res. (USA), vol.95, no.2, p.370-81 (Aug. 1983).
Young adult (6 weeks old) female CBA mice were exposed to whole-body irradiation with either 2.5-Gy fast fission neutrons of 1 MeV mean energy or 6.0-Gy 300 kVp X-rays at center-line dose rates of 0.1 and 0.3 Gy/min, respectively. The weight of spleen and animal and the weight, cellularity, and histological structure of the thymus were studied at different times after irradiation. Thymic recovery after whole-body irradiation showed a biphasic pattern with minima at 5 and 21 days after irradiation and peaks of regeneration at days 14 and 42 after X-irradiation or at days 14 and 70 after neutron irradiation. After the second phase or recovery, a marked decrease in relative thymus weight and cellularity was observed, which lasted up to at least 250 days after irradiation. Splenic recovery showed a monophasic pattern with an overshoot on day 21 after irradiation. After neutron irradiation a late decrease in relative spleen and animal weight was observed. The observed late effects on thymus and spleen weight and thymus cellularity are discussed in terms of a persistent defect in the bone marrow. (33 refs.)

Proceedings of Workshops III and IV and of the Topical Meeting of the COSPAR Interdisciplinary Scientific Commission F (Meeting F2) of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 110195

87.50B Interactions of biosystems with radiations

110077 Energy adsorption from waveguides in biological-like media. M.Bozzetti (Dipartimento di Elettrotecnica ed Elettronica, Univ. di Bari, Bari, Italy), R.de Leo, C.Ercoli.
Alta Freq. (Italy), vol.52, no.3, p.185-7 (May-June 1983). (4th Italian National Meeting on Applied Electromagnetics, Florence, Italy, 4-6 Oct. 1982).
The EM radiation of open-ended waveguides into a biological medium is analyzed in order to obtain the dissipated power distribution into the biological body along with the aperture radiation characteristics as a function of waveguide excitation and of biological medium parameters. (3 refs.)

110078 Dielectric properties of ocular tissues at 374°C. C.Gabriel, R.J.Sheppard, E.H.Grant (Phys. Dept., Queen Elizabeth Coll., London, England).
Phys. Med. & Biol. (GB), vol.28, no.1, p.43-9 (Jan. 1983). [received: Sept. 1983]
Values of the relative permittivity, dielectric loss and conductivity are given for various rabbit ocular tissues at frequencies in the range 10 MHz-10 GHz. The tissues measured were cornea, retina, choroid, iris, and the cortical and nuclear zones of the lens. The dielectric parameters were determined using the technique of multiple response time domain spectroscopy. For all tissues the water relaxation could be characterised by a Debye dispersion with a relaxation time longer than that of pure water, indicating that its dielectric behaviour was affected by the presence of the biological macromolecules. (16 refs.)

87.50C Bioacoustics (sonic and ultrasonic effects on living matter)

A halt to sound pollution! .... See Entry 106928

Medical ultrasound: is there a hazard .... See Entry 110102

87.50E Bio-optics (effects of microwaves, light, laser and other electromagnetic waves)

110079 Microwave effects on cell cultures. G.d'Ambrosio, G.Ferrara, A.Scaglione (Istituto Elettrotecnico, Univ. di Napoli, Napoli, Italy), G.Colletta, P.P.di Fiore.
Alta Freq. (Italy), vol.52, no.3, p.179-81 (May-June 1983). (4th Italian National Meeting on Applied Electromagnetics, Florence, Italy, 4-6 Oct. 1982).
F4/6 Friend cells were chosen as a suitable system for investigating microwave induced bioeffects. A number of preliminary tests were carried out regarding the response of the cultures to conventional heating and to other stresses. Serum-free samples were exposed to pulsed wave or to continuous wave, or were conventionally heated. Comparison of growth rates showed an inhibitory effect due to pulsed radiation. (12 refs.)

110080 Analysis of the safety levels for impulsive electromagnetic fields. P.Bernardi, G.D'Inzeo (Dipartimento di Elettronica, Univ. Degli Studi di Roma, Roma).
Alta Freq. (Italy), vol.52, no.3, p.182-4 (May-June 1983). (4th Italian National Meeting on Applied Electromagnetics, Florence, Italy, 4-6 Oct. 1982).
The quantitative criteria for setting the safety levels of nonionizing electromagnetic waves are usually based on interaction mechanisms that produce thermal effects and do not refer to other possible mechanisms. The authors examine the effects that an electromagnetic field incident on a biological tissue produces at the cell membrane level, inducing on the membrane a voltage that alters its resting conditions. In particular, for impulsive fields, they have evaluated if the usual standard levels are of actual security in the light of this mechanism of interaction. (6 refs.)

110081 Heat flow in laser-irradiated biological systems: some experimental considerations. G.Delfino, E.Casale (Inst. di Cibernetica, CNR, Napoli, Italy).
Appl. Opt. (USA), vol.22, no.17, p.2712-15 (1983).
The investigation of problems of heat transmission in laser-irradiated samples and the relative modelistic approaches acquire particular significance when whole biological specimens are considered. The possibility of employing a theoretical model, generally utilized in laser irradiation of solid materials, is here analyzed in the irradiation of biological samples. Also, experimental modifications of the thermal diffusivity values are related to the energy level of the single optical pulse obtained from a CW Ar^+ laser. (11 refs.)

110082 Stimulation of E. coli growth by laser and incoherent red light. T.J.Karu, O.A.Tiphlova (Laser Tech. Center, Acad. of Sci., Troitzk, USSR), V.S.Letokhov, V.V.Lobko.
Nuovo Cimento D (Italy), vol.2D, ser.1, no.4, p.1138-44 (July-Aug. 1983).
The effect of low-intensity He-Ne laser radiation ($\lambda=632.8$ nm) and incoherent red light on DNA synthesis and cell division in Escherichia coli has been studied. It has been shown that the radiations of He-Ne laser ($\lambda=632.8$ nm) and filament lamp ($\lambda=(631\pm4)$ nm) stimulate DNA synthesis and cell growth at doses of 10^3 to 10^4 J/m^2. The highest level of DNA synthesis is observed 10 min after irradiation and the difference in the numbers of irradiated and control cells is maximum 1 or 2 h after irradiation. The action spectrum of visible light on the growth rate of E. coli cells (from 560 nm to 640 nm) has been measured. The action spectrum has its maximum at (620 ± 7) nm. (7 refs.)

110083 Observations of Syrian hamster features after exposure to 2450-MHz microwaves. E.Berman, H.B.Carter (Experimental Biology Div., Health Effects Res. Lab., Research Triangle Park, NC, USA), D.House.
J. Microwave Power (Canada), vol.17, no.2, p.107-12 (June 1982).
The teratogenic potential of microwaves was examined in a rodent species, the Syrian hamster. Exposure of hamsters to 2450-MHz CW microwaves at a power density of 20 mW/cm^2 (estimated SAR=6 mW/g) for 100 minutes daily on days 6-14 of gestation caused no significant change in fetal survival, body weight, skeletal maturity, or incidence of terata. Thirty mW/cm^2 (estimated SAR=9 mW/g) caused significantly increased fetal resorptions, decreased fetal body weight, and decreased skeletal maturity. Rectal temperatures of pregnant hamsters after exposure to 20 mW/cm^2 were slightly increased (0.4°C) over those of sham-irradiated dams; 30 mW/cm^2 caused maternal rectal temperatures to be increased 1.6°C over sham-irradiated dams' temperatures. It appears that the hamster fetus may be more susceptible to microwave radiation than the mouse. (11 refs.)

110084 Assessment of immune function development in mice irradiated in utero with 2450-MHz microwaves. R.J.Smialowicz, M.M.Riddle, R.R.Rogers, G.A.Stott (Health Effects Res. Lab., US Environmental Protection Agency, Research Triangle Park, NC, USA).
J. Microwave Power (Canada), vol.17, no.2, p.121-6 (June 1982).
Groups of time-bred pregnant mice were irradiated with 2450-MHz microwaves at an incident power density of 28 mW/cm^2 for 100 min daily from day 6 to day 18 of pregnancy. The average specific absorption rate (SAR) was 16.5 W/kg. Two experiments were performed under these conditions. At 3 and 6 weeks of age the mice were assessed for development of the primary immune response to sheep erythrocytes, in vitro mitogen stimulated lymphocyte proliferation, and natural killer (NK) cell activity. No consistent significant difference in the primary immune response, in the mitogen response, or in the NK cell activity was observed between irradiated and sham-irradiated mice. (17 refs.)

110085 Effects of ambient temperature and exposure to 2450-MHz microwave radiation on evaporative heat loss in the mouse. C.J.Gordon (Health Effects Res. Lab., US Environmental Protection Agency, Research Triangle Park, NC, USA).
J. Microwave Power (Canada), vol.17, no.2, p.145-50 (June 1982).
Whole-body evaporative heat loss was measured as whole-body evaporative water loss in mice during a 90-min exposure to 2450-MHz microwave radiation at an ambient temperature of 20°C and in non-exposed mice maintained at ambient temperatures of 20, 25, 30, 33, and 35°C. The ambient-temperature threshold for increasing evaporative water loss was between 30

and 33°C. A specific absorption rate of microwave radiation in excess of 29 W/kg was required to produce an increase in heat loss. For absorption rates ranging from 29 to 44 W/kg, the mouse dissipated 65% of the total absorbed heat by water evaporation; the remainder was dissipated passively. The data collected in the mouse may be extrapolated to larger species, such as man, but only by an exponential relationship. Using this relationship, it was shown that a threshold specific absorption rate of 29 W/kg in a 0.033-kg mouse was equivalent to approximately 0.25 W/kg in a 70-kg human. (25 refs.)

110086 Comments on a review of radiofrequency and microwaves (EHC 16) by Sol M. Michaelson (Radiat. Res. 92, 217-219 (1982)) [and reply]. M.L.Shore (Nat. Center for Devices & Radiological Health, Food & Drug Administration, Dept. of Health & Human Services, Rockville, MD, USA), M.H.Repacholi, B.Servantie, P.Czerski, S.M.Michaelson.
Radiat. Res. (USA), vol.95, no.2, p.414-20 (Aug. 1983).
As members of the WHO working group, which developed the international consensus for and the text of the environmental health criteria #16 of the World Health Organization, Radiofrequency and Microwaves (EHC 16), Shore et al. respond to the review of the document prepared by Dr. Sol M. Michaelson. They have a somewhat different perspective on the criteria document EHC 16 than that which Dr. Michaelson provided. Dr. Michaelson's main thesis is that EHC 16 is 'unbalanced', in that literature that supports so-called nonthermal interactions was included in the report 'wiith cursory critique and quite often at the expense of literature which refutes such viewpoints', and so EHC 16, in his opinion, 'does not come up to the high scientific caliber and accuracy of the usual WHO publications'. Various points of Dr. Michaelson's review are commented on and in a reply Dr. Michaelson comments on the comments. (no refs.)

Non-linear effects in the electromagnetic heating of living tissues ....See Entry 109971

Spin exchange in nitroxide-charged membrane models: an ESR method for detecting photodynamic effects ....See Entry 109977

87.50G Ionizing radiations (u.v., X-ray, gamma-ray; particle radiation effects)

110087 Response of a human colon adenocarcinoma (DLD-1) to X-irradiation and mitomycin C in vivo. E.N.Spremulli (Dept. of Medicine, Roger Williams General Hospital, Providence, RI, USA), J.T.Leith, S.F.Bliven, D.E.Campbell, D.L.Dexter, A.S.Glicksman, P.Calabresi.
Int. J. Radiat. Oncology Biol. Phys. (GB), vol.9, no.8, p.1209-12 (Aug. 1983).
Mice hosting a heterogeneous human colon xenograft tumor produced by subcutaneous injection of the DLD-1 tumor cell line were treated either with X-irradiation alone, with mitomycin C alone (4 mg/kg), or with X-irradiation given two hours after intraperitoneal injection of mitomycin C (4 mg/kg). Radiation alone produced a dose dependent delay in the time needed for tumors to regrow to twice their size at the time of irradiation, and in the mice receiving mitomycin C plus X-irradiation, an additional growth delay equivalent to that produced by 3-3.5 Gy of X-rays was seen at all X-ray dose level. As the DLD-1 tumor xenografts do not appear to possess a significant hypoxic fraction, the authors conclude that the two agents are acting in a simple additive cytotoxic manner by the killing of oxic tumor cells. (16 refs.)

110088 Recombination of parent and daughter strand DNA after UV-irradiation in mammalian cells. A.J.Fornace,Jr. (Lab. of Pathology, NIH, Bethesda, MD, USA).
Nature (GB), vol.304, no.5926, p.552-4 (11 Aug. 1983).
The mechanism by which mammalian cells replicate DNA containing pyrimidine dimers is poorly understood. When DNA synthesis is initiated after UV-irradiation in bacteria, parental DNA containing pyrimidine dimers has been shown to 'exchange' into the daughter strand DNA by a recA-dependent mechanism. The author reports that up to 3 dimers per 10^9 daltons of daughter strand DNA could be detected 34-45 h after UV-irradiation in human peripheral blood lymphocytes, normal human fibroblasts, group A xeroderma pigmentosum fibroblasts and mouse 3T3 cells. This represents approximately 1-3% of the dimers present in the parent strand at this time after UV. (23 refs.)

110089 Targeted mutagenesis of SV40 DNA induced by UV light. F.Bourre, A.Sarasin (Inst. de Recherches Sci. sur le Cancer, Villejuif, France).
Nature (GB), vol.305, no.5929, p.68-70 (1 Sept. 1983).
UV light is a potent mutagen in most living cells, but molecular analysis of its mode of action in animal cells has not been possible because of the high complexity of the cell genome. Therefore, the authors have used simian virus 40 (SV40) as a biological probe to study the mutagenic effect of UV-irradiation at the molecular level. A thermosensitive SV40 mutant of the large T antigen (tsA58), which is defective at high temperature for intitiation of viral DNA replication and for repression of early transcription, was UV-irradiated in vitro, then replicated in monkey kidney cells. Revertants of tsA58 were selected for growth at the nonpermissive temperature, then the reversion sites were mapped by using the marker rescue technique, and precisely localized by DNA sequencing. The authors report that all revertants analysed showed one or two base pair substitutions localized in the C-terminal half of the T antigen gene. The original tsA mutation was still present in all revertent genomes. In 16 DNAs sequenced, seven reversion sites were found on the large T antigen gene, all of which localized opposite a possible UV-induced pyrimidine-pyrimidine lesion, suggesting targeted mutagenesis. UV-irradiation of the host cell before infection did not change the pattern of reversion sites at the molecular level, although it strongly increased the mutation frequency. These results demonstrate for the first time in animal cells the specificity of UV-induced mutagenesis. (20 refs.)

110090 Bremsstrahlung production by potassium-40 in muscle. S.G.Graham (Atomic Weapons Research Establ., Reading, England).
Phys. Med. & Biol. (GB), vol.28, no.1, p.19-30 (Jan. 1983). [received: Sept. 1983]
The bremsstrahlung spectrum produced when 1320 keV beta particles, emitted by the naturally occurring isotope ^{40}K, are absorbed in muscle has been calculated. With reference to the external measurement of ^{239}Pu in the lung using the 17 keV UL X-rays, a simple model was used to estimate the number of bremsstrahlung photons with energies between 12 and 25 keV that would emerge from the chest wall of a normal subject. This was calculated to be 3 min^{-1} for a detection area of 628 cm^2, although internal bremsstrahlung may increase this to 4 in^{-1}. The latter figure is a factor of approximately three lower than the counting rate observed when a pair of phoswich NaI detectors of the same total area are placed over an average subject. Possible reasons for this discrepancy are discussed. (27 refs.)

110091 The applications of track calculations to radiobiology. I. Monte Carlo simulation of proton tracks. M.Zaider (Coll. of Physicians & Surgeons, Columbia Univ., New York, NY, USA), D.J.Brenner, W.E.Wilson.
Radiat. Res. (USA), vol.95, no.2, p.231-47 (Aug. 1983).
In the first of a series of papers on the application of track-structure calculations to radiobiology, a detailed Monte Carlo proton transport code in water vapor is described. In the code all important interaction types (elastic scattering, five levels of ionization, 12 types of excitation) are considered explicitly. All cross sections are based closely on experimental data. The proton energy range considered is 0.3-1.5 MeV since this is the range of available experimental ionization cross sections. Results are presented in terms of energy partitions, w values, stopping powers, and radial dose distributions, all showing agreement with the experiment. (49 refs.)

110092 Resistance of human erythrocytes containing elevated levels of vitamin E to radiation-induced hemolysis. M.A.Brown (School of Biological Sci., Macquarie Univ., North Ryde, Australia).
Radiat. Res. (USA), vol.95, no.2, p.303-16 (Aug. 1983).
Human erythrocytes were isolated from the blood of healthy donors and then incubated in the presence of suspensions of α-tocopherol for 30 min at 37°C. Unabsorbed tocopherol was removed by centrifugation using several washes of isotonic phosphate-buffered saline. Washed erythrocytes were resuspended to 0.05% Hct and exposed to hemolyzing doses of ^{60}Co gamma radiation, and hemolysis was monitored continuously by light scattering at 700 nm in a recording spectrophotometer. The extent of hemolysis with time was sigmoid and data analysis was carried out on the time taken for 50% hemolysis to occur ($t_{50\%}$). The vitamin E content of erythrocytes was significantly elevated by the incubation procedure and resulted in the cells exhibiting a significantly increased resistance to hemolysis as reflected by the extended $t_{50\%}$ values. Oral supplementation of 500 IU of vitamin E per day to eight normal human subjects for a period of 16 days also resulted in their washed erythrocytes exhibiting a significant increase in resistance of radiation-induced hemolysis. When comparing vitamin E incubated cells with control cells, both the dose-reducing factor and the time for 50% hemolysis quotient ($Qt_{50\%}$) were observed to increase with increasing radiation dose. (30 refs.)

110093 DNA damage in irradiated endothelial cells of the rat cerebral cortex. Protective action of cysteamine in vivo. H.Cerda, K.Rosander (Dept. of Phys. Biology, Gustaf Werner Inst., Uppsala, Sweden).
Radiat. Res. (USA), vol.95, no.2, p.317-26 (Aug. 1983).
The induction and repair of DNA damage by ^{60}Co in single endothelial cells of rate cerebral cortex capillaries were studied in vivo and in vitro. Capillaries from the cerebral cortex were prepared in suspension, embedded in agarose on microscope slides, and treated with alkaline solution (causes unwinding of DNA). After neutralization the slides were stained with the fluorescent dye acridine orange and endothelial cell nuclei were evaluated in a microscope photometer. The intensity of the red fluorescence (from single-stranded DNA) divided by the green fluorescence (from double-stranded DNA) was used as a measured of DNA strand breaks. The results showed that most DNA strand breaks were repaired within 30 min postirradiation. A linear dose-effect relationship was found up to 18 Gy. Similar results were obtained from in vitro and in vivo experiments. Cysteamine administered 20 min before irradiation in vivo gave a protective effect on the cells studied. An EMF of 1.3 was determined. (28 refs.)

110094 Hyperthermic potentiation of unrejoined DNA strand breaks following irradiation. M.D.Mills, R.E.Meyn (Dept. of Phys., Univ. of Texas, Houston, TX, USA).
Radiat. Res. (USA), vol.95, no.2, p.327-38 (Aug. 1983).
Previous reports have suggested that the potentiation of cellular radiation sensitivity by hyperthermia may be due to its inhibition of the repair of single-strand breaks in DNA. Such inhibition could result in increased numbers of unrejoined breaks at long times following irradiation, lesions that are presumed to be lethal to the cell. As a test of this hypothesis, the amounts of residual strand-break damage in cells following combined hyperthermia and ionizing radiation (^{137}Cs γ-rays) were measured. The results show that hyperthermia does significantly enhance the relative number of unrejoined strand breaks as measured by the technique of alkaline elution and that the degree of enhancement is dependent on both the temperature and duration of the hyperthermia treatment. For example, compared to unheated cells, the proportion of unrejoined breaks measured 8 hr after irradiation was increased by a factor of 1.5 in cells that were treated for 30 min at 43°C, by a factor of 6 for cells treated for 30 min at 45°C, and by a factor of 4 for cells treated at 43°C for 2 hr. In experiments in which the sequence of heat and irradiation were varied, a high degree of correlation was observed between the resulting level of cell killing and the relative numbers of unrejoined strand breaks. The greatest effects of both of these parameters were observed in those protocols in which the irradiation was delivered either during, just before, or just after the heat treatment. (28 refs.)

110095 A comparison of the lethal effects of intracellular radionuclides in human and rodent cells. P.K.LeMotte, J.B.Little (Dept. of Physiology, Harvard School of Public Health, Boston, MA, USA).
Radiat. Res. (USA), vol.95, no.2, p.359-69 (Aug. 1983).
The relative sensitivities of a human diploid fibroblast strain (AG1522) and an established line of contact-inhibited mouse embryo fibroblasts (10T1/2) were compared after incorporation of [^{3}H]thymidine or [^{125}I]-iododeoxyuridine into the cellular DNA and growth at 37°C. Whereas these cells show similar sensitivities to acute X-irradiation, the D_0 for clonal survival of the mouse fibroblasts was 5- to 10-fold higher than the D_0 for the human fibroblasts for both ^{3}H and ^{125}I. A large difference in sensitivity between these two cell types was also seen after protracted irradiation form ^3H_2O at 37°C, but this difference was markedly reduced when cells were exposed to ^3H_2O at 0°C to simulate an 'acute' irradiation. An established human tumor cell line was similarly hypersensitive to killing by ^3H_2O at 37°C as compared with early passage diploid hamster embryo cells. These results indicate that human cells are more radiosensitive than rodent cells when a radiation dose is protracted over several days rather than given as an 'acute' exposure, and are consistent with the hypothesis that human cells are hypersensitive to low-dose-rate irradiation as compared with rodent cells. (14 refs.)

110096 The repair of sublethal damage in diploid human fibroblasts: a comparison between human and rodent cell lines. M.L.Freeman, E.Sierra, E.J.Hall (Dept. of Radiology, Columbia Univ., New York, NY, USA).
Radiat. Res. (USA), vol.95, no.2, p.382-91 (Aug. 1983).
Two diploid cell lines of human origin were irradiated in vitro. Repair of sublethal damage was observed in both lines when they were exposed to a single γ-ray dose and incubated at 37°C prior to receiving a graded second dose. In addition cells were irradiated at a low dose rate (56 or 76 rad/hr) and survival was compared to that after an acute exposure. A dose-rate effect was demonstrated. Sublethal damage repair was also studied using CHO or V-79 Chinese hamster cells, and the data suggest that the degree of repair is similar in human and rodent cell lines at photon doses up to 500 rad. The

repair of sublethal damage can be a significant factor in the survival of human cells in vitro for fractionated doses. (12 refs.)

110097 Quantitative radiation dose-response relationship for normal tissues in man. II. Response of the salivary glands during radiotherapy. K.L.Mossman (Dept. of Radiation Medicine, Georgetown Univ. Medical Center, Washington, DC, USA).
Radiat. Res. (USA), vol.95, no.2, p.392-8 (Aug. 1983).
For pt.I see ibid., vol.91, p.265-74, 1982. A quantitative dose-response curve for salivary gland function in patients during radiotherapy is presented. Salivary-function data used in this study was obtained from four previously published reports. All patients were treated with ^{60}Co teletherapy, to the head and neck using conventional treatment techniques. Salivary dysfunction was determined as specific dose levels by comparing salivary flow rates before therapy with flow rates at specific dose intervals during radiotherapy up to a total dose of 6000 cGy. Fifty percent salivary dysfunction occurred after 1000 cGy and eighty percent dysfunction was observed by the end of the therapy course (6000 cGy). The salivary-function curve was also compared to the previously published dose-response curve for taste function (pt.I). Comparisons of two curves indicate that salivary dysfunction precedes taste loss and that the shapes of the dose-response curves are different. A new term, tissue tolerance ratio, defined as the ratio of responses of two tissues given the same radiation dose, was used to make the comparisons between gustatory and salivary gland tissue effects. Measurements of salivary gland function and analysis of dose-response curves may be useful in evaluating chemical modifiers of radiation response. (17 refs.)

110098 Are lesions induced by ionizing radiation direct blocks to DNA chain elongation?. R.B.Painter (Lab. of Radiobiology & Environmental Health, Univ. of California, San Francisco, CA, USA).
Radiat. Res. (USA), vol.95, no.2, p.421-6 (Aug. 1983).
Ionizing radiation blocks DNA chain elongation in normal diploid fibroblasts but not in fibroblasts from patients with ataxia-telangiectasia, even though there are no differences in the damage induced between the two cell types. This difference suggests that radiation-induced lesions in DNA are not themselves blocks to chain elongation in ataxia cells and raises the possibility that in normal cells a mediator exists between DNA damage and chain termination. (17 refs.)

110099 Experimental condition and the acute reaction of mouse skin to ionizing radiation. H.D.Suit, G.Silver, R.S.Sedlacek (Dept. of Radiation Medicine, Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA), A.Walker.
Radiat. Res. (USA), vol.95, no.2, p.427-33 (Aug. 1983).
The acute reactions of skin of the thigh-leg of normal young adult C3Hf/Sed mice following five equal radiation doses (^{60}Co) were studied in mice irradiated at various leg skin temperatures and while respiring various gas mixtures in control or anesthetized condition (sodium pentobarbital, 0.05 mg/g^{-1} body wt.). At 25 and 35°C, anesthesia reduced the RD_{50} (2.5+reaction) by 4-5%. An increase of temperature from 25 to 35°C resulted in a decrease in RD_{50} by 10-12% for subjects respiring air or 5% for subjects respiring O_2 at 1 or at 3 ATA. The major modifier of radiation response was to change from respiration of air to O_2 at 1 or 3 ATA. Enhancement ratios for RD_{50} Air/O_2 1 ATA were 1.4-1.5 for 25 and 35°C. The ratios O_2 1 ATA/3 ATA were 1-1.05. (21 refs.)

Proceedings of the British Institute of Radiology, Radiobiology Work-in-Progress Meeting (papers in summary form only received) .....See Entry 105011

Short- and long-term effects of whole-body irradiation with fission neutrons or X-rays on the thymus in CBA mice ....See Entry 110076

The low-dose controversy and radiological risk assessment ....See Entry 110180

87.60 MEDICAL AND BIOMEDICAL USES OF FIELDS, RADIATIONS, AND RADIOACTIVITY

(see also 28.80 Nuclear radiation technology, including shielding)

110100 Engineering research in medical imaging: a synergistic relationship. M.M.Ter-Pogossian (Mallinckrodt Inst. of Radiology, Washington Univ. School of Medicine, St. Louis, MO, USA).
IEEE Trans. Med. Imaging (USA), vol.MI-1, no.4, p.206-9 (Dec. 1982). [received: Sept. 1983]
Discusses some of the very basic aspects of medical imaging including computed tomography, digital radiography, emission tomography, ultrasound, and nuclear magnetic resonance. (no refs.)

110101 Overview of a unified SNR analysis of medical imaging systems. R.F.Wagner, D.G.Brown (Office of Radiological Health, Food and Drug Administration, Rockville, MD, USA).
IEEE Trans. Med. Imaging (USA), vol.MI-1, no.4, p.210-12 (Dec. 1982). [received: Sept. 1983]
In their studies of medical imaging systems over the last decade the authors find that there are elements common to all systems which, when properly understood, simplify the analysis and understanding of these systems and their performance. They present a brief introductory overview of these elements. (20 refs.)

Lecture to American College of Radiology [medical image processing] ....See Entry 105007

87.60B Sonic and ultrasonic radiation

110102 Medical ultrasound: is there a hazard. M.H.Repacholi (Non-Ionizing Radiation Section, Health & Welfare Canada, Ottawa, Ontario, Canada).
Australas. Phys. & Eng. Sci. Med. (Australia), vol.6, no.2, p.64-70 (April-June 1983). [received: Aug. 1983]
With the very large numbers of people exposed to ultrasound, it is normal to pose the question—is there any hazard to health?. The author concludes that, with the precautions and recommendations noted, the actual or potential risks of human exposure to medical ultrasound would be minimal. At this stage in one's knowledge, any detriments from ultrasound exposure are insignificant compared to the benefits. (41 refs.)

110103 Spectral energy of the first heart sound in relation to mitral valve size parameter. T.C.Hearn (Dept. of Appl. Maths., Univ. of Adelaide, Adelaide, Australia), J.Mazumdar, E.Goldblatt, D.Nandagopal, N.L.Fazzalari.
Australas. Phys. & Eng. Sci. Med. (Australia), vol.6, no.2, p.76-81 (April-June 1983). [received: Aug. 1983]
Simultaneous phonocardiograms and two dimensional echocardiograms were recorded from twelve children subjects. Stop-action frames of the mitral valve in parasternal long-axis and four-chambered views were photographed from the video-taped echocardiographic recordings, to provide biaxial measurements of the mitral valve diameter for each subject. The product of the two diameter measurements was used as a size parameter for the mitral valve. From the corresponding digitized phonocardiograms, first heart-sound power spectra were obtained by means of fast Fourier transformation. The relative area of the spectra in 15 Hz intervals up to 150 Hz was then correlated with the mitral valve size parameter. It was noted that the best correlation was attained in the 30-45 Hz bandwidth. A possible interpretation in terms of documented heart-sound determinants is discussed. (7 refs.)

110104 Semireal time monitoring of the functional movements of the mandible. R.J.Isaacson (Dept. of Growth & Dev., Univ. of California, San Francisco, CA, USA), S.Baumrind, S.Curry, R.A.Molthen.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.22-35 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
Many branches of dental practice would benefit from the availability of a relatively accurate, precise, and efficient method for monitoring the movements of the human mandible during function. The authors report work aimed at developing a relatively non-restrictive semireal time acoustical system for monitoring the functional movement of the mandible relative to the rest of the head. A set of three sparking devices is mounted to the mandibular component of a light, relatively non-constraining extra-oral harness and another set of three sparkers is attached to the harness's cranial or skull component. The sparkers are fired sequentially by a multiplexer and the sound associated with each firing is recorded by an array of three or more microphones. Computations based on the known speed of sound are used to evaluate the distances between the sparkers and the microphones. These data can then be transformed by computer to provide numeric or graphic information on the movement of selected mandibular landmarks with respect to the skull. Total elapsed time between the firing of the sparkers and the display of graphic information need not exceed 30-60 seconds using even a relatively modest modern computer. (22 refs.)

110105 Transverse forces on a finger tendon analyzed using transmission ultrasound imaging. P.Dev, K.W.Marich, V.R.Hentz (Rehabilitative Engng. Res. & Dev. Center, Veterans Adminstration, Palo Alto, CA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.262-6 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
Transmission ultrasound imaging (TUS) with the SRI camera has been used to visualize the index finger flexor tendons in live hands during flexion-extension movements. The digitised data on tendon trajectory is analysed to obtain tendon curvature. Assuming the tendon to be frictionless, the relative transverse forces on the tendon are computed. The distribution of these forces along the tendon, and the changes in this distribution, indicate how tendon force may be transmitted to the bone to cause movement. (2 refs.)

110106 Imaging modalities [medical]. A.Moss (Dept. of Radiology, Univ. of California, San Francisco, CA, USA).
IEEE Trans. Med. Imaging (USA), vol.MI-1, no.4, p.215-19 (Dec. 1982). [received: Sept. 1983]
A review of ultrasound, X-ray computed tomography and NMR is given. Ultrasound has the advantages of portability, harmlessness and real-time data acquisition. NMR also is probably harmless. Computed tomography has the best spatial resolution while the main advantage of NMR scanning is improved contrast discrimination between tissues. The particular organs/systems that these techniques are best for are discussed. (no refs.)

110107 Medical diagnosis by ultrasound. A.Trono.
Elettrotecnica (Italy), vol.70, no.4, p.315-20 (April 1983). In Italian.
Describes the principles of ultrasound generation and the mechanism of its propagation through human tissue. Outlines the basis of ultrasound assisted diagnosis with some illustrated examples. (no refs.) *M.P.R.*

110108 In vivo measurement of thickness or of speed of sound in biological tissue structures. H.Ohkawai, S.-I.Nitta, M.Tanaka (Res. Inst. for Chest Diseases & Cancer, Tohoku Univ., Sendai, Japan), F.Dunn.
IEEE Trans. Sonics & Ultrason. (USA), vol.SU-30, no.4, p.231-7 (July 1983).
Though the wave reflected from thin biological tissue structures is affected by interference, the wave transmitted through thin tissue is not. This implies the possibility of in vivo measurement of thickness or of sound speed in thin tissue structures. Spectroscopy facilitates the measurement. Measurement of these quantities are presented for plastic plates, and for in vivo thickness measurement of the mitral valve and in vivo measurement of the aortic and tricuspid valves of dog hearts. The values obtained for the thickness of the valves from in vivo and from in vitro acoustic measurements by this method and from micrometer measurement of the excised tissues compare favorably. (9 refs.)

110109 Experiments in automatic classification of laryngeal pathology. M.Mezzalama, P.Prinetto, B.Morra (Istituto di Elettrotecnica Generale, Politecnico di Torino, Torino, Italy).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.5, p.603-11 (Sept. 1983).
Addresses the problems of the automatic classification of laryngeal pathology using a quantitative measure of voice-extracted parameters. Preliminary results show that a proper selection of these parameters guarantees a satisfactory discrimination capability. The selected features for classification purposes are discussed and a model of the speech production system in the case of laryngeal pathologies is presented. (16 refs.)

110110 Automated apnoea detection by computer: analysis of tracheal breath sounds. J.Peirick, J.W.Shepard,Jr. (Geriatric Res., Education & Clinical Centre, St. Louis VA Medical Centre, St. Louis, MO, USA).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.5, p.632-5 (Sept. 1983).
Complete polygraphic evaluation of sleep involves considerable equipment, expense, and personnel time for the collection and analysis of the data. An automated method of reliably evaluating patients for sleep apnoea using a minimum of apnoea detection equipment and personnel time would be clinically useful. Such a method has been devised, using tracheal sound as the physiological indicator of apnoea. Tracheal sound is monitored by a microcomputer, which detects periods of low tracheal sound corresponding to a lack of airflow. Periods of low tracheal sound which last 10s or longer are recorded overnight and stored for review by the user at any time. This tracheal sound method of apnoea detection has been compared with data obtained during polygraphic sleep studies utilising thermistors to detect airflow and an ear oximeter to monitor arterial oxygen saturation. The results compare favorably, and although tracheal sound detection introduces some error into apnoea detection, it can be seen that tracheal sound detection can be a useful screening tool to indicate patients in need of more detailed sleep study. (5 refs.)

110111 Real-time acquisition and offline quantitative analysis of cardiac Doppler spectral data: preliminary impressions. G.W.Lighty,Jr., A.S.Pearlman (Div. of Cardiology, Univ. of Washington, Seattle, WA, USA), E.A.Howard. Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.453-6
A prototype system (OASIS) for real-time acquisition, offline storage and analysis of digital Doppler spectral information is being evaluated for clinical research applications. Using commercial hardware components and the UCSD Pascal Operating System, microcomputer-based analysis of Doppler frequency spectra parameters has the potential for improved diagnostic capabilities compared to present analytic methods. Complete Doppler study of all four cardiac valves creates about 1 Mbyte of data. If only significant flow disturbances, detected using qualitative Doppler methods, are quantitated, less data are acquired, but serial comparisons may be compromised. For large volume clinical labs, a separate acquisition system with hard disk storage and tape back-up is suggested. The ability to weight peak and mean frequency measurements by signal amplitude may improve valve gradient and orifice area estimates, while dB thresholds permit timing of prosthetic valve poppet or leaflet motion. The OASIS system represents a powerful research tool. Further software development and definition of algorithms useful in clinical setting will doubtless increase its clinical application. (7 refs.)

87.60G Laser beams, microwaves, and other electromagnetic waves

(inc. NMR; for X-rays and gamma-rays, see 87.60J)

110112 Experimental techiques for direct-contact applicators for microwave hyperthermia. F.Bardati, P.Tognolatti (Dipartimento di Elettronica, Univ. di Roma, Roma, Italy).
Alta Freq. (Italy), vol.52, no.3, p.173-5 (May-June 1983). (4th Italian National Meeting on Applied Electromagnetics, Florence, Italy, 4-6 Oct. 1982).
X- and L-band direct-contact applicators for microwave hyperthermia for cancer treatment have been developed and tested. The reflection coefficient of these applicators, when radiating into the free-space or into a simulated phantom material, has been measured. In order to evaluate the electromagnetic power deposition within biological bodies, the experimental set-ups for both electrical probes measurements and cholesteric plate thermography have been developed. (15 refs.)

110113 Apparatus for RF and microwave hyperthermia. M.Bini, A.Ignesti, L.Millanta, N.Rubino, R.Vanni (Istituto di Ricerca Sulle Onde Elettromagnetiche, CNR, Firenze, Italy), G.Lauri, A.Lenzi, M.Pace, M.Pirillo.
Alta Freq. (Italy), vol.52, no.3, p.176-8 (May-June 1983). (4th Italian National Meeting on Applied Electromagnetics, Florence, Italy, 4-6 Oct. 1982).
Research in progress at IROE and Clinica Chirurgica II for the development of apparatus for local electromagnetic hyperthermia is described. Attention is mainly focused on applicators and thermometric sensors. A 27 MHz apparatus has been developed using a novel type of applicator based on an unbalanced capacitor. Thermometry is essentially based on thermocouples. Thin-wire twisted structure and low-pass RC filter allow control of RF interference and of local temperature perturbation. (8 refs.)

110114 An introduction to medical lasers. J.M.Stamp (Dept. of Medical Phys. & Clinical Engng., Royal Hallamshire Hospital, Sheffield, England).
Clin. Phys. & Physiol. Meas. (GB), vol.4, no.3, p.267-90 (Aug. 1983).
This review deals with the following topics: why use lasers?; what is a laser?; containing and controlling laser beams; types of medical lasers; laser beam delivery systems; evaluation and safety of medical lasers; buying a laser; laser tubes; general maintenance; staff training and safety codes; future outlook. (89 refs.)

110115 Non-invasive fetal monitoring using radiotelemetry. D.J.Albert, H.J.Terry (Medical Phys. Unit, St. James's Univ. Hospital, Leeds, England).
Clin. Phys. & Physiol. Meas. (GB), vol.4, no.3, p.291-8 (Aug. 1983).
A telemetry system for noninvasive monitoring of fetal heart rate and uterine contractions is described. Fetal heart information is obtained by means of Doppler ultrasound, and contractions information using an external tocodynamometer. The more important features of the device are described in detail; the full design is available from the authors. Typical recordings are presented, and the fetal heart rate traces are compared qualitatively with those obtained by direct ECG measurement, with the patient in bed, sitting and walking. The device is now in clinical use. (5 refs.)

110116 The free-electron laser: medicine's rising star. J.T.Riordan.
Photonics Spectra (USA), vol.17, no.7, p.40, 42, 44 (July 1983).
In practical terms, the difference in the free-electron laser's operating principles makes a tremendous difference in its capabilities in comparison with conventional lasers. These differences fall into four main categories: broad tunability, excellent spot size control, excellent pulse width control, and high power density and control. The promise of free-electron lasers falls into two primary areas: laser surgery and photoradiation medicine. In the first instance, it is the extraordinary versatility and control possible with the free-electron laser that make it such an exciting development. The ability to produce a very small spot size makes it easier to get at difficult regions and remove diseased tissue with little damage to surrounding cells. In addition, the tunability of these lasers means that they can be adjusted to precisely meet the wavelength needed for a specific effect on a specific tissue. (no refs.)

110117 Study of craniofacial anomalies with a portable stereo camera. B.S.Savara, Q.D.Clarkson, J.C.Steen, G.F.Gross (Child Study Clinic, School of Dentistry, Oregon Health Sci. Univ., OR, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.2-6 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
This investigation was designed to devise an accurate topographic method for description and comparison of infants and children with craniofacial anomalies. Variations from the norm also could be studied. Biostereometrics was the method of choice. As the infants could not be brought to one central office, a portable stereo camera unit was built. Two 2 1/4″×2 1/4″ cameras were mounted on one base and synchronised to expose simultaneously with the flash unit pointed towards the ceiling. A pair of stereo photographs was obtained. The stereo photographs were used to create a face contour diagram and measured in X, Y, Z coordinates and provided quantitative data in three dimensions which can be used for comparative studies. (1 ref.)

110118 Family of calibrated stereometric cameras for direct intraoral use. S.Curry (Dept. of Growth & Dev., School of Dentistry, Univ. of California, San Francisco, CA, USA), F.Moffitt, D.Symes, S.Baumrind.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.7-14 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
In order to study empirically the relative efficiencies of different types of orthodontic appliances in repositioning teeth in vivo, the authors have designed and constructed a pair of fixed-focus, normal case, fully-calibrated stereometric cameras. One is used to obtain stereo photography of single teeth at a scale of approximately 2:1, and the other is designed for stereo imaging of the entire dentition, study casts, facial structures, and other related objects at a scale of approximately 1:8. Twin lenses simultaneously expose adjacent frames on a single roll of 70 mm film. Physical flatness of the film is ensured by the use of a spring-loaded metal pressure plate. The film is forced against a 3/16″ optical glass plate upon which is etched an array of 16 fiducial marks which divide the film format into 9 rectangular regions. Using this approach, it has been possible to produce photographs which are undistorted for qualitative viewing and from which quantitative data can be acquired by direct digitisation of conventional photographic enlargements. (6 refs.)

110119 Automated system for stereometric analysis of the human face. M.Keefe (Mech. Eng. Dept., Univ. of Minnesota, MN, USA), D.R.Riley, F.W.Worms, T.M.Speidel.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.15-21 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
A system that uses stereophotogrammetry to semi-automatically generate three-dimensional facial soft tissue surfaces is presented. The basis of the system is the stereometric technique of direct linear transformation (DLT) which is utilised to eliminate the elaborate instrumentation of present day systems. Automatic digitising using a scanning image analyser requires no hand digitising, and a lightweight headframe provides orientation information for use in evaluating facial changes. The system is computer based to provide graphic images of the resulting data to ease understanding and to provide the beginnings of a large data base concerning human facial form. (6 refs.)

110120 Rapid three-dimensional measurements in clinical dentistry—a new approach. G.W.Butcher, C.D.Stephens (Univ. of Bristol Dental School & Hospital, Bristol, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.36-40 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
The conventional method for measuring small objects in three dimensions utilising close range stereo photogrammatic techniques is complex and time consuming. A recent development called the reflex metrograph allows an unskilled operator to collect three dimensional co-ordinates both simply and rapidly. A clinical application to compare in vivo and in vitro measurements showed a similar level of precision. The results compare favourably with a conventional approach. (11 refs.)

110121 Three-dimensional stereometric measurement system using optical scanners, cylindrical lenses, and line sensors. Y.Yamashita (Dept. of Biomedical Engng., School of Medicine, Tokai Univ., Kanagawa, Japan), N.Suzuki, M.Oshima, Y.Yamaguchi.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.67-73 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
A simple and low-cost 3-dimensional stereometric measurement system has been developed which measures the shape of the object by means of trigonometry. This system is composed of an X-Y optical scanner, cylindrical lenses and line sensors. A laser beam is incident on an object and is scanned over the area of interest by the optical scanner. Cartesian coordinates of a laser spot hit by the laser beam in a three dimensional space are determined simply and at high speed through the combined use of cylindrical lenses and line sensors. The cylindrical lens makes a line focus and, therefore, the coordinates of a light spot are projected onto a line orthogonal to the axis of the cylindrical lens. The position of the line focus in a line sensor can easily be measured by detecting the photo-cell which indicates the maximum output. Preliminary experiments suggest that the shape of the human torso surface can be measured with fairly good accuracy. (4 refs.)

110122 Contouring of tooth imprints by means of a fluorescence technique adapted to a spatially filtered moire illumination. F.H.M.Jongsma, P.Lambrechts, G.Vanherle (Dept. of Biophys., Univ. of Limburg, Maastricht, Netherlands).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.76-80 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
A technique has been developed to produce plane equidistant contouring surfaces on tooth-imprints. This technique consists of spatially filtering a negative obtained by photographing the print under a moire illumination. Unfortunately this technique turned out to be very sensitive for a non-uniform surface reflectivity. To obtain an object-brightness depending only upon the contouring mechanism, the imprint has been coated with a fluorescent dye. A HeCd-laser (λ=422 nm) served as a lightsource for the projection of the moire interference pattern on the imprint. The radiation of the fluorescent coating (λ=530 nm) is used to form an image on the negative. In this way the surface with specular reflection properties is transformed into a Lambertian surface. The spatial filtering technique allows multiple exposures of the final negative enabling an increased depth of field. Contour mappings with a resolution in depth of less than 10 μm have been obtained. (8 refs.)

110123 Automatic topography using high precision digital moire methods. T.Yatagai, M.Idesawa, S.Saito (Inst. of Phys. & Chem. Res., Saitama, Japan).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.81-8 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
Three types of moire topographic methods using digital techniques are proposed. Deformed gratings obtained by projecting a reference grating onto an object under test are subjected to digital analysis. The electronic analysis procedures of deformed gratings described enable one to distinguish between depression and elevation of the object, so that automatic measurement of 3-D shapes and automatic moire fringe interpolation are performed. Based on the digital moire methods, the authors have developed a practical measurement system, with a linear photodiode array on a micro-stage as a scanning image sensor. Examples of fringe analysis in medical applications are presented. (21 refs.)

110124 Studying abdomen size and shape variations during pregnancy: an application of moire topography. G.E.Karras (Lab. of Photogrammetry, Nat. Tech. Univ. of Athens, Athens, Greece), K.N.Tympanidis.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.89-91 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
The biostereometric study of body changes can lead to valuable information regarding the metabolism and the physiological development of pregnancy as well as the well-being of the foetus. In this contribution a technique for the calculation of abdomen volume variations from measurements on moire photographs is outlined and experimental results are presented. (4 refs.)

110125 Moire techniques in biomedical case studies. O.D.D.Soares (Centro de Fisica, Faculdade de Ciencias do Porto, Porto, Portugal).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.92-8 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
Optical metrology of three-dimensional objects is a subject of major interest for science and technology. Several methods have been proposed and research is being pursued on the study of various principles. The method described employs a coded illumination of the three-dimensional space by fringes projection and the information of the object is decoded with a moire technique. The principle of the method covers a large spectrum of applications. The emphasis for practical applications is given in the field of biomedical studies. The analysis of dismorphosises in static (anatomy) and dynamical (functional) situations is presented, in particular for the study of feet-system and locomotor movement, face aesthetic morphology and trunk studies. Capabilities and advantages of the method are described and demonstrated including video recording. (15 refs.)

110126 Reconstruction of anatomical shapes from moire contourographs. G.G.Saunders (Medical Engng. Resource Unit, Univ. of British Columbia, Vancouver, BC, Canada).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.99-106 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
A moire system which rotates an object in front of a slit camera has been used to obtain continuous photographic maps around amputee socket and shoe last shapes. Previous analysis methods required the use of IBM 370 hardware and extensive software overhead. Using a systematic manual digitising technique and user-interactive FORTRAN software, the shape reconstruction has been easily performed on a PDP-11 minicomputer system. Both the digitising technique and the software are oriented towards the shape reproduction process. Numerically controlled machining parameters are used to identify a 'skewed' grid of required points along the cutter path. Linear interpolation and anti-interference techniques resulted in reproduction of shoe lasts to within 0.05 inches (1.2 millimetres) from the sensing axis. Difficulties were experienced in obtaining information to resolve the ends of the shapes. Current efforts focus on circumferential shape sensing of live subjects and automatic digitisation of sensed data. (6 refs.)

110127 Measurement of kyphosis using moire topography. B.Drerup (Orthopadische Univ., Abteilung Biomech., Munster, Germany).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.107-10 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
Contour line patterns, as they are produced by moire topography are dependent on position, posture and body shape of the patient. For all medical applications data are needed, which are only dependent on shape and posture and which therefore are independent on positioning. The measurement of the kyphotic angle from topograms can be performed to meet these requirements and to yield results, which are independent of positioning. Different techniques for measuring this angle are discussed. Digitisation and reconstruction of profiles from moire topograms are presented. In order to get reproducible results, landmarks are needed on the body surface. Landmarks may be found either by palpation or by analytical investigation of the back shape. Here, the inflection points of the sagittal back profile are taken as intrinsic landmarks. Their relation to anatomical landmarks, which are found, e.g. by palpation, is studied. (4 refs.)

110128 Analysis of scoliosis by back shape topography. A.R.Turner-Smith, J.D.Harris (Oxford Orthopaedic Engng. Centre, Univ. of Oxford, Oxford, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.111-15 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
The use of surface topography for the assessment of scoliotic deformity in the clinic depends firstly on the quality of measures which reliably characterise deformity of the back, and secondly on the ease and speed with which these measures can be applied. A method of analysis of back shape measurements is presented which can be applied to any topographic measurement system. Measures presented are substantially independent of minor changes in the patient's posture in rotation and flexion from one clinic to the next, and yet sensitive enough to indicate significant improvement or degeneration of the disease. The presentation shows (1) horizontal cross-sections at ten levels up the back from sacrum to vertebra prominens; (2) angles of rotation of the surface over a small region about the spine; (3) three vertical profiles following the line of the spine; and (4) measures of maximum kyphosis and lordosis. Extreme care in positioning the patient is unnecessary and those spinous processes which are easily palpable, the vertebra prominens and the two dimples over the posterior superior iliac spines are marked. Analysis proceeds entirely automatically once the basic shape data have been supplied. Applications of the technique to indirect moire topography and a television topographic measurement system are described. (22 refs.)

110129 Stereophotogrammetric method for breast cancer detection. D.B.Sheffer, R.E.Herron, W.M.Morek, F.Proietti-Orlandi (Inst. for Biomed. Engng. Res., Univ. of Akron, Akron, OH, USA), C.W.Loughry, R.H.Hamor, R.A.Liebelt, R.S.Varga.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.120-4 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
This study reports on 29 patients (58 breasts), selected in a stratified manner to include 7 cancers, 13 benign tumours and 38 apparently normal breasts, that were subjected to biostereometric analysis. This process consisted of analysis in a blind setting of contour mammograms made from stereophotographs of the breast which resulted in the correct identification of all 7 cancers, 11 of the 13 benign tumours and 30 of the remaining 38 normal breasts. There were 8 false positives identified. This study, in conjunction with a previous study, indicates that the biostereometric analysed contour mammograms have the potential to be developed into a process for breast cancer screening. Suggested areas for further study include volume differences in individual breasts as well as the volume differences in individual breast slices and their relationship to breast pathology. (6 refs.)

110130 Automatic measurement of body surfaces using rasterstereography. E.Hierholzer, W.Frobin (Abteilung Biomech., Orthopadische Univ. Munster, Munster, Germany).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.125-31 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
The measurement of three-dimensional body shape is of considerable interest in orthopaedic applications, for example the assessment of spinal deformities from the shape of the back surface. At present these measurements are mostly carried out using optical methods such as stereophotogrammetry or moire topography. The image data acquisition is generally performed by hand. However, due to the large number of measurement points necessary for a satisfactory representation of a surface, this procedure is very tedious and time consuming. In contrast to this, rasterstereography using a line raster enables considerable time savings by automated image scanning. The method of rasterstereography is briefly explained. Due to the simple structure of line rasterstereographs an automatic image evaluation is relatively easy. The evaluation procedure consisting of image scanning (using a CCD sensor camera), line detection, line pattern analysis and three-dimensional surface reconstruction is outlined. Examples of back surface measurements in the case of spinal deformities are presented. (4 refs.)

110131 Holographic three-dimensional hard copy for medical computer graphics. B.E.Keane (Dept. of Medical Phys., Royal Sussex County Hospital, Brighton, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.164-8 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
A computer graphics array may contain all the information required for a three-dimensional display but conventional VDUs (video display units) and printers can only provide a flat image. The problem is approached by converting the computer output into a form suitable for synthesis of a volume hologram. Suitable methods and apparatus are discussed and typical results presented, including CT (computer tomography) scan in radiotherapy treatment planning and radiological architecture applications. (3 refs.)

110132 Television scanning technique for topographic body measurements. A.R.Turner-Smith (Oxford Orthopaedic Engng. Center, Univ. of Oxford, Oxford, England).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.279-83 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
A television/computer system is used to measure the apparent distortion of a line of light as it is scanned over an object. A projector and camera are fixed relative to one another in a swinging frame which rotates at a constant speed through a vertical arc. The displacement of the line in the television picture is a function of the distance of the object from an imaginary cylinder about the axis of rotation, while the position of the frame is also read by the television interface from a spot inserted into the video signal. The geometrical configuration of camera, projector and frame allows simple analysis of the data to yield an output consisting of scattered three-dimensional points. Calibration is achieved by measuring an object of known dimensions. The use of the system is illustrated by application to a project for the assessment of scoliotic deformity of the back. (20 refs.)

110133 Algorithms for two-camera video motion analysis. J.Au, J.Pugh (Dept. of Orthopaedics, Hospital for Joint Diseases Orthopaedic Inst., New York, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.314-20 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
The efficiency of any motion analysis is largely dependent on the software generated for the specific purposes intended. Many of the problems in acquiring and analyzing data with computers of limited memory can be circumvented by clever algorithms. Several algorithms for two-camera video motion analysis are discussed in detail. These algorithms are intended for resolution of problems that include video ghosts, blockage of data points by extraneous movement of ancillary body parts, statistical techniques to improve accuracy, efficient searching routines, and calibration programs. All of these algorithms have been implemented as specific programs in a complete system intended for the analysis of the parameters of human motion. (5 refs.)

110134 Contour photography of the optic nerve head: stereometric basis. J.M.Shapiro (Dept. of Ophthalmology, Boston Univ. School of Medicine, Boston, MA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.322-3 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
Considers the relationships among the variables which determine the stereo base in contour photography. It is shown how the coefficient of variation of the topographic measurements may be minimized. (no refs.)

110135 Stereo measurement of the ocular fundus in ophthalmology. T.Takamoto, B.Schwartz (Dept. of Ophthalmology, Tufts-New England Medical Center, Boston, MA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.324-9 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
Glaucoma, a common cause of blindness, can be detected in the early stages by studying topographic changes or cupping in the optic disc. The direct observation of fundus using an ophthalmoscope or the evaluation of the disc in fundus photographs has been primarily subjective, differing considerably from observer to observer. The authors have, therefore, developed an objective quantification technique—the photogrammetric radial section method, which can quantitate not only cupping or swelling of the optic nerve, but also the growth of tumor or the development of posterior staphyloma in the myopic eye. With the radial section method the authors have computed a new cup parameter, slope, from stereopairs of five normal eyes. The averages of the coefficients of variation for the following parameters, derived from measurements of the cup slopes of five normal eyes, were: 3.3% for the peripapillary retina; 5.7% for the neural rim; 3.1% for the cup wall; and 4.0% for the cup bottom. (14 refs.)

110136 Diagnostic NMR. R.W.Redington (Corporate Res. & Dev. Center, General Electric Co., Schenectady, NY, USA).
IEEE Trans. Med. Imaging (USA), vol.MI-1, no.4, p.230-3 (Dec. 1982). [received: Sept. 1983]
A general discussion of diagnostic NMR is given including in vivo chemical shift spectroscopy and NMR imaging. The way in which General Electric became involved in diagnostic NMR is described. (3 refs.)

110137 A NMR tomograph electromagnet design. P.Holec.
Elektrotech. Cas. (Czechoslovakia), vol.34, no.7, p.458-70 (1983). In Czech.
The paper deals with magnetic field homogeneity problems of NMR tomography. The differences between idealized and real conditions are analyzed and a new construction is presented, allowing one to find the optimum position of electromagnet coils by a simple algorithm. (11 refs.)

110138 A combined light and scanning electron microscopy on human urinary cytology. H.Kumon, Y.Nasu, Y.Matsumura, H.Ohmori (Dept. of Urology, Okayama Univ. Medical School, Okayama, Japan), T.Tanaka.
J. Electron Microsc. (Japan), vol.32, no.1, p.27-32 (1983).
Approximately 250 bladder-washing and voided urine specimens from normal, and inflammatory and malignant lesions were examined using light microscopy (LM), scanning electron microscopy (SEM) and a newly-designed mesh. This mesh, containing 42 compartments in 25 mm^2 on gelatine-coated glass-slip, permitted the authors to directly correlate LM and SEM images. With SEM, malignancy of exfoliated urothelial cells mainly depended on the presence or absence of pleomorphic cytology was proposed. (13 refs.)

110139 Microwave thermography—characteristics of waveguide applicators and signatures of thermal structures. M.Robillard, M.Chive, Y.Leroy (Centre Hyperfrequences et Semiconducteurs, Univ. des Sci. et Tech. de Lille I, Villeneuve d'Ascq, France), J.Audet, Ch.Pichot, J.Ch.Bolomey.
J. Microwave Power (Canada), vol.17, no.2, p.97-105 (June 1982).
Studies the problem of the interpretation of the signals provided by microwave thermography, which allows the detection of the thermal gradients in living tissues. These signals correspond to the thermal noise measured by a radiometer when the probe scans the surface of the tissues (passive process).

The paper describes how these signals can be computed by means of a new method based on the antenna reciprocity principle. This process requires a knowledge of the electrical field distribution in the lossy medium when the applicator is radiating a microwave signal (active process). Examples of computations of the thermal signals and experimental verifications are presented. Then, the paper introduces a new concept of 'thermal signature' and shows how it is possible to reach a quantitative interpretation of the thermal signals such as those obtained in clinical investigations (thermal pattern recognition). (29 refs.)

110140 The role of thermal imaging in the diagnosis, treatment and prognosis of pain. R.Rizzi (Dept. of Anaesthesia, Reanimation & Pain Therapy, Regional Hospital of Vicenza, Vicenza, Italy), F.Merlo.
Medicamundi (Netherlands), vol.27, no.3, p.133-5 (1982).
A report is presented on the use of thermography in a pain therapy centre. The technique offers safe and non-invasive method for the diagnosis and prognosis of a wide spectrum of pain associated with disorders of the somatic nervous system and the vegetative system, and forms a valuable aid to treatment. The results obtained are demonstrated with the aid of several thermograms. (5 refs.)

110141 Microprocessor-based image processing system for dynamic foot pressure studies. C.I.Franks, R.P.Betts, T.Duckworth (Royal Hallamshire Hospital, Sheffield, England).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.5, p.566-72 (Sept. 1983).
A microprocessor-based system is described for data capture and analysis of dynamic foot pressure images. A run-length encoding video digitiser captures up to 32 frames at a rate of 25 per second and stores the data in memory. These data are displayed on a colour monitor and can be analysed to produce pressure against time curves or printed or plotted as isopressure contour plots. (9 refs.)

110142 Analysis of resonant coupled coils in the design of radio frequency transcutaneous links. N.deN.Donaldson, T.A.Perkins (Medical Res. Council, Neurological Prostheses Unit, London, England).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.5, p.612-27 (Sept. 1983).
A theory of coupled resonant coils has been developed which makes possible the design of radio frequency transcutaneous links of simultaneously high overall efficiency and good displacement tolerance while keeping circuitry simple (particularly in the implanted receiver). Series-tuned transmitter coils were used, obtaining high efficiency. In the first example a stimulator which has excellent displacement tolerance because it works at critical coupling is designed. The second example shows how the theory was used when the voltage in the implant was regulated. The design process involves ad hoc compromises between disparate quantities (e.g. efficiency against voltage transfer ratio), rendering a standard design procedure unsuitable. Fortunately, the derived theoretical formulae are simple enough for every design to be considered from fundamentals, based on coil parameters. Extensive coil loss data are presented here for the frequency band 0.2 to 20 MHz. (10 refs.)

110143 Radiofrequency-induced hyperthermia: computer simulation of specific absorption rate distributions using realistic anatomical models. D.W.Armitage (Dept. of Electronic Engng. Sci., Univ. Coll. of North Wales, Bangor, Wales), H.H.LeVeen, R.Pethig.
Phys. Med. & Biol. (GB), vol.28, no.1, p.31-42 (Jan. 1983). [received: Sept. 1983]
A description is given of a computer simulation technique which predicts the specific absorption rate (SAR) distribution within the human body resulting from the application of radiofrequency electromagnetic energy. The method uses an extension to the principle of over-relaxation of electric potentials and the basis of the simulation is a realistic three-dimensional model derived from both dielectric and anatomical data. Two of the principal means of applying radiofrequency hyperthermia, namely the use of capacitive electrodes and inductive coils, have been provided for. The accuracy of the simulation has been favourably tested using an agar split-phantom and an infrared thermograph camera. The simulations can be used to assist the design and clinical use of radiofrequency applicators, and examples are given of the application of both an inductive coil and switched capacitive electrodes to heat the thorax. (28 refs.)

110144 Imaging system using gradient index fibers: a tutorial. [Medical imaging]. T.R.Hsing (Telecommunication Res. Lab., Waltham, MA, USA).
Proceedings of the Second International Conference and Workshop on Picture Archiving and Communication Systems (PACS II) for Medical Applications, Kansas City, MO, USA, 22-25 May 1983 (New York, USA: IEEE 1983), p.46-53 (24 refs.)

4th Italian National Meeting on Applied Electromagnetics ....See Entry 105009

Biostereometrics '82 ....See Entry 105016

Imaging modalities [medical] ....See Entry 110106

87.60J Corpuscular radiation and radioisotopes

(inc. X-rays and gamma-rays)

110145 Stereotactic implantation of radioactive sources for the treatment of brain tumours. C.Karolis (Dept. of Medical Phys., Prince of Wales Hospital, Randwick, NSW, Australia), P.S.Reay-Young, F.C.G.Southon, J.Matheson.
Australas. Phys. & Eng. Sci. Med. (Australia), vol.6, no.2, p.59-63 (April-June 1983). [received: Aug. 1983]
The authors discuss their experiences in the treatment of recurrent brain tumours with Au-198 seeds in temporary implants. Included in the discussion is a description of stereotactic geometry and instrumentation; the application of computerised axial tomography for planning; the efficacy of the authors' choice of isotope and method and the radiation protection problems encountered with the procedure. The authors conclude that this treatment has a role to play in the management of selected brain tumours, but would recommend the use of after loading techniques and high activity I-125 to minimise radiation protection problems. (5 refs.)

110146 Examination of vocal fold movement by ultra-short pulse X-radiography. N.J.Noscoe (Dept. of Oncology, Middlesex Hospital Medical School, London, England), A.J.Fourcin, N.J.Brown, R.J.Berry.
Br. J. Radiol. (GB), vol.56, no.669, p.641-5 (Sept. 1983).
Antero-posterior radiographs of the larynx lack spatial and temporal resolution, due to the movement of the vocal folds during phonation. By utilising the electrolaryngograph to monitor vocal fold movement, single X-ray pulses of 30 nanoseconds duration have been triggered at predetermined points during the cycle of vocal field movement to visualise these in normal phonation. (8 refs.)

110147 Fast neutron therapy at Edinburgh: staff protection. D.E.Bonnett (MRC Cyclotron Unit., Western General Hospital, Edinburgh, Scotland).
Br. J. Radiol. (GB), vol.56, no.669, p.665-72 (Sept. 1983).
The major hazards encountered by staff using neutrons for radiotherapy are discussed. Specific reference is made to the experience gained at the MRC Cyclotron Unit at the Western General Hospital, Edinburgh, using neutrons generated by the d(15 MeV)+Be reaction. The neutron therapy facility consists of a cyclotron and both a fixed horizontal and an isocentric therapy beam, and staff protection during five years' operation is reviewed. Levels of induced activity in the cyclotron and therapy equipment are reported and problems of radioactive contamination discussed. Summaries of whole-body and finger dose equivalents received by engineering staff, and of whole-body dose equivalents received by physics and radiography staff, are presented and analysed. It is shown that, although doses received by staff are higher than for staff in an X-ray facility, they are all well below the maximum permissible levels, and it is also concluded that radioactive contamination of staff is minimal. (4 refs.)

110148 A single isotope method of post-prandial duodenogastric reflux assessment using ^{99}Tc^{m}-labelled IDA in patients with gallstones. I.A.Eyre-Brook (Dept. of Surgery, Royal Hallamshire Hospital, Sheffield, England).
Clin. Phys. & Physiol. Meas. (GB), vol.4, no.3, p.299-307 (Aug. 1983).
A technique for the quantitative assessment of post-prandial duodenogastric bile reflux is described using a single isotope ^{99}Tc^{m} and a single-channel large-field gamma camera with a data processing system. The stomach is localised with pertechnetate prior to IDA administration and duodenogastric reflux is calculated as the percentage of hepatic IDA output reaching the stomach after correction for background activity and hepatic overlap. The technique has been validated, and used to study reflux in 25 patients with gallstones and in 10 control patients. Gall bladder function was assessed with an oral cholecystogram. Marked reflux ($>7\%$) occurred in 5 out of 9 patients with a nonfunctioning gall bladder, but in no controls and in none of 16 patients with gallstones in a functioning gall bladder. When patients were studied again after cholecystectomy, 2 patients with normal functioning gall bladders had developed marked reflux while those with preoperative reflux continued to reflux after cholecystectomy. Symptoms of gallstone dyspepsia before operation were more severe in those with marked reflux than those without. Surgery improved these symptoms even in those who continued to reflux after operation. (8 refs.)

110149 Roentgen stereophotogrammetry in orthopedics. G.Selvik (Dept. of Anatomy & Diagnostics Radiology, Univ. of Lund, Lund, Sweden).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.178-85 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
A system for Roentgen stereophotogrammetry has been used in Lund, Sweden, since August 1972, and by August 1982 ten thousand stereo films were evaluated using this method. The skeletal parts investigated have been permanently marked with tantalum balls 0.5 or 0.8 mm in diameter. The causes for the investigation were bone growth disorders in the lower extremity (134 patients), spinal fusions (35 patients), high tibial osteotomies for gonarthrosis (21 patients) and endoprosthetic replacement of the knee (68 patients) or hip (42 patients) joint. By Roentgen stereophotogrammetric analysis (RSA), information on, for instance, the development of angular deformities and staple loosening in the leg, the healing process of the intended fusion in the spine or at the knee, and on the migration and stability of prosthetic components, have been obtained. RSA is of value both for prognostic and follow-up purposes, and is versatile enough in a proper setting to be used for routine clinical investigation. (58 refs.)

110150 Single image X-ray photogrammetry system used to detect total joint loosening. F.G.Lippert, S.A.Veress, R.M.Harrington, T.El-Garf (Dept. of Orthopaedics, Veterans Administration Medical Center, Seattle, WA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.186-92 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
Loosening is the number one complication of total joint replacements. A direct method of measuring small motions between the prosthetic implant and the surrounding bone would allow the surgeon to evaluate replacement surgery or activity restrictions. Single plane X-ray photogrammetry uses stainless steel markers in the bone and prosthetic implant and a control frame in order to accomplish this measurement. Testing of models representing a total hip replacement and total knee replacement has shown that displacements can be measured with a root mean square error of less than 0.2 mm. (no refs.)

110151 Method for determining in-vivo ligament lengths from biplanar X-rays with incomplete data. T.S.Buchanan (Biomed. Engng. Center, Northwestern Univ., Evanston, IL, USA), A.F.Mak, J.L.Lewis.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.193-9 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
A noninvasive biplanar radiographic technique for in-vivo determination of ligament lengths is presented. By taking biplanar X-rays of a human subject joint and locating the images of prominent bony reference points on the films, the three-dimensional locations of these points are determined. A unique scaling method is employed that compares the coordinates of the reference points with those previously obtained from a cadaver. Scaling equations that describe the subject joint in terms of the cadaver joint allow reference points to be clearly visible in only one X-ray view. The origin and insertion of ligament points from the cadaver are mapped onto the subject's joint and the ligament length is taken as the distance between the two. An application of this technique to the human knee joint is presented. (7 refs.)

110152 Dedicated stereophotogrammetric X-ray system for craniofacial research and treatment planning. S.Baumrind (Dept. of Growth & Dev., School of Dentistry, Univ. of California, San Francisco, CA, USA), F.Moffitt, S.Curry, R.J.Isaacson.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.200-9 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
The authors have constructed and brought into use what they believe to be the first dedicated coplanar craniofacial stereometric X-ray system for clinical use. Paired Machlett Dynamax 50/58 X-ray tubes with 0.3 mm focal spots are employed. Displacement between emitters is 16 inches. The focus film distance for both emitters is 66.5 inches. The mid-sagittal plane to focus distance is 60 inches. One film of each stereo pair conforms with the standards of the Second Roentgenocephalometric Workshop and can be used to make all standard two-dimensional orthodontic and cephalometric measurements. When supplemented by data from the conjugate film, a three-dimensional coordinate map can be generated as a machine operation. Specialized complementary software has been developed to increase the reliability of landmark location both in two and in three dimensions. (5 refs.)

110153 Stereoentgenographic system with portable calibration cage for use in clinical medicine. F.Moffitt (Dept. of Civil Engng., Univ. of California, Berkeley, CA, USA), Baumrind S., N.Chafetz, S.Curry.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.210-16 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
For the past five years, the authors have been accumulating information on the performance of a stereoentgenographic system developed for use in clinical medicine and first reported at the NATO Symposium on the Application of Human Biostereometrics (Paris, 1978). This system represents an adaptation of normal case coplanar stereometry and involves the use of a single emitter which is displaced in a controlled fashion between exposures. The system has been used primarily for the detection of applicance loosening and settling following the placement of total hip protheses and also for the detection of pseudorthosis following lumbo-sacral fusion. One major goal has been the development of a data acquisition and analysis system suitable for general hospital use which can be operated by technicians without specialized photogrammetric training. This report focuses on system design and on the delineation of technical problems encountered during routine clinical use of the system. (5 refs.)

110154 Establishing quantitative within-subject confidence limits for clinical stereoentgenographs. E.L.Korn (Dept. of Biomaths., School of Medicine, Univ. of California, Los Angeles, CA, USA), S.Baumrind, N.Chafetz, N.Curry, F.Moffitt.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.217-23 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
It is not quite clear that under ideal conditions, discrete points can be located on X-ray films with standard deviations of less than 50 μ. However, under routine clinical conditions, such considerations as individual variation in anatomy, movement of the subject between exposures, and variations in image quality combine to produce considerable reductions in the confidence which can be placed in quantitative assessments made from stereoentgenographic films. This paper discusses some considerations involved in designing mathematical models in such a way as to optimize the use of imperfect data in answering specific clinical questions. (13 refs.)

110155 Accuracy of stereometry in assessing orthognathic surgery. G.E.King, R.A.Bays (Dept. of Biomed. Engng., Medical Coll. of Georgia, Augusta, GA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.224-8 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
An X-ray stereometric technique has been developed for the determination of 3-dimensional coordinates of spherical metallic markers previously implanted in monkey skulls. The accuracy of the technique is better than 0.5 mm. and uses readily available demountable X-ray equipment. The technique is used to study the effects and stability of experimental orthognathic surgery. (3 refs.)

110156 X-ray photogrammetry for endocavitary radiation therapy. E.Baj Agnoletto (Istituto di Topografia Fotogrammetria e Geofisica, Politecnico di Milano, Milano, Italy), U.Cerchiari, A.E.Sichirollo.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.229-32 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
X-Ray photogrammetry has been applied to reconstruct the disposition of the radioactive sources in a patient to be treated by endocavitary radiation therapy. It is concluded that the X-ray photogrammetric method has enabled improvements to be madè compared with previous dosimetric studies. Moreover it enables one to evaluate the errors made in the plotting of radioactive sources and to correct the results obtained. (5 refs.)

110157 Advances in nuclear medicine. R.G.Evens (Mallinckrodt Inst. of Radiology, Washington Univ., St. Louis, MO, USA).
IEEE Trans. Med. Imaging (USA), vol.MI-1, no.4, p.223-5 (Dec. 1982). [received: Sept. 1983]
The author tries to put into clinical relevance a portion of diagnostic imaging. He discusses nuclear medicine, which did not really come about until after World War II. He gives an introduction to, and discusses the clinical use of, this branch of medicine. Over the last twenty-five years the major improvements have been in the technology of what is injected. Highly sophisticated radiopharmaceuticals have been utilized to go to specific organs, along with real improvements in the electronic imaging devices used. (no refs.)

110158 Relationship between regional pertechnetate cerebral circulation time and EEG in patients with cerebral infarction. U.Tolonen, A.Ahonen (Dept. of Clinical Neurophysiology, Univ. of Oulu Central Hospital, Oulu, Finland).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.2, p.125-32 (Aug. 1983).
The qualitative and regional correlations between the EEG and the cerebral circulation time (CCT), obtained by using intravenously injected pertechnetate and a multidetector device, were studied in 75 patients with supratentorial cerebral infarction. Overall good correlations could be demonstrated between both inter- and intrahemispheric CCT abnormalities and the EEG, though not in all patients. The number of patients with pathological CCT findings showed a tendency to increase with increasing severity of the EEG abnormality. The number of abnormal CCT areas per patient (indicating the size of the circulation disturbance) also increased significantly with increasing severity of the EEG disturbance. The present study on cerebral infarction, though using intravenously injected pertechnetate for the CCT measurement, showed a reasonable correspondence with earlier reports on the relationship between the EEG and either the cerebral blood flow or the CCT (obtained by intraarterially injected isotope). This would seem to suggest that the non-invasive method used for regional CCT measurement has potential for evaluation of cerebral haemodynamics. (22 refs.)

110159 Radioisotopes for the treatment of cancer. C.B.G.Taylor (IAEA Lab., Seibersdorf, Austria).
Int. At. Energy Agency Bull. (Austria), vol.25, no.2, p.3-6 (June 1983).
Gives a short history of radiotherapy for cancer, particularly of the cervix. Teletherapy techniques and equipment are discussed. (no refs.)

110160 A modern universal angiography installation with a 14 in. image intensifier. H.C.Rucker (Radiologische Abteilung, Klinik Roderbirken, Leichlingen/Rhld., Germany), M.K.Jalloul.
Medicamundi (Netherlands), vol.27, no.3, p.111-18 (1982).
Modern technological refinements enable all vascular regions to be examined using medium-format fluorography, combined with a 14 in. image intensifier. A versatile angiography system is described in which a large-field image intensifier and a generator with automatic dose-rate control enable examinations to be carried out efficiently, and with the minimum of stress for the patient. The design of the system also permits optimal integration of digital subtraction angiography. (8 refs.)

110161 Computerized dual-energy imaging: a technical description. J.Coumans, J.Kosanetzky (Philips Res. Lab., Hamburg, Germany), F.W.Zonneveld.
Medicamundi (Netherlands), vol.27, no.3, p.125-32 (1982).
X-ray attenuation is material- and energy-dependent. In general, energy dependence is ignored, or regarded as understandable, because it leads to unwanted spectral artifacts and unreliable quantitative values in computed X-ray images. This article describes the practical application of energy dependence in computed tomography and computed radiography for providing reliable quantitative image information, inherently free of spectral artifacts, in addition to the usual qualitative visual information. A switched-voltage dual-energy technique is employed. Some of the new diagnostic possibilities offered by the technique are discussed, including the synthesis of mono-energetic images with enhanced contrast, and bone/soft tissue densitometry. (9 refs.)

110162 Image reconstruction methods from transaxial tomographic samples: frequency domain techniques. C.R.Padron (Univ. Politecnico de Madrid, Madrid, Spain), M.A.M.Fernandex, J.A.Martin Pereda.
Mundo Electron. (Spain), no.131, p.93-100 (Sept. 1983). In Spanish.
Transaxial tomography is a radiographic technique that provides an image of an isolated two-dimensional section of a three-dimensional object. The basic principles of this technique and a general view of the reconstruction methods based on Fourier analysis are reviewed; discrete versions for the treatment with digital computers are also shown. (14 refs.)

110163 New method to calculate the renal transit time spectrum from conventional three-probe renography. R.Gullquist, H.Abrahamson, R.Brandt (Dept. of Clinical Physiology, St. Erik's Hospital, Stockholm, Sweden), J.Philip, T.Strandell.
Med. & Biol. Eng. & Comput. (GB), vol.21, no.5, p.599-602 (Sept. 1983).
A model of the kidneys and the systemic blood pool is constructed to derive the renal transit time spectrum from data obtained from three-probe renography. The transit time spectrum is derived by a deconvolution technique based on the maximum likelihood method. The computations were done on a microcomputer, and the c.p.u. time for solving two transit time spectra was mostly less than 5 min when 50 averaged sample points per measuring detector were used. The method is shown to be very insensitive to statistical noise, which is generally a problem using deconvolution techniques. The averaging of samples was done to save memory and reduce c.p.u. time, but no further filtering procedure or blood background subtraction was needed prior to execution of the algorithm. (8 refs.)

110164 Spot-camera of Medicor Works, type: SPOT-1. M.Csontos.
Medicor News (Hungary), vol.15, no.4, p.87-93 (1982).
Summarizes the importance of the spot-cameras used for X-ray systems built up with an image converter and an image intensifier. The spot-camera manufactured by Medicor Works, which makes exposures on cut-film of 100 mm by 100 mm size, is described. It is suitable for making single and serial exposures. In serial operating mode the device makes two exposures in a second. The simplicity of the device, as well as the simple elimination of the pullbacks occasionally caused by the motion of the film is also emphasized. The mechanical and electrical operation of the camera, as well as its main technical data are considered in detail. (no refs.)

110165 Subsequent addition of a spotfilm camera to existing X-ray equipment with image intensifier.
Medicor News (Hungary), vol.15, no.4, p.94-6 (1982).
The BK9/6/4-1 devices of Medicor Works are single-channel X-ray systems with a TV which are suitable for fluoroscopy only. The conversion of these devices to the BK9/6/4-2B two-channel system by the addition of a spotfilm camera (type SPOT-1) is described. This conversion enables radiographs to be made. (no refs.)

110166 Tissue-air ratios and scatter-air ratios for diagnostic radiology (1-4 mm Al HVL). R.M.Harrison (Regional Medical Phys. Dept., Newcastle upon Tyne, England).
Phys. Med. & Biol. (GB), vol.28, no.1, p.1-18 (Jan. 1983). [received: Sept. 1983]
Tissue-air and scatter-air ratios for use in diagnostic radiology (1-4 mm Al HVL) have been calculated from previously reported measurements of percentage depth doses (PDD) and backscatter factors (BSF) for the same quality range. Tabulations of TAR are presented. The calculated TARs are compared with direct measurements of TAR which have been carried out by other workers. TARs and SARs are shown to be functions of peak tube potential for a given first HVL as a consequence of a similar dependence of PDD. This emphasises once again the inadequacy of the first HVL alone as a specifier of beam quality. (9 refs.)

110167 An efficient method of randomly sampling the coherent angular scatter distribution. J.F.Williamson (Dept. of Therapeutic Radiology, Univ. of Minnesota Hospitals, Minneapolis, MN, USA), R.L.Morin.
Phys. Med. & Biol. (GB), vol.28, no.1, p.57-62 (Jan. 1983). [received: Sept. 1983]
Monte Carlo simulations of photon transport phenomena require random selection of an interaction process at each collision site along the photon track. The possible choices are usually limited to photoelectric absorption and incoherent scatter as approximated by the Klein-Nishina distribution. Coherent scattering events are usually ignored. One reason for this omission is the lack of documentation in the medical physics literature concerning an efficient and accurate procedure for sampling the coherent angular scatter distribution. The authors describe a technique to accomplish this task. Although similar methods have been described elsewhere (Cashwell et al. 1973, Chan 1981), the authors feel this technique should be made more easily available to the medical physics community. (9 refs.)

110168 A general method for three-dimensional filter computation [positron emission tomography application]. B.Schorr, D.Townsend, R.Clack (DD Div., CERN, Geneva, Switzerland).
Phys. Med. & Biol. (GB), vol.28, no.9, p.1009-19 (Sept. 1983).
Application of the Fourier space deconvolution algorithm to three-dimensional (3D) reconstruction problems necessitates the computation of a frequency space filter; which requires taking the 3D Fourier transform of the system response function. In this paper, it is shown that for system response functions of the specific form $d(\theta,\phi)/r^2$, with $d(\theta,\phi)$ an angular function describing the imaging system, the filter computation can always be reduced to single integration which, in many cases, may be performed analytically. Complete expressions are derived for the general 3D filter, and two examples are given to illustrate the use of such expressions. (7 refs.)

110169 An investigation into the presence of secondary electrons in megavoltage photon beams [radiotherapy application]. P.J.Biggs, M.D.Russell (Dept. of Radiation Medicine, Massachusetts General Hospital, Boston, MA, USA).
Phys. Med. & Biol. (GB), vol.28, no.9, p.1033-43 (Sept. 1983).
The presence of secondary electrons in photon beams of ^{60}Co and 4, 8, 10 15 and 25 MV X-rays has been studied by measuring surface charge using thin window ionisation chambers. Measurements have been made for square fields from 4×4 cm^2 to 35×35 cm^2 for locations from the collimator head to a

distance of 4 m from the target. In addition, measurements have been made from rectangular fields at 10 MV and 25 MV for fields of equivalent area from 5×5 cm^2 to 25×25 cm^2. By eliminating the inverse square effect, the presence of contaminants from the head and the effect of build-up in air are clearly seen and well separated. Comparison between the curves at different energies indicates an increasing effect of contamination from the head with energy and a decreasing effect of electron production in air with increasing energy. (8 refs.)

110170 A comparison of attenuation correction methods for quantitative single photon emission computed tomography. S.Webb, M.A.Flower, R.J.Ott, M.O.Lech (Dept. of Phys., Royal Marsden Hospital, Sutton, England).
Phys. Med. & Biol. (GB), vol.28, no.9, p.1045-56 (Sept. 1983).
Transverse section tomograms of experimental phantoms and patients have been obtained using a GE 400T camera and a filtered back-projection reconstruction technique. These tomograms have been compared with the corresponding sections reconstructed from the same tomographic projection data, but using iterative algorithms with correction for photon attenuation. The comparison assesses the importance of including a correction for attenuation as well as demonstrating how closely a simple geometric attenuation correction, applied to the filtered back-projection reconstruction method, approximates to a more accurate correction incorporated in the computation of line integrals during iterative reconstruction. A comparison is also made between the behaviour of reconstruction algorithms with simulated projection data and real data in terms of convergence properties, and some shortcomings arising from simulation are noted. (15 refs.)

110171 Grid weight as an index of radiographic exposure factors. J.Hale (Hospital of the Univ. of Pennsylvania, Philadelphia, PA, USA).
Phys. Med. & Biol. (GB), vol.28, no.9, p.1075-6 (Sept. 1983).
An investigation of the catalogues of the major X-ray equipment suppliers in the United States showed that while all manufacturers provide information on grid ratio and strip density, only one gives specifications for grid weight. The author feels that this is unfortunate because this descriptor is an excellent indicator of both the clinical value of the grid for enhancing contrast and the radiographic exposure factors required for a particular grid. (2 refs.)

110172 Clinical application of auto edge detection cardiac analysis program. K.Higashi, M.Kousaka, S.Kobayashi, S.Hamada, T.Nishiki, I.Yamamoto (Dept. of Radiology, Kanazawa Medical Univ., Kahoku-gun, Ishikawa, Japan).
Radioisotopes (Japan), vol.32, no.6, p.289-92 (June 1983). In Japanese.
Using a Siemens Gamma Sonic data processing Scintiview an auto-edge cardiac analysis program (ACAP) was developed. It relies on area of interest detection using first and second differentials of the profile curve of the left ventricle. Using a weighting factor, alpha, and background subtraction, an ejection fraction is obtained. ACAP was experimentally compared to Cardiac Analysis Program II in 10 patients. Data on ejection fraction (EF), pixel number of end diastolic left ventricle, end diastolic count, end systolic count, end systolic and diastolic count are plotted, EF reproducibility with ACAP was 100%. Problems remained with alpha values of less than 0.3 and greater than 0.6 and achieving high enough counts for short data collection times. (3 refs.) *M.O.*

110173 A scaling method for a system of linear equations—its application to computerised tomography reconstructed from a small number of projection views. F.Kobayashi, S.Yamaguchi (Faculty of Engng., Tokyo Inst. of Technol., Tokyo, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part D (Japan), vol.J66D, no.5, p.549-56 (May 1983). In Japanese.
The best way to scale a matrix is to make the condition number of the transformed matrix as small as possible. From this point of view, the authors propose a new method of scaling linear equations. A coefficient matrix is transformed by an orthogonal transform procedure and then the transformed matrix is equilibrated before a linear-system solver is applied. The new method is applied to scaling numerical examples of ill-conditioned systems of equations. The convergence of the conjugate gradient method in these equations is shown to be greatly influenced by scale effects. The proposed method is useful to computed tomography reconstructed from a small number of X-ray projection views. (15 refs.)

110174 Digital cardiovascular fluoroscopy: a low cost system for development of computer analysis techniques. M.Baroni, G.Coppini, G.Valli (Inst. of Clinical Physiology, CNR, Pisa, Italy).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.497-500
Recently, in X-ray angiocardiography several advances have been made with video digital systems. However, to prevent loss of diagnostic information due to digitization, relatively high cost machines have been developed. Thus, a useful approach is to study a minimal set of specifications, trading off between spatial and temporal resolutions, and to develop flexible image processing software. With this aim, the features and performances of the digital angiographic system are presented. X-ray equipment is computer controlled to improve performance, such as the minimization of dose, quantum noise and motion blur. A package of application software is described. (9 refs.)

Biostereometrics '82 ....See Entry 105016

Enriched uranium as an activatable tracer in environmental research ....See Entry 109947

Computerized model of coronary-pulmonary circulation ....See Entry 110075

Quantitative radiation dose-response relationship for normal tissues in man. II. Response of the salivary glands during radiotherapy ....See Entry 110097

Imaging modalities [medical] ....See Entry 110106

Holographic three-dimensional hard copy for medical computer graphics ....See Entry 110131

Depth dosimetry of curved radon-222 plesiotherapy applicators ....See Entry 110175

Measurements of dose from secondary radiation outside a treatment field ....See Entry 110183

Dosimetry of the Siemens Mevatron 67 linear accelerator ....See Entry 110184

Monte Carlo evaluation of the Sievert integral for brachytherapy dosimetry ....See Entry 110186

87.60M Radiation dosimetry

110175 Depth dosimetry of curved radon-222 plesiotherapy applicators. R.G.S.Taylor (Dept. of Phys. Sci., Queensland Radium Inst., Herston, Australia).
Australas. Phys. & Eng. Sci. Med. (Australia), vol.6, no.2, p.94-5 (April-June 1983). [received: Aug. 1983]
The measurements described were carried out to solve the problem of the high measured values of maximum dose delivered by doubly-curved Radon-222 applicators. Minimum and maximum depth doses are discussed. (5 refs.)

110176 Neutron fluence-to-dose equivalent conversion factors: a comparison of data sets and interpolation methods. C.S.Sims, G.G.Killough (Health and Safety Res. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Radiat. Prot. Dosim. (GB), vol.5, no.1, p.45-8 (1983).
Various segments of the health physics community advocate the use of different sets of neutron fluence-to-dose equivalent conversion factors as a function of energy and different methods of interpolation between discrete points in those data sets. The major data sets and interpolation methods are used to calculate the spectrum average fluence-to-dose equivalent conversion for five spectra associated with the various shielded conditions of the Health Physics Research Reactor. The results obtained by use of the different data sets and interpolation methods are compared and discussed. (20 refs.)

110177 Measurement of potential alpha energy concentration of radon and thoron daughters using an electret dosemeter. P.Kotrappa, S.K.Dua, P.C.Gupta, N.S.Pimpale, A.H.Khan (Health Phys. Div., Bhabha Atomic Res. Centre, Bombay, India).
Radiat. Prot. Dosim. (GB), vol.5, no.1, p.49-56 (1983).
An electret dosemeter consisting of an electret loaded into a 60 ml chamber was modified to hold an air sampling filter paper at the bottom and air was sampled through it. It was shown that nearly 20% of the energy of alpha radiation emitting from the filter paper was dissipated in the volume of the chamber. This energy in turn produced ion pairs which were collected by the electret resulting in a measurable change in charge status of the electret. By taking an air sample of known volume and allowing the registration of alpha energy, not only during sampling but also for three hours after sampling, a direct measure of the potential alpha energy concentration of radon daughters could be calculated in easily interpretable working level units. By proper choice of the thickness of the electret and the total flow, it was possible to measure radon daughter concentations down to milliworking level units. For thoron decay products, it was shown that the alpha energy concentration measured during sampling and up to a period of 7.7 hours post sampling, time being reckoned from the mid-time of sampling, yielded 33% of the potential alpha energy concentration due to thoron daughters. (9 refs.)

110178 Annealing and fading properties of CaF_2:Tm (TLD-300). C.Furetta, Yi-Kang Lee (Inst. of Nuclear Sci., Nat. Tsing Hua Unv., Hsinchu, Taiwan).
Radiat. Prot. Dosim. (GB), vol.5, no.1, p.57-63 (1983).
The annealing and fading characteristics of CaF_2.Tm have been investigated. The best annealing temperature and time are given. The thermal treatment after exposure and before read out has also been studied. This work also reports the results of studies on fading in dark and light conditions. The stability of well separated glow-peaks was studied and is discussed. (7 refs.)

110179 Some characteristics of neutron field and kerma distributions inside a phantom irradiated at a cyclotron. B.Dorschel, G.Streubel (Phys. Dept., Tech. Univ. Dresden, Dresden, Germany).
Radiat. Prot. Dosim. (GB), vol.5, no.1, p.65-70 (1983).
Neutron spectra at the surface and at different depths within a bodylike phantom calculated by the Monte Carlo method are compared with measured spectra. Furthermore, derived fluence and kerma values obtained by integrating the calculated spectra are compared with measured results from track detectors and ionisation chambers. The results demonstrate the applicability of calculation methods for the purpose of radiation protection in neutron fields. (11 refs.)

110180 The low-dose controversy and radiological risk assessment. P.Hubert (CEPN, Fontenay-aux-Roses, France).
Health Phys. (GB), vol.45, no.1, p.144-9 (July 1983).
Identifies the choices and parameters required when elaborating a dose effect relationship and that are important from a practical point of view. The sensitivity of these factors is analysed. Although many figures still rely on BEIR III assumptions and on T 65 dosimetry, the conclusions, primarily methodological in character, should have more general implications. (10 refs.)

110181 Assessment of radiation dose to infants from breast milk following the administration of ^{99m}Tc pertechnetate to nursing mothers. O.T.Ogunleye (Coll. of Medicine, Univ. of Lagos, Lagos, Nigeria).
Health Phys. (GB), vol.45, no.1, p.149-51 (July 1983).
The results of measurements of ^{99m}Tc activity in the milk samples from 2 patients are presented. It was found that, though the concentration in milk after 24 hr from both patients was insignificant, there were some variations in the initial levels of activity in the samples. The maximum concentration was found around 2 hr after injection. This initial level variation may not be unconnected with the functional status of the patients' thyroid since early uptake of technetium pertechnetate by the thyroid has been utilized to determine its status. Thus, a relatively high thyroid uptake in the early hours would reflect in a low concentration in the breast milk. The total body dose a child would have received if feeding had commenced at the times indicated and child was taking 150 ml milk per meal is shown. The child would have accumulated a whole body dose varying from 684.7-0.5 mrad. In addition, the child is exposed to external radiation from the mother delivering a whole-body dose of the same order of magnitude. The dose to the child's thyroid will be about 13.7-0.01 rad. The author feels that it is advisable to instruct nursing mothers to abstain from breast-feeding for at least 24 hr following the administration of up to 1.5 mCi technetium pertechnetate. (8 refs.)

110182 Response of an area albedo neutron dosimeter. V.P.Gupta (EG & G Idaho Inc., Idaho Falls, ID, USA).
Health Phys. (GB), vol.45, no.1, p.158-62 (July 1983).
An area albedo neutron dosimeter (AAND) is described. This AAND is presently used at the Idaho National Engineering Laboratory (INEL) and the Bendix Field Engineering Corporation at Grand Junction, CO. The response of the AAND to different neutron spectra is examined when it is exposed free in air or against concrete block walls. (3 refs.)

110183 Measurements of dose from secondary radiation outside a treatment field. K.R.Kase, G.K.Svensson, A.B.Wolbarst, M.A.Marks (Dept. of Radiation Therapy, Harvard Medical School, Boston, MA, USA).
Int. J. Radiat. Oncology Biol. Phys. (GB), vol.9, no.8, p.1177-83 (Aug. 1983).
Radiation dose to organs outside the radiotherapy treatment field can be significant and therefore is of clinical interest. The authors have made measurements of dose at distances up to 70 cm from the central axes of 5×5, 15×15 and 25×25 cm radiation fields of 300 kVp, 4 MV and 8 MV X-rays,

and ^{60}Co gamma rays, at the surface and at depths in water of 5 and 10 cm. Contributions to the total secondary radiation dose from water scatter, machine (collimator) scatter and leakage radiation have been separated. The authors have found that the component of dose from water scatter can be described by a simple exponential function of distance from the central axis of the radiation field for all energies and field sizes. Machine scatter contributes 20 to 40% of the total secondary dose depending on machine, field size and distance from the field. Leakage radiation contributes very little dose, but becomes the dominant component at distances beyond 60 cm from the central axis. Estimates of the risk of second tumors in long term survivors indicate a small incremental increase above the natural incidence rate based on information from the 1980 BEIR Committee report. (8 refs.)

110184 Dosimetry of the Siemens Mevatron 67 linear accelerator. J.L.Horton (Dept. of Radiation Therapy, Cleveland Clinic Foundation, Cleveland, OH, USA).
Int. J. Radiat. Oncology Biol. Phys. (GB), vol.9, no.8, p.1217-23 (Aug. 1983).
Measurements have been made on a Siemens Mevatron 67 linear accelerator. The change of beam quality has been measured as a function of position off-axis and compared to another Siemens 6 MV linear accelerator. Similarly beam profiles are compared to a Siemens Mevatron VI. Additional measurements include entrance dose, inverse square applicability, central axis percent depth dose, tissue-maximum ratios, output factors, wedge factors and block transmission factors. Comparison is made with an Atomic Energy of Canada Limited Therac 6 and Varian Clinac 6-100. (15 refs.)

110185 Neutron and γ-ray absorbed dose measurements for the d-Be reaction at low incident deuteron energies. R.L.Maughan, M.J.Roper (Cancer Res. Campaign Gray Lab., Mount Vernon Hospital, Northwood, England).
Phys. Med. & Biol. (GB), vol.28, no.1, p.51-6 (Jan. 1983). [received: Sept. 1983]
Measurements have been made using a tissue-equivalent A-150 ionisation chamber and a neutron insensitive Geiger-Muller tube in order to determine separately the neutron and γ-ray absorbed doses for deuteron energies, E_d, in the range 1.5-4.0 MeV. The authors conclude that the d-Be reaction provides a useful neutron source for radiobiological experiments at incident deuteron energies between 2 and 10 MeV. At energies below 2-2.5 MeV and with beam currents between 0.5 and 1 mA the neutron absorbed dose rate drops sharply and the γ-ray contamination increases appreciably. (16 refs.)

110186 Monte Carlo evaluation of the Sievert integral for brachytherapy dosimetry. J.F.Williamson (Dept. of Therapeutic Radiology, Univ. of Minnesota Hospitals, Minneapolis, MN, USA), R.L.Morin, F.M.Khan.
Phys. Med. & Biol. (GB), vol.28, no.9, p.1021-32 (Sept. 1983).
The Sievert integral, widely used to compute dose distributions about filtered line sources, assumes that the emitted energy fluence if exponentially attenuated by the filter thickness traversed by the primary photons. To evaluate this approximation, a Monte Carlo simulation was performed realistically modelling the diffusion and energy degradation of primary photons due to coherent, incoherent and photoelectric interactions in the source filter. Estimates of the exposure rate at points near the source were obtained using analytical averaging. Comparison of the two models shows that for ^{226}Ra and ^{192}Ir sources, the Sievert algorithm consistently overestimates the exposure rate per unit activity. However, such errors may be significantly reduced if source intensity is expressed in terms of exposure rate. Computed exposure rate distributions based on exposure rate calibrations are also less sensitive to uncertainties in available spectroscopic data. (22 refs.)

110187 Microdosimetric properties of alpha-particle tracks measured in a low-pressure cloud chamber. T.Budd (Environmental & Medical Sci. Div., AERE Harwell, England), C.S.Kwok, M.Marshall, S.Lythe.
Radiat. Res. (USA), vol.95, no.2, p.217-30 (Aug. 1983).
A cloud chamber which can make visible individual ions in the tracks of α-particles is available at Harwell. Work on the theory of droplet formation and growth has enabled a tissue-equivalent gas of lower density than previously possible to be used in the chamber. This has enabled even the closest ions in α-particle tracks to be individually resolved. Extensive spatial analysis has been carried out on α-particle track segments at 5.0, 3.4, and 1.1 MeV. Radial distributions of ionization density with distance from the track have been derived. Rossi 'Y' distributions have been calculated for target sizes of 10 and 50 nm (at 100 kg m^{-3}) and, finally, interdroplet distance distributions have been derived. These results may be compared to Monte Carlo calculations of track structure and may also provide useful data for theories of radiation damage. (8 refs.)

Electromagnetic stirred mode cavities (SMCs) .... See Entry 105340

A modern approach to radiation metrology .... See Entry 106174

Coaxial nonmetallic thermocouple with electronic ice point for dosimetric use in electromagnetic environments .... See Entry 109973

Quantitative radiation dose-response relationship for normal tissues in man. II. Response of the salivary glands during radiotherapy .... See Entry 110097

X-ray photogrammetry for endocavitary radiation therapy ..... See Entry 110156

Tissue-air ratios and scatter-air ratios for diagnostic radiology (1-4 mm Al HVL) .... See Entry 110166

Grid weight as an index of radiographic exposure factors ..... See Entry 110171

Sterilization of TLD finger monitors .... See Entry 110188

Biorack experiment A08/19 D: dosimetric mapping inside Biorack .... See Entry 110204

87.60P Radiation protection

(inc. radiation monitoring)

110188 Sterilization of TLD finger monitors. R.W.Pollock (Siemens Gammasonics Inc., Des Plaines, IL, USA), P.C.Philip, S.Jayaraman.
Health Phys. (GB), vol.45, no.1, p.157-8 (July 1983).
It is important to measure extremity dose during surgical procedures such as heart catheterizations, yet many doctors are hesitant to wear an unsterilized monitoring device. This note describes work on the effect of sterilization on lithium fluoride thermoluminescent dosimeters which has been shown that a cold, chemical method may be satisfactorily used. It is concluded that cold sterilization with ethylene oxide does not appear to have a significant effect on the response of TLD finger monitors, even when the rings are repeatedly sterilized. The authors hope that these results will induce more medical personnel to monitor their extremity exposures during surgical procedures. (no refs.)

110189 Monitoring of ^{125}I in saliva of workers internally contaminated with ^{125}I. K.Nishizawa, N.Hamada, S.Sakuma (School of Medicine, Nagoya Univ., Nagoya-shi, Japan).
Radioisotopes (Japan), vol.32, no.8, p.364-71 (Aug. 1983).
Monitoring of workers who did iodination of protein was performed for 5 months on 10 persons. The activity in saliva was evaluated by the sum peak method and by using a NaI(Tl) detector and a 400-channel analyzer. The concentration of ^{125}I in saliva ranged from 4.65±2.1 cBq/ml to 135±2.7 cBq/ml and the average was 20.8±1.9 cBq/ml. The ratio of concentration in saliva to used activity ranged $(2.2\pm0.64)\times10^{-9}$ to $(3.6\pm0.073)\times10^{-8}$ and the average was $(8.1\pm1.1)\times10^{-9}$. The thyroidal uptake per iodination ranged 146 Bq to 2700 Bq. The ratio of the uptake to the used activity ranged from 7.3×10^{-5} to 5.4×10^{-6}. The thyroidal absorbed dose ranged from 378 μGy to 4740 μGy. Monitoring of ^{125}I in saliva was proved to be a useful method for investigating the internal contamination of workers doing iodination. (15 refs.)

110190 Measurement and shielding of the secondary radiation from betatrons. S.Cuzino, D.Catana, I.Panaitescu (Inst. Central de Fizica, Inst. de Fizica si Tehnologia. Aparatelor cu Radiatii, Bucuresti-Magurele, Rumania).
Stud. & Cercet. Fiz. (Rumania), vol.35, no.6, p.519-26 (1983). In Rumanian.
Secondary radiation is generated by leakage and/or scattering outside the useful primary beam of an accelerator. Its measurement is necessary for each accelerator, first of all for the calculation of biological protection barriers. Owing to the high energy of the bremsstrahlung these measurements raise specific problems and have to be carried out by means of cavity ion chambers with convertor caps of suitable material and thickness. Measurements carried out on two 15 MeV nondestructive testing betatrons concerning their secondary radiation are reported. Results show that, when local shielding is provided on the radiation source, the secondary radiation is everywhere less than 1% of the primary beam. A secondary maximum is manifest, generated by a spurious target. The calculation of the protection barriers for the secondary radiation and their subsequent testing through measurements are discussed. (12 refs.)

Development and testing of prototype alpha waste incinerator off-gas systems .... See Entry 105988

10 CFR 61 waste form requirements .... See Entry 106038

Evaluation of geologic materials to limit biological intrusion of low-level waste site covers .... See Entry 106043

In-situ stabilization of a low-level radioactive site—a case history .... See Entry 106044

A modern approach to radiation metrology .... See Entry 106174

Operational quantities for use in external radiation protection measurements. An investigation of concepts and principles .... See Entry 106177

Introduction to radiation protection principles .... See Entry 106178

A risk assessment for the transportation of radioactive zeolite liners .... See Entry 106180

Fast neutron therapy at Edinburgh: staff protection .... See Entry 110147

87.60R Radioactive pollution

(see also 86.70 Environmental science)

110191 Radon and thoron in buildings. G.C.Meggitt (UKAEA, Culcheth, England).
Radiat. Prot. Dosim. (GB), vol.5, no.1, p.5-17 (1983).
The physical factors determining the levels of radon and thoron in buildings are reviewed, including the sources, the ventilation rate and the natural aerosol concentration. The health risks are summarised and the significance for actinide-in-air monitoring is discussed. (40 refs.)

110192 Deep-ocean radioactive waste disposal: an evaluation of the seaweed critical pathway. M.S.Baxter (Dept. of Chem., Univ. of Glasgow, Glasgow, Scotland), S.R.Aston.
Health Phys. (GB), vol.45, no.1, p.139-44 (July 1983).
Develops upon a recent (1980) review by the Nuclear Energy Agency of the Organisation of Economic Cooperation and Development in which the critical pathways for public exposure to radioactivity released to the marine environment are defined for each of the major nuclides in solid nuclear wastes. Conservative conclusions are drawn, namely that deep-sea disposal of all high-activity wastes accumulated by 2000 AD could conceivably produce a significant and excessive hazard to man via the seaweed consumption pathway. The major risk would be associated with ^{224}Cm and Am isotopes. (16 refs.)

110193 ^{137}Cs deposition in Japanese temporary residents of England. M.Togo, I.Anzai (Dept. of Radiological Health, Univ. of Tokyo, Tokyo, Japan), T.Togo.
Health Phys. (GB), vol.45, no.1, p.162-6 (July 1983).
The subjects of the study reported were five siblings in a family and their father. It is shown that: (1) deposited ^{137}Cs in the Japanese who temporarily resided in England was most likely to have come through fish from the North Sea, being slightly polluted with the nuclide discharged from Sellafield, and (2) the ^{137}Cs deposited in England decreased after return to Japan, in spite of increased fish, shellfish and seaweed consumption, which are only contaminated with ^{137}Cs from weapon tests' fallout. (16 refs.)

Evaluation of geologic materials to limit biological intrusion of low-level waste site covers .... See Entry 106043

In-situ stabilization of a low-level radioactive site—a case history .... See Entry 106044

Implications of pathway analysis of deminimus concentrations of radioactive waste .... See Entry 106061

Waste management and environmental controls in the Australian uranium mining industry .... See Entry 106173

The point of zero charge and adsorption properties of natural magnetite .... See Entry 109781

Estimate of radon-222 concentrations in rainclouds from radioactivity of rainwater observed at ground level .... See Entry 109937

Interferences in the radiochemical determination of ^{230}Th [in soil and water] .... See Entry 109946

Enriched uranium as an activatable tracer in environmental research .... See Entry 109947

Monitoring of ^{125}I in saliva of workers internally contaminated with ^{125}I .... See Entry 110189

87.65 AEROSPACE BIOPHYSICS AND MEDICAL PHYSICS (EFFECTS OF ACCELERATIONS, WEIGHTLESSNESS AND ENVIRONMENT)

(see also 94.80 Aerospace facilities and techniques; space research)

110194 Prospects of autotrophic link functioning in biological life-support systems based on cell biology studies. E.L.Kordyum, E.M.Nedukha, A.F.Popova, P.G.Sidorenko, V.M.Fomicheva, K.M.Sytnik (N.G. Kholodny Inst. of Botany, Acad. of Sci., Kiev, Ukrainian SSR).
Acta Astronaut. (GB), vol.10, no.4, p.225-8 (April 1983).
On the basis of using modern methods of cytological analysis, growth peculiarities, reproduction and structure of plant cells of different levels of organisation (unicellular algae, mosses, angiosperms, cell cultures of higher plants) were investigated in response to the following factors—weightlessness, hypogravity, magnetic fields of various intensity, vibration and acceleration. It was shown that many discovered biological effects of space flight are connected with the degree of complexity of the object organisation and are intensified with increasing duration of flight. (7 refs.)

110195 Proceedings of Workshops III and IV and of the Topical Meeting of the COSPAR Interdisciplinary Scientific Commission F (Meeting F2) of the COSPAR Twenty-Fourth Plenary Meeting.
Adv. Space Res. (GB), vol.3, no.8 (1983).
Conference held at: Ottawa, Canada. Date 16 May-2 June 1982. Sponsors: COSPAR. The following topics were dealt with: biological quarantine procedures for spacecraft, extreme environments such as Mars and Antarctica, radiation effects on bacteria, plants, seeds and insects, and finally the biological hazards of radioactivity and radiation to man and other mammals.

110196 Proceedings of Workshop VII and of the Topical Meeting of the COSPAR Interdisciplinary Scientific Commission F (Meetings F1 and F4) of the COSPAR Twenty-Fourth Plenary Meeting.
Adv. Space Res. (GB), vol.3, no.9 (1983).
Conference held at: Ottawa, Canada. Date 16 May-2 June 1982. Sponsors: COSPAR. The following topics were dealt with. Amino acids in meteorites, chemistry and molecules in interstellar space, prebiotic biochemistry on the primitive Earth, prebiotic molecular biophysics, extraterrestrial intelligent life and very low gravity biological experiments on animals and plants.

110197 Life science research on-board Spacelab. II. European multipurpose experimental facilities. M.J.F.Fowler (Dept. of Physiology, Royal Free Hospital School of Medicine, London, England).
J. Br. Interplanet. Soc. (GB), vol.36, no.8, p.345-50 (Aug. 1983).
For pt.I see ibid., vol.36, no.6, p.243-8 (1983). To facilitate life science studies on board Spacelab, a number of multipurpose experimental facilities are under development by the European Space Agency (ESA). These include: (1) the Biorack for biological investigations on plants, tissues, cells, bacteria and insects; (2) the Space Sled for vestibular (balance) studies; (3) the Anthrorack for advanced human physiology experiments; and (4) Eureca, a retrievable carrier, for botanical and protein crystallisation studies of up to six months' duration. These facilities are briefly described together with a chronology of the planned flights. (12 refs.)

110198 A systems approach to the physiology of weightlessness. R.J.White, J.I.Leonard (Management & Tech. Services Co., Houston, TX, USA), J.A.Rummel, C.S.Leach.
Proceedings of the Fifteenth Hawaii International Conference on System Sciences 1982, Honolulu, HI, USA, 6-8 Jan. 1982 (HI, USA: Hawaii Int. Conference Syst. Sci. 1982), p.264-73 vol.2
This paper presents a systems approach to the unraveling of the complex response pattern of the human subjected to the challenge of weightlessness. The major goal of this research is to obtain an understanding of the role that each of the major components of the human system plays following the transition to and from space. The cornerstone of this approach is the utilization of a variety of mathematical models in order to pose and test alternative hypotheses concerned with the adaptation process. An integrated hypothesis for the human physiological response to weightlessness is developed. (24 refs.)

110199 Somatic embryogenesis in anise (Pimpinella anisum L.) cell cultures in microgravity environment. R.A.Kudielka, R.R.Theimer (Botanisches Inst., Univ. Munchen, Munchen, Germany).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.63-8
Dedifferentiated cultures of anise will be sent into orbit in Spacelab (SL) during its D1-mission. Every 24 hr aliquots will be tranferred to embryogenic growth medium under microgravity conditions to induce somatic embryogenesis. During the 7 day period of the SL-D1-mission the cell aggregates will differentiate into torpedo-shaped embryoids via globular and heart-shaped embryo forms. After return, embryoids in each stage of differentiation will be recovered and intact anise plants will be regenerated. These and part of the embryoids will be examined using morphological, biochemical and physiological methods. The data will be compared to those obtained with plant material differentiated under simulated SL conditions in a 1 g environment on Earth. The experiments should yield important data on the effect of gravity on embryogenesis and differentiation in higher plants. (12 refs.)

110200 The influence of near weightlessness conditions on the development of the vertebrate gravity sensing system—Statex experiment Spacelab Mission D1. J.Nuebert, W.Briegleb, A.Schatz (Inst. for Aerospace Medicine, Cologne, Germany).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.69-74
The goal of the Frog Statolith Experiment of the Spacelab Mission D1 is to study the effect of near weightlessness on different development stages of embryos and tadpoles. The results will be compared with those of weightlessness simulation experiments. Looking forward to long duration manned spaceflight onboard space stations, investigations of the interaction between gravity sensing system function and development and near weightlessness becomes very important. Despite many studies in diverse organisms knowledge of these phenomena is incomplete. One sector of investigation should be the analysis of possible morphologic alterations in the gravity sensing system in vertebrates influenced by near weightlessness conditions. Morphology and function of this system is similar in principle in vertebrate classes including man. (7 refs.)

110201 Effects of microgravity on the mechanisms for genetic recombination. O.Ciferri, M.Sosio, A.M.Orlandoni, O.Tiboni, P.G.Mazza (Dept. of Genetics & Microbiology, Univ. of Pavia, Pavia, Italy).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.75-6
The effect(s) of microgravity on genetic recombination, that is, the transfer of DNA from cell to cell, will be investigated (in a space experiment) in bacterial cells undergoing conjugation, transduction, or transformation. These fundamental processes involve primarily the activity of the cell membrane and concern the interactions cell/cell, cell/bacteriophage, and cell/DNA, respectively. (2 refs.)

110202 The role of gravity in the establishment of the dorso-ventral axis in the developing amphibian embryo. G.A.Ubbels, T.G.Brom, H.P.Willemsen, J.J.H.van Nunen (Hubrecht Lab., Utrecht, Netherlands).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.77-82
The establishment of polarities in early embryogenesis is essential for normal development. Centrifugation experiments in Xenopus laevis eggs have shown that gravitationally induced rearrangements of the yolk predictably determine the orientation of the dorso-ventral axis of the embryo, regardless of the original position of the sperm entry point or the grey crescent. This suggests a role of gravitation in the determination of bilateral symmetry. That assumption will be tested in a microgravity experiment (A08/52NL) in Biorack in the Space Shuttle. Preparatory experiments and the development of an automatic experiment container for fertilization and fixation of Xenopus eggs are described. (27 refs.)

110203 The possible involvement of gravitational forces in the topological distribution of cytoplasmic determinants in Drosophila melanogaster embryos. R.Marco, I.Vernos, M.Cervera, A.Domingo (Inst. de Enzimologia y Patologia Molecular, Univ. Autonoma de Madrid, Madrid, Spain).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.83-7
The hypothesis tested in the proposed space experiment described is the possible involvement of gravitational forces in the shaping of the topological distribution of the maternal information in the early embryo. In earlier space flights, both American and Russian, it has been observed, in Drosophila and other insects, that developmentally abnormal animals have appeared during or immediately after the space flight. The objective of this proposed experiment is to test in a controlled way whether the appearance of these abnormalities correlate with the microgravity conditions during oogenesis. The proposed protocol makes possible a detailed study of the presumptive subcellular and molecular mechanisms affected by the microgravity or other parameters of the space flight environment. (22 refs.)

110204 Biorack experiment A08/19 D: dosimetric mapping inside Biorack. H.Bucker (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt eV, Cologne, Germany), O.C.Allkofer, R.Beaujean, W.Enge, R.Facius, H.Francois, W.Heinrich, G.Horneck, R.Pfohl, G.Portal, G.Reitz, M.Schafer, E.Schopper, J.-U.Schott.
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.89-91
The experiment described will document the radiation environment inside Biorack. These experimental data will be compared with those of other spaceflights and with theoretical predictions. It will provide radiation baseline data for the other Biorack experiments. For this purpose, 6 type I containers housing stacks of different kinds of radiation detectors (cellulose nitrate, lexan, CR 39, nuclear emulsions, AgCl, and LiF-thermoluminescence dosimeters) will be accommodated in the incubators of Biorack. The analysis of the dosimeters will be performed by the Biostack research team. (10 refs.)

110205 Experiment A08/18 D on Biorack: embryogenesis and organogenesis of Carausius morosus under spaceflight conditions.. H.Bucker (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt eV, Cologne, Germany), H.Francois, E.H.Graul, W.Heinrich, H.Hoffken, G.Horneck, G.Reitz, W.Ruther, R.Pfohl, G.Portal, E.Schopper, J.-U.Schott.
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.93-6
The influence of space flight environment, especially HZE particles of cosmic radiation and microgravity, on embryogenesis and organogenesis of insects will be studied in Carausius morosus eggs. Five different stages of development will be used, which differ in radiation sensitivity and regenerative capacity. The eggs, in monolayers, will be sandwiched between visual track detectors. The results will give information on: the effectiveness of heavy ions of cosmic radiation on developmental processes in insects; potential disturbances of differentiation processes by microgravity; potential combined effects of radiation and microgravity. (9 refs.)

110206 The clinostat—a tool for analysing the influence of acceleration on solid-liquid systems. W.Briegleb (Inst. for Aerospace Medicine, Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt eV, Cologne, Germany).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.97-101
The (fast) clinostat is a platform which rotates about an horizontal axis. Near the center of rotation is mounted a stiff, closed cuvette filled with a liquid suspension of particles. Depending on the density difference between the particles and the liquid, and on the viscosity of the liquid, particles may settle within circular trails. These circular trails become points if the speed of rotation of the clinostat increases (fast clinostat); the particles become motionless in respect to gravity. Instead of gravity centrifugal forces become effective. But within microscopic dimensions the influence of the centrifugal force on particles even with a density difference to the liquid of 1 g cm^{-3} and 2 μm in diameter can be balanced by Brownian movement. Thus for typical cell systems the degree of zero g simulation is 100%. From experiments with different cell systems on special clinostats the author has obtained indications for regulatory reactions of different cell parameters during zero g simulation. (18 refs.)

110207 Problems of 0-g simulation with the fast-running clinostat (for cellular study). A.Schatz (Inst. for Aerospace Medicine, Deusche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt eV, Cologne, Germany).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.103-5
The theoretical background of the 0 g simulation technique with the fast-running clinostat is presented together with the important parameters and limitations on biological systems for selection. Specific attention is paid to the interaction with the Earth's magnetic field which might introduce effects in addition to those of μ.g. (9 refs.)

110208 The use of horizontal clinostats in plant physiology. W.Hensel (Botanical Inst., Univ. of Bonn, Bonn, Germany).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.107-8
Slow rotating clinostats (e.g. 2 rpm) are common tools in experiments on gravitropism. But, if normal grown roots are subjected to clinostat rotation for 20 h, ultrastructural response of statocytes, delay in graviresponse, increase in ethylene production and shortening of the cycle time of root meristem are caused. These effects can be avoided if plants develop on the clinostat from the onset of soaking of the seeds. Only under these specific conditions do clinostats simulate physiological zero-g and can be used in experiments on gravitropism without too many restrictions. (8 refs.)

110209 Influence of gravity on cell growth and migration. A.Tschopp, A.Cogoli (Lab. fur Biochem., Eidgenossische Tech. Hochschule Zurich, Zurich, Switzerland).
Space Biology with Emphasis on Cell & Developmental Biology Proceedings of a Workshop (ESA SP-206), Cologne, Germany, 9-11 March 1983 (Noordwijk, Netherlands: ESA 1983), p.109-14
When HeLa cells, chicken embryo fibroblasts, sarcoma Galliera cells, Friend leukemia virus transformed cells and human lymphocytes are cultured in a hypergravitational field (e.g. 10×g) growth rate is increased by 20-30%, whereas glucose consumption per cell is lower than at 1×g. Tracking of cell movements on gold-coated substrates reveals that cell migration is hindered at high-g. These findings suggest that under gravitational stress the cell is either capable of shifting to other metabolic pathways and/or consumes less energy at high-g than 1×g. The authors describe ground-based investigations related to experiments to be performed on future SPACELAB missions. (33 refs.)

Scientific goals of the D1-mission (Spacelab) ....See Entry 109701

Measurement of reach envelopes with a four-camera selective spot recognition (SELSPOT) system [astronaut application] ....See Entry 110248

87.70 BIOMEDICAL ENGINEERING

110210 An instrument for measuring small flows during biliary tract surgery. P.Baxa (Istituti di Geodesia e Geofisica, Univ. of Trieste, Trieste, Italy), G.Alberi, M.Cherubini, G.Poiani.
Clin. Phys. & Physiol. Meas. (GB), vol.4, no.3, p.333-7 (Aug. 1983).
Presents the components of an instrument able to measure low flows and describes the physical principles on which the instrument is based. The main features of this instrument are: (i) it is simple, compact and easy to handle; (ii) it avoids any contact between the electronic circuit and the saline solution; (iii) it allows continuous flow measurement; and (iv) it has an analogue output, which is recorded graphically. This graphic record of the measurement can be used later to give information on the volume of the biliary tract and on its elastic properties. It is possible to change the scale of this instrument simply by substituting a different narrow section of the main tube; the sensitivity of the instrument is increased for lower values of the cross-section. (6 refs.)

110211 Efficient, inexpensive rapid cuff inflator for venous occlusion plethysmography. A.C.M.Chu, D.St. Andrew (Dept. of Medical Phys., Univ. Coll. Hospital, London, England).
Clin. Phys. & Physiol. Meas. (GB), vol.4, no.3, p.339-41 (Aug. 1983).
The cuff inflator design described has been found to be adequate for clinical purposes. It has a cuff inflation time of less than 0.3 s. It is safe to use as prolonged overpressurisation cannot happen. It is economical to produce, and is sufficiently compact to be mounted on a trolley side by side with the plethysmographic equipment to form a mobile unit, enabling venous occlusion plethysmography to be performed at any location. (no refs.)

110212 A technique for the measurement of 'sucking' in bottle fed infants. T.Drake (Dept. of Linguistics, Univ. of Sheffield, Sheffield, England), A.J.Wilson.
Clin. Phys. & Physiol. Meas. (GB), vol.4, no.3, p.343-5 (Aug. 1983).
Describes a technique for measuring the 'sucking' pressures of bottle-fed infants. The system is based on standard feeding bottle components and therefore the regime used during a study can closely resemble the regime that is used for 'normal' feeding. The system provides a semi-quantitative way of assessing the sucking process which can be used to assess the efficacy of the oral prosthesis and special teats that are currently available for infants with cleft palates. In addition to this, such a system could prove useful in evaluating new prostheses and new specialist teats as they are developed, since there is currently no objective method of assessment. (1 ref.)

110213 Four-dimensional processing and display system for cardiovascular data. S.E.Wixson (Clinical Cardiology Computer Centre, Univ. of Alabama, University Station, Birmingham, AL, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.140-5 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
A four-dimensional image refers to a time (or other) series of three-dimensional images. The system consists of components to develop, test and run programs and to manipulate and store multidimensional digital images. A four-dimensional display is used to study raw and processed data. The display uses binocular stereo to generate a three-dimensional image and bulk memory to store multiple stereo pairs for the fourth dimension. Voice input and output will be used to communicate with the system. A binocular infrared eye tracker will be used as a multidimensional cursor to interact with the data. Software development areas are summarised. (no refs.)

110214 Biostereometric data processing in ERGODATA: choice of human body models. J.C.Pineau, R.Mollard, M.Sauvignon, M.Amphoux (Lab. d'Anthropologie Appliquee, Univ. Rene Descartes, Paris, France).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.169-71 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
The definition of human body models was elaborated with anthropometric data from ERGODATA. The first model reduces the human body into a series of points and lines. The second model is well adapted to represent volumes of each segmentary element. The third is an original model built from the conventional anatomical points. Each segment is defined in space by a triangular plane located with its 3-D coordinates. This new model can answer all the processing possibilities in the field of computer-aided design (CAD) in ergonomy and also biomechanics and orthopaedics. (no refs.)

110215 Visual and spectral EEG analysis in the evaluation of the outcome in patients with ischemic brain infarction. K.Sainio (Dept. of Pediatrics, Univ. of Helsinki, Helsinki, Finland), D.Stenberg, I.Keskimaki, A.Muuronen, M.Kaste.
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.2, p.117-24 (Aug. 1983).
Serial EEGs were recorded in 15 patients with acute cerebral infarctions in order to study clinical and prognostic correlations. The EEG was recorded within 48 h from the first symptoms and thereafter weekly for 4 weeks. The EEGs were analyzed both visually and with a computerized spectral analysis. Eight of the patients recovered fully and seven had permanent neurological deficits. On admission, 87% of the patients had an abnormal EEG by visual analysis. The spectral parameters correlated well with visual findings, especially the delta and alpha bands. The spectral analysis was superior to visual in predicting the correct laterality of the lesion. It showed the correct side of the lesion in 87%, while the visual did it in only 54% of the cases. The first EEG records reliably predicted the outcome of the patients. The degree of background abnormality was most important in visual EEG analysis. In spectral analysis, parameters from single derivations were superior to the average of all derivations. A high proportion of delta or low proportion of alpha power were reliable indicators of poor outcome. (16 refs.)

110216 Improved telemetric EEG monitoring in epileptic patients. A.Kamp, J.W.Aitink (Inst. of Medical Phys. TNO, Utrecht, Netherlands).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.2, p.254-5 (Aug. 1983).
Describes a 20-channel EEG telemetry system which provides EEG monitoring with standard EEG recording performance for use in epileptic patients. The EEG activities of 20 electrodes are separately amplified and transmitted employing PCM cable telemetry. A standard EEG apparatus is used, allowing montages to be freely selected and changed during recording. (4 refs.)

110217 The use of strain gauges for biometrics in Europe. P.M.Calderale (Politecnico di Torino, Torino, Italy).
Eng. Med. (GB), vol.12, no.3, p.117-33 (July 1983).
Strain gauges have a relevant role in mechanical measurements, and it is therefore quite natural that they find widespread use in biomechanics. They are used for the evaluation of the strain and stress distribution in particular points of structures of biomechanical interest, and, moreover, for the validation of numerical analyses. This work reviews the use that European researchers make of this technique, mainly in orthopaedics, dentistry, and sport biomechanics. (63 refs.)

110218 Medical engineering: meetings on research priorities. E.A.Mason (Sci. & Engng. Res. Council, Swindon, England).
Eng. Med. (GB), vol.12, no.3, p.143-4 (July 1983).
The importance of 'workshop' type meetings to determine research priorities in a range of medical engineering topics has been demonstrated by means of a series of such meetings organised by the Science and Engineering Research Council. Four workshop-type meetings have been held in the past 2 years on topics ranging from incontinence to body access, and these have resulted in new, collaborative research programmes and an increase in the general level of interest in the topic. Further meetings of this type are planned in the coming twelve months. (4 refs.)

110219 Bioengineering at Durham University. A.Unsworth (Dept. of Engng., Univ. of Durham, Durham, England).
Eng. Med. (GB), vol.12, no.3, p.149-50 (July 1983).
Bioengineering at Durham University has its origins in the early years of the Department of Engineering. During the late 1960s, the main themes of the research were human joint lubrication and the mechanical properties of particular cartilage. These continue as major areas of interest, but the work of the Bioengineering Research Group has now expanded to include many more aspects of orthopaedic engineering as well as the application of biomechanics of the field of rehabilitation. Membership of the Research Group is drawn from a number of establishments, but principally from the Department of Engineering at the University of Durham, the Departments of Orthopaedic Surgery at Newcastle University and Sunderland General Hospital, Departments of Rheumatology and Rehabilitation at Middlesbrough General Hospital, and Dryburn Hospital in Durham. (14 refs.)

110220 Delineation of the QRS complex using the envelope of the e.c.g.. M.-E.Nygards, L.Sornmo (Dept. of Medical Informatics, Linkoping Univ., Linkoping, Sweden).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.5, p.538-47 (Sept. 1983).
A new algorithm for QRS delineation has been developed. Based on the envelope of the e.c.g. signal a delineation function is defined, which yields a single positive pulse for each complex. From this function the onset and end of the QRS or, alternatively, a fiducial point is determined. To remove low-frequency components such as S-T abnormalities without distortion of the QRS complex a filter with time-varying characteristics is used. The accuracy of the method has been evaluated in a test set of different QRS complexes obtained from coronary care patients. For QRS onset, the standard deviation of the difference between automated and manual determination was 7 ms in normal beats and 14 ms in ectopic beats. With simulated noise added to each waveform an average dispersion of 7 ms was observed in the recognition of the QRS onset at a signal-to-noise ratio of 15 dB. The corresponding dispersion in the location of a fiducial point was 2 ms. Using simulated e.c.g. data, the stability of the method is demonstrated for transitions between different waveform morphologies. (18 refs.)

110221 Noninvasive automatic monitoring of instantaneous arterial blood pressure using the vascular unloading technique. K.Yamakoshi, A.Kamiya (Res. Inst. of Applied Electricity, Hokkaido Univ., Sapporo, Japan), H.Shimazu, H.Ito, T.Togawa.
Med. & Biol. Eng. & Comput. (GB), vol.21, no.5, p.557-65 (Sept. 1983).
For the noninvasive monitoring of the beat-to-beat systolic and diastolic pressure and pressure waveform in the human finger, a new automated instrument was designed. This measurement is based on a principle called the vascular unloading technique. Using a hydraulic servocontrol system, the vascular volume change caused by intra-arterial pressure change can be compensated by applying counter pressure to maintain a constant vascular volume in the unloaded state. In this state the controlled counterpressure instantaneously follows the intra-arterial pressure. In this instrument all the necessary procedures, such as the setting of the reference value for the servocontrol, control of the servogain, processing and displaying of the data on a recorder, were carried out automatically. The simultaneous comparison of data with direct measurements and a few examples of the indirect pressure recordings by this instrument are shown and the principles, operation and evaluation of this method are described. This instrument was shown to permit the noninvasive and accurate tracking of instantaneous arterial pressure and to perform acceptably over a wide range of arterial pressure. (16 refs.)

110222 Ensemble averaging of locomotor electromyographic patterns using interpolation. R.Shiavi, N.Green (Vanderbilt Univ. Medical Center, Nashville, TN, USA).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.5, p.573-8 (Sept. 1983).
A technique for calculating the ensemble averages of locomotor electromyographic patterns is described. It combines standard linear envelope detection with LaGrange interpolation. The e.m.g. envelope in each stride is demarcated with times obtained from foot-contact patterns and the time base is altered to 256 points by interpolation. The time-normalised envelopes are then averaged together to form the ensemble average. (27 refs.)

110223 CARRES: system for monitoring cardio-respiratory rhythms and the acquisition of electrophysiological data from the infant, application to the study of sudden infant death syndrome. R.Bruckert, F.Perrin, J.Pernier (CEMI-INSERM, Bron, France), M.-J.Challamel, M.Revol.
Med. & Biol. Eng. & Comput. (GB), vol.21, no.5, p.636-43 (Sept. 1983). In French.
Describes a computer system for monitoring the cardiac and respiratory rhythms and for collecting electrophysiological data from the newborn child to study the sudden infant death syndrome. The system uses the minicomputer MINC 23. The acquisition of the signals from the transducers, the detection of characteristic events on these signals, the coding of these events and the storage of the coded information in a file on floppy disc allowing its processing offline are performed in real time. (10 refs.)

110224 Method of averaging and of recognition of biomedical signals. Z.M.Wojcik (Polish Akad., Nauk, Poland).
Rozpr. Electrotech. (Poland), vol.28, no.1-2, p.315-25 (1982). In Polish. [received: Aug. 1983]
The paper presents a method and an electronic system for automatic averaging of a sampled analog signal, as well as a method and electronic systems for the recognition of these averaged signals. The averaging consists in determining a weighted mean of the results of sampling at each measuring point of the signal under consideration, distributed symmetrically in relation to the point. Due to the weighting, the influence of neighboring values of the signal being measured decreases as the point grows more and more remote. The results of the averaging remain in accordance with the elementary condition of representing events. In the process of recognition the values of characteristic functions of growth, decrease and zero of the signal under consideration are investigated. The values of these functions make up the alphabet of a formal grammar. The features of the signal under consideration constitute a set of final symbols of the grammar, being a result of the set of productions of the grammar. A certain automation exists for this grammar. The results of recognition and of statistical analysis of the signals under consideration constitute the final states of the automation. Electronic systems determining the most elementary characteristics of the signals are presented. The method presented is described with the recognition of electrocardiograms as an example. (13 refs.)

110225 The basic principles for acquiring an amplified signal from the His bundle by statistical filtering. R.J.Ascoeta, R.M.Campero, D.M.Gil, G.Gimenez Lascano, A.del Valle Herrero, J.Navarro, F.Martinez Corvalan.
Rev. Telegr. Electron. (Argentina), vol.71, no.838, p.162-6 (March 1983). In Spanish.
The authors explain that the His-Purkinje system is a set of cells for the transmission of electrical signals. Originating in the auriculo-ventricular node these signals are propagated by the myocardium which controls the ventricular contraction. The section of the electrocardiagram indicating this contraction process is of great importance in clinical cardiology since a knowledge of the form and location of the electrical signal which passes through the His bundle facilitates the diagnosis and prognosis of heart diseases. The signal to be examined, obtained at the body surface, requires to be amplified in such a way that noise can be eliminated. This is achieved by averaging various cycles from the required section of the electrocardiogram. To explain in detail how this signal is obtained the authors discuss the signal characteristics and the inherent noise, the method of treating the analogue signal and the recording of the relevent part of the electrocardiogram, the triggering of the A/D converter, the averaging process, the final reconversion to the analogue signal, the recording of the signal and its evaluation. (8 refs.) *G.W.*

110226 Real time signal processing of the exercise electrocardiogram. A.T.Moser, R.Stickney, C.Sawyer, C.Orrestad, V.Bhargava (Quinton Instrument Co., Univ. of California, San Diego, CA, USA).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.461-4
A system is described intended for on-line use during exercise testing. Absolute spatial vector velocity (ASVV) is generated from an orthogonal lead set and used for QRS detection, estimate of QRS duration and waveform correlation. Signals are averaged for noise reduction and search is made for isoelectric level and QRS offset in the ASVV as a function of minimal activity. Results of testing QRS detection algorithms are given. (11 refs.)

110227 QT interval measurements of long-term ECG recordings. Application of an automatic Holter analysis system. G.Critelli (Istituto di Patologia Medica, Univ. di Napoli, Napoli, Italy), F.Marciano, M.Mazzarella, M.L.Migaux.
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.481-4
A previously reported long-term ECG analysis system has been used to measure the QTc. Particular care has been given to the problem of accurate measurement of the end of T waves. The preliminary object of this investigation is the degree of correlation between the lengthening of the QTc and the appearance or the intensification of PVCs. However, a pilot study, conducted on 24th recordings of a group of 9 subjects with various pathology and 9 subjects with no evidence of pathology, has disclosed the existence of some correlation between heart rate and QTc, the latter being calculated with a well-known widely used formula due to Bazett. The effect of this correlation on QTc is relatively small and it is evident that it could be detected only through automatic and precise measurement of 24 h recordings. It can superpose and interfere with the original object of the investigation (relation between QTc and PVCs). The authors are therefore planning a further inquiry in order to assess: the limits of the formula used for QTc calculations; and the characteristics of the correlation in well defined groups of subjects distinct for age, sex, pathology. (3 refs.)

110228 Application of identification and linear filtering algorithms to the R-R interval measurements. F.Bartoli, G.Baselli, S.Cerutti (Dept. of Electronics, Politech. di Milano, Milano, Italy).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.485-8
The first results of a measurement procedure of heart rate variability (HRV) are presented by using algorithms of identification with autoregressive (AR) models applied to the tachograms of a series of cardiological patients during exercise tests with the Batch Least Squares method. The pole diagram on the complex plane is plotted for a comprehensive evaluation of the identification results. The power spectrum is also estimated following the criterion of Maximum Entropy Method (MEM), fulfilling efficient information means as regards the various mechanisms involved in the HRV control and their pathophysiology already studied in literature. Such a new approach is considered important to realize original ways of information storing and displaying based upon statements of rigorous theoretical aspects. The trend towards the implementation of new developmental and technological tools for automatic analysis of HRV is remarkable. (22 refs.)

110229 The importance of measuring couplet frequency in the ambulatory electrocardiogram: correlation with invasive electrophysiologic studies. A.H.Gradman, W.P.Batsford, D.V.Cicchetti, E.C.Rieur, L.Leon, A.M.Van-Zetta (Cardiology Section, Yale Univ. School of Medicine, New Haven, CT, USA).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.489-92
In order to determine the usefulness of quantitative couplet frequency analysis in the evaluation of ventricular vulnerability, ambulatory ECG recordings (mean duration 13.8 hrs) were obtained in 48 adult patients undergoing invasive electrophysiologic (EPS) studies. During EPS, nine were found to be completely non-inducible, 11 demonstrated intraventricular reentry, 19 had non-sustained and 9 had sustained ventricular tachycardia. The YALECG computer system was used to quantify PVC and couplet frequencies and calculate the repetition index (R = the ratio of couplets to PVCs). While all three of these quantitative arrhythmia parameters increased progressively with increasing degree of ventricular inducibility, both couplet frequency and R correlated better than did PVC frequency. In addition, it was found that couplet frequency and R could be used to identify patient subgroups with a high likelihood of exhibiting serious inducible arrhythmias during EPS. It is concluded that couplet frequency is an important quantitative arrhythmia parameter which may be derived from the ambulatory ECG using computer-based analysis techniques. (9 refs.)

110230 HIS-bundle electrogram interpretation system. I.Beinlich, G.Neumann, E.Nash, A.Schade (Cardiology Div., Univ. of Bonn, Bonn, Germany).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.509-12
Time consumption is one of the drawbacks of clinical electrophysiology studies. HIS—a microcomputer based interpretation system for electrophysiology studies—was developed to reduce analysis time and to provide a standardized documentation form. Each program obtains data from such studies as incremental atrial pacing, sinus node overdrive suppression or programmed atrial extrastimulation. HIS measures basic conduction intervals, plots graphs of typical function curves and calculates parameters such as SNRT, SACT or the different refractory periods. Two reports will automatically be generated. All data are stored on floppy disc and may be accessed for further data analysis, editing, summarizing or printing. Emphasis was placed on user guidance, program flexibility and customization capability. (7 refs.)

Biostereometrics '82 .... See Entry 105016

Biomedical engineering training in Dundee .... See Entry 105057

Education in bioengineering: experience at the University of Leeds .... See Entry 105058

The masters degree in bioengineering at the University of Strathclyde .... See Entry 105060

Coaxial nonmetallic thermocouple with electronic ice point for dosimetric use in electromagnetic environments .... See Entry 109973

Spectral energy of the first heart sound in relation to mitral valve size parameter .... See Entry 110103

Semireal time monitoring of the functional movements of the mandible .... See Entry 110104

Automated apnoea detection by computer: analysis of tracheal breath sounds .... See Entry 110110

Non-invasive fetal monitoring using radiotelemetry .... See Entry 110115

Family of calibrated stereometric cameras for direct intraoral use .... See Entry 110118

Rapid three-dimensional measurements in clinical dentistry—a new approach .... See Entry 110120

Three-dimensional stereometric measurement system using optical scanners, cylindrical lenses, and line sensors .... See Entry 110121

Contouring of tooth imprints by means of a fluorescence technique adapted to a spatially filtered moire illumination .... See Entry 110122

Studying abdomen size and shape variations during pregnancy: an application of moire topography .... See Entry 110124

Moire techniques in biomedical case studies .... See Entry 110125

Reconstruction of anatomical shapes from moire contourographs .... See Entry 110126

Holographic three-dimensional hard copy for medical computer graphics .... See Entry 110131

Television scanning technique for topographic body measurements .... See Entry 110132

Algorithms for two-camera video motion analysis .... See Entry 110133

Microprocessor-based image processing system for dynamic foot pressure studies .... See Entry 110141

Dedicated stereophotogrammetric X-ray system for craniofacial research and treatment planning .... See Entry 110152

87.70E Diagnostic methods and instrumentation

(see also 87.60 Medical and biomedical uses of fields, radiations and radioactivity)

110231 Microcomputer system for electro-oculography. M.Keye, J.Attikiouzel (Dept. of Electrical & Electronic Engng., Univ. of Western Australia, Nedlands, Australia), J.L.Black.
Australas. Phys. & Eng. Sci. Med. (Australia), vol.6, no.2, p.82-7 (April-June 1983). [received: Aug. 1983]
The design of a microcomputer based data acquisition system for EOG applications is described. The system measures the absolute voltage excursion corresponding to a horizontal eye movement of a specific amplitude. Several parameters of eye motion are measured including saccadic velocity, eye movement latency and accuracy of fixation. Calibration, light stimulus, data acquisition and processing are performed automatically. A number of tests are performed for averaging purposes. Individual tests are displayed in real time and can be manually aborted to inhibit acquisition of bad data. The system incorporates a Z80 based microcomputer with terminal and dual double-density floppy disk drives. Data acquisition hardware is separated and modularized in a standard 19″ subrack assembly. The system is inexpensive and portable, which permits its use for diagnosis in areas other than large hospitals. Expansion for applications other than EOG can easily be implemented with the existing system. (1 ref.)

110232 ISFET, a chemical sensor: an ion-sensitive transistor developed at the TH Twente. D.Sjobbema.
Elektronica (Netherlands), vol.31, no.12, p.43-5 (17 June 1983). In Dutch.
In the biomedical field there is a need to monitor continuously the behaviour of certain physical and chemical quantities in the body of the patient (in vivo). The intensive study of microelectronic circuits applied to the measurement of such quantities as ion concentrations and enzyme activity has led to the development of the ion-sensitive field effect transistor (ISFET). The electrical characteristics of this implantable and hence extremely small biosensor are reviewed, and its use for ion concentration measurement is compared with conventional techniques. The ISFET can be mass-produced, and should thus be reasonably priced. Work is in hand to improve the quality of the ISFET pH sensor, and to widen the principle to the measurement of other chemical quantities. (no refs.) *D.J.B.*

110233 Detection of fluid entry into the urethra by electric impedance measurement: electric fluid bridge test. S.Plevnik, P.Vrtacnik (Inst. 'J Stefan', Univ. 'E Kardelj', Ljubljana, Yugoslavia), J.Janez.
Clin. Phys. & Physiol. Meas. (GB), vol.4, no.3, p.309-13 (Aug. 1983).
The electric impedance of urine is considerably lower than that of urothelium: thus electrodes placed in the uretha can be used to show when urine penetrates the uretha during urinary incontinence. This principle is presented as part of a possible diagnostic test of urethral incompetence. (9 refs.)

110234 Cardiac electrophysiological studies: computer analysis using a digitiser and interactive visual display unit. T.Cochrane (Dept. of Cardiology, St. Bartholomew's Hospital, London, England), A.W.Dunlop, A.W.Nathan, A.J.Camm.
Clin. Phys. & Physiol. Meas. (GB), vol.4, no.3, p.321-31 (Aug. 1983).
Recording of localised intracardiac electrical potentials provides useful and important information on conduction disease in man. Analysis of intracardiac recordings involves measurement of large numbers of timing intervals representing the sequence of activation of the various parts of the cardiac conduction system. The authors describe a semi-automatic computer based analysis system tailored to the specific requirements of cardiac electrophysiological measurement. A digitising tablet is used in conjunction with a visual display oriented data handling package to input data directly to computer memory for sorting and further analysis. Particular attention is paid to providing the user with a system that is simple to learn yet is robust and flexible in use. The computer software is written entirely in the high level FORTRAN language. It is modular in design and is therefore easily adapted for the changing needs of a research oriented department. (9 refs.)

110235 Three-dimensional anthropometric measurement. C.Gross, M.Neuwirth, J.Graham, J.Pugh (Div. of Bioengng., Dept. of Orthopaedics, Hospital for Joint Diseases Orthopaedic Inst., New York, NY, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.116-18 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
Three techniques for anthropometric assessment have been outlined: (1) spinal lordosimetry; (2) tibial torsimetry; and (3) leg inertiomet. All three techniques utilise computerised point encoding techniques and a variety of data output and presentation modes. Repeatability and accuracy were both shown to be acceptable when compared to that produced by conventional radiographic techniques. In fact, the recent concern over radiation exposure during routine anthropometric and orthopaedic assessments originally prompted the development of these non-radiographic techniques. (4 refs.)

110236 Improvement of the detectability of simulated pathological tremour e.m.g.s. by means of demodulation and spectral analysis. H.L.Journee (Dept. of Neurosurgery, State Univ. Groningen, Groningen, Netherlands), J.van Manen.
Med. & Biol. Eng. & Comput. (GB), vol.21, no.5, p.587-90 (Sept. 1983).
In e.m.g.s. recorded from patients with pathological tremours, the tremour cannot often be recognised by visual inspection. Demodulation of tremour e.m.g.s. improves the detectability of the tremour, but the signal-to-noise ratio remains poor. In this study, demodulated artificially generated tremour e.m.g.s. and e.m.g.s. from a patient with a pathological tremour were subjected to digital spectral analysis. Power spectra, phase and coherence functions of the modulating and demodulated signals were calculated. The result is that the detectability is improved from a modulation depth of 60% in modulated noise to 2-4% after demodulation and spectral analysis. The results suggest a useful application of the demodulator and analysing software to tremour e.m.g.s. in clinical practice. (10 refs.)

110237 A high-speed computerized tomography image reconstruction using direct two-dimensional Fourier transform method. N.Niki, T.Mizutani, Y.Takahashi (Faculty of Engng., Tokushima Univ., Tokushima, Japan), T.Inouye.
Trans. Inst. Electron. & Commun. Eng. Jpn. Part D (Japan), vol.J66D, no.6, p.707-14 (June 1983). In Japanese.
A practical high-speed image reconstruction algorithm based on direct two-dimensional Fourier transform method is developed. It eliminates low image quality resulting from the previous direct two-dimensional Fourier transform method. The key point of the new algorithm is the elaborate interpolations of the coordinate transform in the Fourier domain. The program based on the new algorithm is developed and is compared with that based on the conventional filtered backprojection method. The result reveals that the processing time is only one tenth of the latter and the quality of the obtained images are almost the same. (11 refs.)

Lecture to American College of Radiology [medical image processing] .... See Entry 105007

Computerized model of coronary-pulmonary circulation .... See Entry 110075

Engineering research in medical imaging: a synergistic relationship .... See Entry 110100

Overview of a unified SNR analysis of medical imaging systems .... See Entry 110101

Medical ultrasound: is there a hazard .... See Entry 110102

Imaging modalities [medical] .... See Entry 110106

Medical diagnosis by ultrasound .... See Entry 110107

Experiments in automatic classification of laryngeal pathology .... See Entry 110109

Real-time acquisition and offline quantitative analysis of cardiac Doppler spectral data: preliminary impressions .... See Entry 110111

Study of craniofacial anomalies with a portable stereo camera .... See Entry 110117

Automated system for stereometric analysis of the human face .... See Entry 110119

Automatic topography using high precision digital moire methods .... See Entry 110123

Measurement of kyphosis using moire topography .... See Entry 110127

Analysis of scoliosis by back shape topography .... See Entry 110128

Stereophotogrammetric method for breast cancer detection .... See Entry 110129

Automatic measurement of body surfaces using rasterstereography .... See Entry 110130

Contour photography of the optic nerve head: stereometric basis .... See Entry 110134

Stereo measurement of the ocular fundus in ophthalmology .... See Entry 110135

Diagnostic NMR .... See Entry 110136

A NMR tomograph electromagnet design .... See Entry 110137

A combined light and scanning electron microscopy on human urinary cytology .... See Entry 110138

Microwave thermography—characteristics of waveguide applicators and signatures of thermal structures .... See Entry 110139

The role of thermal imaging in the diagnosis, treatment and prognosis of pain .... See Entry 110140

Imaging system using gradient index fibers: a tutorial. [Medical imaging] .... See Entry 110144

Examination of vocal fold movement by ultra-short pulse X-radiography .... See Entry 110146

A single isotope method of post-prandial duodenogastric reflux assessment using $^{99}Tc^{m}$-labelled IDA in patients with gallstones .... See Entry 110148

Roentgen stereophotogrammetry in orthopedics .... See Entry 110149

Single image X-ray photogrammetry system used to detect total joint loosening .... See Entry 110150

Method for determining in-vivo ligament lengths from biplanar X-rays with incomplete data .... See Entry 110151

Stereoroentgenographic system with portable calibration cage for use in clinical medicine .... See Entry 110153

Establishing quantitative within-subject confidence limits for clinical stereoroentgenographs .... See Entry 110154

Advances in nuclear medicine .... See Entry 110157

Relationship between regional pertechnetate cerebral circulation time and EEG in patients with cerebral infarction .... See Entry 110158

A modern universal angiography installation with a 14 in. image intensifier .... See Entry 110160

Computerized dual-energy imaging: a technical description .... See Entry 110161

Image reconstruction methods from transaxial tomographic samples: frequency domain techniques .... See Entry 110162

New method to calculate the renal transit time spectrum from conventional three-probe renography .... See Entry 110163

Spot-camera of Medicor Works, type: SPOT-1 .... See Entry 110164

Subsequent addition of a spotfilm camera to existing X-ray equipment with image intensifier .... See Entry 110165

Tissue-air ratios and scatter-air ratios for diagnostic radiology (1-4 mm Al HVL) .... See Entry 110166

A general method for three-dimensional filter computation [positron emission tomography application] .... See Entry 110168

A comparison of attenuation correction methods for quantitative single photon emission computed tomography .... See Entry 110170

Grid weight as an index of radiographic exposure factors .... See Entry 110171

Clinical application of auto edge detection cardiac analysis program .... See Entry 110172

A scaling method for a system of linear equations—its application to computerised tomography reconstructed from a small number of projection views .... See Entry 110173

Digital cardiovascular fluoroscopy: a low cost system for development of computer analysis techniques .... See Entry 110174

87.70G Patient care and treatment

110238 True r.m.s. volt/ammeters for surgical diathermy measurements during an operation. S.Grimnes (Dept. of Biomedical Engng., Rikoshospitalet Oslo, Oslo, Norway).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.5, p.654-6 (Sept. 1983).
The risk of skin burns and the disturbance of electromedical equipment by high frequency currents are two important problems linked with the use of surgical diathermy in the operating room. The risk of skin burns is related to the high frequency power and measuring instruments used must respond to the true r.m.s. value. The crest factor may be >10 and the peak potential several thousand volts. In contrast, the disturbance of electromedical equipment probably depends more on the peak value than the r.m.s. value. The author discusses measuring principles and voltmeter and ammeter design. (2 refs.)

Experimental techiques for direct-contact applicators for microwave hyperthermia .... See Entry 110112

Apparatus for RF and microwave hyperthermia .... See Entry 110113

An introduction to medical lasers .... See Entry 110114

The free-electron laser: medicine's rising star .... See Entry 110116

The role of thermal imaging in the diagnosis, treatment and prognosis of pain .... See Entry 110140

Radiofrequency-induced hyperthermia: computer simulation of specific absorption rate distributions using realistic anatomical models .... See Entry 110143

Stereotactic implantation of radioactive sources for the treatment of brain tumours .... See Entry 110145

Fast neutron therapy at Edinburgh: staff protection .... See Entry 110147

Accuracy of stereometry in assessing orthognathic surgery .... See Entry 110155

X-ray photogrammetry for endocavitary radiation therapy .... See Entry 110156

Radioisotopes for the treatment of cancer .... See Entry 110159

Depth dosimetry of curved radon-222 plesiotherapy applicators .... See Entry 110175

Measurements of dose from secondary radiation outside a treatment field .... See Entry 110183

Dosimetry of the Siemens Mevatron 67 linear accelerator .... See Entry 110184

Monte Carlo evaluation of the Sievert integral for brachytherapy dosimetry .... See Entry 110186

87.70J Prosthetics and other practical applications

110239 Impact resistance of variously mounted ophthalmic lenses. J.M.Fields,Jr., W.Goldsmith (Dept. of Mech. Engng., Univ. of California, Berkeley, CA, USA).
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.8, p.725-38 (Aug. 1983).
An experimental investigation was conducted to determine the frangibility of ophthalmic glass lenses loaded by the impact of steel spheres with diameters ranging from 6.35 to 28.6 mm when dropped from heights up to 1.905 m. These lenses were supported either simply, by a ring similar to that used in US Food and Drug Administration (FDA) drop tests, or while inserted in three different commercially used frame configurations placed on a head form. Strains up to 4000 μ strain were recorded by gauges cemented to the lenses, and impact forces on the glass up to 10.2 kN were determined, with many lenses surviving. Plano lenses tested according to standards experienced peak values of 2300 μ strain. The maximum force transmitted to the head form at the nose piece was found to be 91 N as determined by embedded crystal transducers. A series of special tests on circular plano lenses inserted in specially constructed rings and a circular eyewire indicated that eyewire tension is not a significant factor in impact resistance of lenses under both static and dynamic loading. (13 refs.)

110240 Hearing aids. R.Maas, R.Beck.
Acta Medicotech. (Germany), vol.30, no.6, p.207-13 (Dec. 1982). In German.
For 70 years hearing aids have been developed to enormous technical perfection. The development of these aids is, of course, a long process, and many technical parameters, as well as wishes and needs of patients, have to be considered. For a variety of forms of ear defects there is also a variety of different hearing aids. (no refs.)

110241 A study of antero-posterior load transfer in total hip replacement using a modelling technique. A.W.Miles, D.M.Dall, M.Rivarola (Univ. of Cape Town, Cape Town, S Africa).
Eng. Med. (GB), vol.12, no.3, p.113-15 (July 1983).
Describes the application of a modelling technique to determine the effect of the antero-posterior loading in the hip joint on bone and prosthesis stresses. The technique employs the use of model femora cast in a polyurethane foam and femoral prostheses made from various plastics to simulate titanium and chrome-cobalt. The study showed that antero-posterior forces produce significant stresses in the prostheses and emphasises the importance of considering these forces in the design of femoral prostheses. (3 refs.)

110242 A new approach to the fixation of a metacarpophalangeal joint prosthesis. P.S.Walker (Orthopaedic Biomech., Brigham & Women's Hospital, Boston, MA, USA), D.Nunamaker, R.Huiskes, T.Parchinski, D.Greene.
Eng. Med. (GB), vol.12, no.3, p.135-40 (July 1983).
A significant problem with rigid prosthetic stems applied in the finger bones, as well as in other bones of the upper and lower extremity, is resorption of bone at the interface. An investigation was carried out using a plastic plug which would more evenly distribute the stresses to the bone, with fine ridges to produce enhanced fixation by bony ingrowth. A total knee prosthesis in the cat was used as the model, radiographic and histological studies being made at up to one year. A finite element analysis identified areas of high interface and material stresses. With a finely grooved plug, bone ingrowth occurred in all regions except for the region near the bone entry, where the finite element analysis showed the highest interface shear stresses and bone material stresses to occur. (12 refs.)

110243 Pulsatile flow experiments on heart valve prostheses. K.B.Chandran, T.L.Yearwood, C.-J.Chen, H.L.Falsetti (Dept. of Internal Medicine, Univ. of Iowa, Iowa City, IA, USA).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.5, p.529-37 (Sept. 1983).
In vitro fluid dynamic characteristics of aortic valve prostheses were experimentally measured for physiologically relevent pulsatile flows using hot-film velocimetry. The prostheses studied were (i) centrally occluding ball-in cage and (ii) tilting disc valves. The valves sewn to a plexiglass ring were placed in a specially designed valve chamber. The valve chamber was mounted in a mock circulatory system in which glycerol solution was used as the blood analogue fluid. Physiological pulsatile flow experiments were conducted at a time-averaged flow rate of 86.7 $cm^3\ s^{-1}$ (mean Reynolds number of 1320 based on the cross-sectional averaged velocity with a tissue annulus diameter of 27 mm). With the aid of a three-sensor probe, the instantaneous values of the three velocity components (component along the axis, as well as radial and tangential velocity components in a cross-section) were measured and used to compute the mean velocity profiles as well as turbulent normal stresses. The results showed that peak turbulent normal stresses were obtained at 108 ms after the opening of the valves with maximum magnitudes of 110 Pa, 45 mm downstream from the silastic ball valves, compared to about 35 Pa for the stellite ball valve. The largest turbulent normal stresses of about 150 Pa were obtained behind tilting disc valves in the minor flow region parallel to the tilt axis. (17 refs.)

110244 An in vivo method of measurement of the mechanical properties of vascular prostheses: the mechanical properties of saphenous vein bypass grafts. B.L.W.Chapman, D.Charlesworth (Dept. of Surgery, Univ. of Manchester, Manchester, England).
Phys. Med. & Biol. (GB), vol.28, no.9, p.1067-74 (Sept. 1983).
It seems likely that long term patency of small bore vascular prostheses is dependent upon, among other things, the mechanical properties of their walls. Arteries are visco-elastic but there is no accurate method of measuring the visco-elasticity of arterial substitutes in vivo. The most successful vascular substitute is autogenous saphenous vein and it is essential to know its elastic properties if one is to mimic them in prostheses. (Veins rapidly lose their elasticity when excised and measurements made in vitro are unrealistic.) The authors describe an in vivo method which is based on measurements of pressure alone from which they calculate a propagation constant and phase speed, which characterises the visco-elastic behaviour of vein. Sixteen patients who had a femoro-popliteal bypass were studied. Measurements of pressure were used to calculate the phase speed of the pulse and the relationship of phase speed to frequency was calculated. The asymptotic phase speed for human saphenous vein was 13.6 ms^{-1}. (21 refs.)

Fabrication and wear test of a continuous fiber/particulate composite total surface hip replacement .... See Entry 109520

Effect of aqueous cations on friction between rubber and glass .... See Entry 109529

Ion sputtering and its application to biomaterials [reviews] ....See Entry 109549

Analysis of resonant coupled coils in the design of radio frequency transcutaneous links .... See Entry 110142

Single image X-ray photogrammetry system used to detect total joint loosening .... See Entry 110150

87.80 BIOPHYSICAL INSTRUMENTATION AND TECHNIQUES

110245 Close-range photogrammetry in predicting animal weight. J.N.Hatzopoulos (Dept. of Civil Engng. & Surveying & Photogrammetry, California State Univ., Fresno, CA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.41-7 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
The use of photogrammetry to determine dimensional and volume data of animals from a remote distance is investigated. The animal tranquilisation process requires a precise knowledge of the weight of the animal for adjusting the appropriate dosage of medication. Practical experimentation using graphical and analogical processing methods proves that close-range photogrammetry is the best tool for the determination of the correlation between dimensional and volume data and weight of the animal. A practical example of the correlation determination which involved a study of several horses is presented. (8 refs.)

110246 Rotating microscope for Landsat photography of vertebrate embryos. R.Gordon (Pathology Dept., Univ. of Manitoba School of Medicine, Winnipeg, Manitoba, Canada).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.48-52 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
A rotating microscope has been developed which can rotate around a single, living embryo. The purpose of this instrument is to allow the investigator to take mosaic images covering the whole surface of the embryo at regular time intervals. Such data is essential to an analysis of the cell motions and interactions involved in the first steps of the morphogenesis of the brain. Because the degrees of freedom and the image processing problems are so similar to photography of the earth from satellites, the author has called this 'Landsat' photography of embryos. (9 refs.)

110247 Biostereometric study of a sample of 50 young adults by photogrammetry. R.Mollard, M.Sauvignon, J.C.Pineau (Lab. d'Anthropologie Appliquee, Univ. Rene Descartes, Paris, France).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.234-40 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
A specific photogrammetric device is described. It is composed of one pair of cameras on a vertical base and two vertical mirrors. A sample of 50 young French males was studied by using this method for the purpose of establishing the relationship between overall and segmentary dimensions, surfaces and body volumes and evaluating the variability of these parameters. The conventional anthropometric method and photogrammetry are compared. (19 refs.)

110248 Measurement of reach envelopes with a four-camera selective spot recognition (SELSPOT) system [astronaut application]. J.H.Stramler,Jr. (Northrop Services Inc., Houston, TX, USA), B.J.Woolford.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.241-5 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
A four-camera SELSPOT system received at the Johnson Space Center is thought to be the first such system in the United States. The basic SELSPOT system has been interfaced by the Southwest Research Institute to custom-built hardware to provide a very flexible system. The four cameras provide a 360 degree field of view with a data redundancy which should permit a reduction in the number of missing data point errors. Some test data collected with the system and a brief description of the software used to present it are discussed. (10 refs.)

110249 Cinephotogrammetric evaluation of thoracic deformation due to safety belt action during a crash test. J.P.Verriest (Organisme Nat. de Securite Routiere, Lab. des Chocs et de Biomecanique, Bron, France).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.246-56 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
In order to estimate the thoracic injury tolerance of a belted automobile occupant, and to gain better knowledge about the mechanical behaviour of the belt/torso system, the dynamic deformation of the thorax due to the action of a safety belt load can be measured by cinephotogrammetry. The methodology of data acquisition and processing involved in this technique is described and a few graphical results are given. (7 refs.)

110250 Analysis and display of human wrist motion. S.W.Peterson, A.G.Erdman (Dept. of Mech. Engng., Univ. of Minnesota, Minneapolis, MN, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.257-61 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
The 3D kinematic analysis of the wrist is a complex problem. A method utilizing high speed stereocinematography has been developed to accurately measure the motion of the bones in the wrist. Both relative and absolute motions can be obtained using this system. The system has been shown to accurately locate a point to ±0.003 inch. The 3D motion characteristics of the capitate in radial ulnar deviation were analyzed using this system, and the results are presented. A computer graphics program, developed by the authors, is used to display the motion characteristics of the carpal bones. In this program, the bone surface, defined using a special stereopointer and bicubic surface fitting algorithms, is displayed along with the kinematic data. (8 refs.)

110251 Stereometric analysis of the human body and articular surfaces. Z.Ren-xiang, L.Ming, L.Zu-yun, Z.Hong-zi (Beijing Univ. of Iron & Steel Technol., Beijing, China).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.284-6 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
Introduces the method of Moire contourography to measure human body and animal articular surfaces and teeth. Animal articulation surfaces are rather complicated. The authors haven't seen an expression of a complete mathematical formula yet. Hence they adopt Moire contourography to express in three dimensions animal aticular surfaces. The authors also consider the characteristic equation of Moire contourography using an irradiation grating, and the relationship of the contour Moire fringes and influence coefficients. Thus this technique is very useful to measure errors.The authors introduce some of their research on animal articulation surfaces and teeth. (8 refs.)

110252 Stereometric description and analysis of skull growth in P. cynocephalus anubis (Olive Baboon). O.J.Oyen (School of Dentistry, Case Western Reserve Univ., Cleveland, OH, USA), P.E.Lestrel.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.330-7 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
Biostereometric techniques have demonstrated advantages over traditional craniometric methods in describing and analyzing irregular biological forms and form-changes. This paper demonstrates how data obtained with a simple stereoplotting craniostat can be used to precisely describe growth-related changes observed in a cross-sectional collection of olive baboon (Papio cynocephalus anubis) skulls. Data obtained from this extremely prognathic primate species are analyzed using principles of stereographic projections. Demonstrations are made showing how readily understandable representations of other-

wise complex multidimensional shapes and shape changes associated with the skull can be made. (7 refs.)

110253 Three-dimensional perspective display for chicken brain autoradiographs. K.Takaya, S.W.Ellis, J.I.Hasegawa (Dept. of Electrical Engng., Univ. of Saskatchewan, Saskatoon, Canada).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.361, p.338-42 (1983). (Biostereometrics '82, San Diego, CA, USA, 24-27 Aug. 1982).
The glucose metabolism in certain areas of the brain becomes highly active and reflects the degree of the epileptic seizure when evoked. In order to visualize the localization of glucose, C^{14} labeled glucose is used to produce autoradiographs from brain slices in chicken. The areas having a high concentration of C^{14} labeled glucose appear darker in the developed film. This paper describes an image processing computer system which displays 3 dimensional perspective views from the brain slice autoradiographs. The series of autoradiographs were digitized by a video frame grabber. The shape of the brain was displayed 3 dimensionally by means of surface contours and the dark areas representing high glucose concentration was embedded in the outlines. (no refs.)

110254 Accurate measurement of flash-evoked alpha attenuation. B.Kemp (Dept. of Clinical Neurophysiology, Univ. Hospital, Leiden, Netherlands).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.2, p.248-53 (Aug. 1983).
An accurate method for measuring flash evoked alpha attenuation has been derived, based on a model of the alpha generator. The method has been applied to 10 healthy volunteers in order to determine their alpha attenuation latencies (AALs). For the 9 subjects which showed at least some alpha rhythm, the AAL group mean is 95 msec. The AAL inaccuracy (SD 5 msec) is smaller than interindividual differences (SD 13 msec). There exists no relationship between the AAL and the frequency of the alpha rhythm. (16 refs.)

110255 Detection of reaction time by an adaptive filter based on the least squares fit. D.G.Ruegg, A.Eichenberger (Inst. of Physiology, Univ. of Fribourg, Fribourg, Switzerland).
Electroencephalogr. & Clin. Neurophysiol. (Netherlands), vol.56, no.2, p.256-8 (Aug. 1983).
An adaptive filter based on the least squares fit between a template and individual records was developed. It has been applied to compute reaction times of a voluntary movement. Its performance was tested by comparing these reaction times with the latency of the EMG responses. Different properties of the least squares fit technique and Woody's filter technique (Woody 1967) are discussed. (6 refs.)

110256 512-channel X-ray DARK-2.0 diffractometer with a mosaic detector for investigating protein single crystals. B.K.Vainshtein, N.I.Komyak, F.P.Reznikov, D.A.Goganov, D.M.Kheiker, A.V.Mirenskii, A.Z.Pliss, O.I.Ageev, V.M.Shul'meister.
Instrum. & Exp. Tech. (USA), vol.25, no.6, pt.2, p.1492-8 (Nov.-Dec. 1982). Translation of: *Prib. & Tekh. Eksp. (USSR)*, vol.25, no.6, p.160-5 (Nov.-Dec. 1982).
Describes the design and the characteristics of the 512-channel X-ray DARK-2.0 diffractometer with a mosaic detector for research on protein single crystals. The research technique and the results of an experimental evaluation of the instrument are described. Since all diffractive reflections in 4-layer planes can be simultaneously recorded with a resolution of 2 Å, the recording speed on the DARK-2.0 was increased 30 times over that of the single-channel DAR-UMB diffractometer. Recordings of single crystals of lung hemoglobin protein (α=92.95 Å; b=38.31 Å, c=52.15 Å; and γ=99°) and its five derivatives were made with a resolution of 2 Å (150000 reflections) and confirmed the high accuracy and speed of operation of the instrument. (19 refs.)

110257 Nuclear instrument maintenance—problems, solutions, and obstacles. P.H.Vuister.
Int. At. Energy Agency Bull. (Austria), vol.25, no.2, p.24-9 (June 1983).
To guarantee reliable results and effective use of invested capital, maintenance and quality control of instruments are essential for laboratories involved in research, analysis of samples, and medical diagnostics. Badly maintained or inoperable instruments entail important economic losses and social hardship. Nevertheless, expert reports, technical co-operation requests, recent surveys on use and maintenance of nuclear medicine instruments, and many other sources, reveal frequent breakdowns and insufficient maintenance and quality control of nuclear equipment. Nuclear medicine instruments in particular, which are expensive and relatively sophisticated, need regular checks and are difficult to maintain in good working order, especially in developing countries. (4 refs.)

110258 A new conductive substrate for preparing cells in suspension for scanning electron microscopy. H.Kumon, K.Ohno, Y.Matsumura, H.Ohmori (Dept. of Urology, Okayama Univ. Medical School, Okayama, Japan), T.Tanaka.
J. Electron Microsc. (Japan), vol.32, no.1, p.20-6 (1983).
Improvement in conductibility of substrates was attempted to overcome a technical problem of charging artifacts caused by limited cell surface attachment to the substrates, when cells prefixed in suspension are observed under SEM. Gelatin-covered slips were impregnated with osmium vapor and coated with polylysine. Using the newly-designed slips, the authors have succeeded in the elimination of the charging artifacts, such as irregular bright and dark lines parallel to the scan direction or abnormal contrast by a higher magnification. Subsequently, a mesh containing 42 compartments in 25 mm^2 was prepared by drawing sharp lines on the above conductive substrates. With a combined use of SEM with light microscopy, this particular mesh has solved another problem of differentiating individual cells in mixed cell populations. (11 refs.)

110259 Estimation of the mean size of spheres from the profiles in ulthrathin sections: a stereological method. K.Abe (Dept. of Anatomy, Hokkaido Univ., School of Medicine, Sapporo, Japan), S.Matsushima, M.Mita.
J. Electron Microsc. (Japan), vol.32, no.1, p.57-60 (1983).
The authors have found that a mean area, a, of the sectional profiles of spheres of varying size cut into infinitely thin sections gives the size of the largest sectional profile, A, which representatively indicates the three dimensional size of the spheres by a formula, $A \approx (3/2)\bar{a}$. From this stereological principle, one can easily and quickly estimate the approximate size of spherical objects from a relatively small number of profiles. This is especially convenient and useful in finding the size of larger objects, such as nuclei and cells, where it is difficult to get a large number of profiles for measurements in one population, and may also be useful in obtaining the mean size of any spherical object by electron microscopy. (12 refs.)

110260 A new embedding medium available for stereoscopic observation of semi-thin sections under 200 kV transmission electron microscope. H.Kushida (Electron Microscope Labs., Keio Univ., Tokyo, Japan), T.Kushida, K.Yonehara, E.Nakazawa.
J. Electron Microsc. (Japan), vol.32, no.1, p.61-5 (1983).
A new embedding medium, 'Quetol 812' is found to be satisfactory for the observation of semi-thin sections of biological specimens at an accelerating potential of 200 kV with a conventional TEM, because of its low electron scattering property. 200 kV TEM images of 0.5 and 1.0 μm Quetol 812-embedded sections of mouse seminiferous tubule. (3 refs.)

110261 The use of fluorescent tracers in the peripheral sensory nervous system. D.C.M.Taylor, Fr.-K.Pierau, H.Schmid (Max-Planck-Inst. fur Physiologische und Klinische Forschung, Bad Nauheim, Germany).
J. Neurosci. Methods (Netherlands), vol.8, no.3, p.211-24 (July 1983).
Describes an injection technique which simplifies the use of fluorescent tracers in investigating the projections of peripheral nerves both in rats and pigeons, and avoids the difficulties experienced with the cut nerve technique. The tracers are injected into the peripheral nerve and transported to cell bodies in the dorsal root ganglia (DRG). By a careful choice of tracer it is possible to investigate the projections of two or more nerves in the same preparation. The authors have used two combinations of tracer which can be viewed simultaneously in the cell at the same excitation wavelength (405 nm): (1) propidium iodide and bisbenzimide which produce an orange cytoplasmic fluorescence and blue nuclear fluorescence respectively; and (2) fast blue and nuclear yellow which label the cytoplasm blue and the nucleus yellow. This distribution of tracers is similar to that reported in central neurones but differs from that reported in the efferent peripheral nervous system. Using these tracers the authors have observed double-labelled neurones in the DRG of both rats and pigeons, which is an indication for the dichotomizing of peripheral fibres. The existence of two tracers in double-labelled cells has been confirmed microspectrophotometrically. (22 refs.)

110262 A new photographic method for mapping spatio-temporal receptive field using television snow stimulation. E.Hida, K.Naka, K.Yokoyama (Nat. Inst. for Basic Biology, Okazaki, Japan).
J. Neurosci. Methods (Netherlands), vol.8, no.3, p.225-30 (July 1983).
A means was devised to measure simultaneously spatial as well as temporal characteristics of visual receptive fields by stimulating the retina with the noise obtained on an unused television channel. The input, television snow, and the output, neural response, were recorded on a video tape. The tape was played back to obtain the (linear) spatio-temporal Wiener kernel by cross-correlating the input with the output. This method can be applied to extract the linear part of the visual responses in time and space. (12 refs.)

110263 Fiber microelectrodes for electrophysiological recordings. H.J.Reitboeck (Dept. of Appl. Phys. & Biophys., Philipps-Univ., Marburg, Germany).
J. Neurosci. Methods (Netherlands), vol.8, no.3, p.249-62 (July 1983).
Methods for the fabrication of tungsten-glass and platinum-rhodium-quartz fiber microelectrodes and of fiber pipettes are described and the electrical and mechanical properties of fiber electrodes are discussed. These properties (minimal tissue damage, good single unit isolation and temporal stability) make them particularly suited for multielectrode recordings from the central nervous system. (36 refs.)

110264 The development of linear sweep voltammetry with carbon paste electrodes in vivo. R.D.O'Neill, M.Fillenz, W.J.Albery (Lab. of Physiology, Univ. of Oxford, Oxford, England).
J. Neurosci. Methods (Netherlands), vol.8, no.3, p.263-73 (July 1983).
A number of advances have been made in the application of linear sweep voltammetry with carbon paste electrodes to the monitoring of ascorbate and monoamine neuroregulator metabolities in the brain of the freely-moving rat. These new measures are: the reduction of the sweep rate of 5 mV/s; the elimination of semidifferentiation in chronic recordings; the measurement in situ and subtraction of the background current for each electrode; the reduction, to practically zero levels, of the ascorbate signal in alternate scans; and corrections for circadian changes. These innovations enable one to monitor changes in the monoamine metabolities, even when there are simultaneous, large changes in ascorbate. (12 refs.)

110265 Multioscillator simulator for gastrointestinal electrical activity modelling. D.A.Linkens, M.Khelfa, G.Nicklin (Dept. of Control Engng., Univ. of Sheffield, Sheffield, England).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.5, p.591-8 (Sept. 1983).
Describes a coupled 64-oscillator electronic simulator for modelling electrical slow-wave activity in the mammalian gastrointestinal digestive tract. The individual oscillator dynamics are based on an electronic implementation of the Hodgkin-Huxley membrane equations. The simulator is constructed to allow for versatility in terms of setting oscillator waveshapes and frequencies and intercoupling parameters. It also allows for automatic readout of the model frequency profile, which is one of the main features studied in gastrointestinal electrical activity. Results are shown illustrating frequency plateaus in a coupled chain of oscillators which have a frequency gradient when uncoupled. Frequency entrainment is also shown for the simulator connected as a tubular structure. (15 refs.)

110266 An eye movement recording method operating with a closed eye. B.Comet (Lab. de Physiologie, Faculte de Medecine, Toulouse, France).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.5, p.628-31 (Sept. 1983).
An eye movement recorder, based on an optoelectronic method, can be used in closed or open eye situations. Three photodiodes are used as proximity sensors. This eye tracker is well adapted for the studies of eye movement in after-image phenomena. (14 refs.)

110267 Identification of r.e.m. sleep in the mouse by measuring the body movements. A.Higashi (Nat. Inst. for Physiological Sci., Okazaki, Japan).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.5, p.644-6 (Sept. 1983).
Recently Higashi et al. (ibid., vol.17, p.131-2, 416-8, 1979) have developed a compact accelerator, the so-called 'BM transducer', for detecting minute body movements of a mouse (size: 5 mm × 5 mm; weight: 0.92 g). This report indicates that the body movements thus recorded could serve as a definitive index for identifying the r.e.m. sleep of mice. (3 refs.)

110268 Determination of twist and handedness of a 39-base pair segment of DNA in solution. S.Iwamoto, Ming-Ta Hsu (Rockefeller Univ., New York, NY, USA).
Nature (GB), vol.305, no.5929, p.70-2 (1 Sept. 1983).
A new method is presented for determining the helical parameters of a segment of DNA in solution. It is the first non-crysallographic method that can directly determine both the helical periodicity and the absolute handedness of DNA. The results obtained using this method are consistent with the classical Watson-Crick right-handed double helical model. (11 refs.)

110269 Computed tomography for measuring annual rings of a live tree. M.Onoe, Jing Wen Tsao, H.Yamada (Inst. of Industrial Sci., Univ. of Tokyo, Tokyo, Japan), H.Nakumura, J.Kogure, H.Kawamura, M.Yoshimatsu.
Proc. IEEE (USA), vol.71, no.7, p.907-8 (July 1983).
A portable X-ray computed-tomography (CT) scanner has been developed for the nondestructive measurement of cross sections of live trees, wooden utility poles, wooden building columns, wooden statues, etc. in the field environment. Temporal resolution of CT reconstruction is good enough for observing details of annual rings of trees. The scanner will be useful in plant physiology, environment assessment, safety assurance of poles, archaeology, and dendrochronology. (2 refs.)

110270 Quality improvement of white blood cell images by using a 2-D digital filter. K.Taniguchi, H.Ito, S.Susanto (Faculty of Engng., Fukui Univ., Fukui, Japan).
Trans. Inst. Electron. & Commun. Eng. Jpn. Part D (Japan), vol.J66D, no.6, p.753-4 (June 1983). In Japanese.
Deals with the enhancement of granules in white blood cells images. Taking the distribution of power spectrum of white blood cell images into account, the enhancement of granules was accomplished by using a 2-D high emphasis digital filter. By this processing, extraction of granules becomes easy. (4 refs.)

110271 A microprocessor based system for real time volume measurement of the instrumented, beating canine left ventricle [using ultrasound]. D.K.Medema, W.E.Moritz, A.S.Pearlman, K.Haneda, R.Thomas, D.G.Brazeale, D.H.Dillard (Univ. of Washington, Seattle, WA, USA).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.473-6
A system has been developed which can accurately and repeatably measure the volume of the beating canine left ventricle (LV) in real time. The system consists of a plastic cylindrical volume chamber (VC) which is connected by rigid tubing to a nylon mounting fixture inserted into the mitral orifice. A balloon is attached to the nylon fixture and the VC, and balloon filled with water. The instantaneous water level in the VC is determined using a sonar transducer. The water level is converted to a volume measurement by a microprocessor and displayed on a video display. Static accuracy is better than 0.5 cc over a 0-10 cc range. No perceptible tracking errors are evident when the VC system is driven by a pulsatile pump. The system appears appropriate for use as a reference standard during in vivo echocardiographic studies of LV volume. The authors are now using the system for LV volume studies in an open-chest dog model. (9 refs.)

110272 A context-sensitive approach to long-term ECG arrhythmia analysis. M.Ebele (LERS, Bagneux, France).
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.505-8
A context-sensitive approach to long-term ECG syntactic analysis is presented. The basic idea consists of coupling a finite-state automaton for pattern-primitives string generation to a linearly bounded memory automaton for paradigmatic error analysis of characters in the string. The context sensitive grammar is used as a semantic smoother or as a fuzzy analyser. Signal preprocessing is achieved by a 2nd order polynomial digital filter and the first derivative is selected. This method has been implemented on a DEC LSI11/03 microprocessor running under a very stripped down version on the UNIX operating system. After a six month off-line evaluation period, it is now in everyday use for the screening of long-term and often noisy ECGs in conscious dogs during drug evaluation in the LERS Cardiovascular Department. The system is now used to control the deviation from some specific standard cardiac state in order to measure the drug's actual effect. (10 refs.)

Biostereometrics '82 .... See Entry 105016

First experience on the high intensity pulsed reactor IBR-2 .. See Entry 106198

The 1-1 hard pulse: a simple and effective method of water resonance suppression in FT ^{1}H NMR .... See Entry 106458

Determination of the absolute handedness of knots and catenanes of DNA .... See Entry 109961

Spin exchange in nitroxide-charged membrane models: an ESR method for detecting photodynamic effects .... See Entry 109977

Numerical averaging of electron micrographs of the 50S subunits of ribosomes .... See Entry 109988

Importance of biostereometrical techniques in analyzing the gestures performed in two distinct environments: air and water .... See Entry 110067

Temporal resolution requirements for the double stance period of human gait [high speed cinematography] .... See Entry 110068

The clinostat—a tool for analysing the influence of acceleration on solid-liquid systems .... See Entry 110206

Problems of 0-g simulation with the fast-running clinostat (for cellular study) .... See Entry 110207

The use of horizontal clinostats in plant physiology .... See Entry 110208

Quantitative phono study of intracardiac and external heart sounds .... See Entry 110273

87.90 OTHER TOPICS IN BIOPHYSICS, MEDICAL PHYSICS, AND BIOMEDICAL ENGINEERING

110273 Quantitative phono study of intracardiac and external heart sounds. A.E.Aubert, B.G.Denys, H.De Geest, F.Meno, P.S.Reddy.
Computers in Cardiology. Ninth Meeting of Computers in Cardiology, Seattle, WA, USA, 12-15 Oct. 1982 (Silver Spring, MD, USA: IEEE Computer Society Press 1983), p.501-4
In 11 closed chest dog experiments left ventricular pressure, left apexcardiogram and quantified intracardiac and external heart sounds were recorded simultaneously using infinite time constant piezo-resistive pressure transducers with equal sensitivity and frequency response. Various hemodynamic interventions were made in order to induce changes in heart sounds, especially to generate diastolic sounds (S_3 and S_4). All signals were recorded on multichannel FM tape with identical settings. Spectral analysis of isolated sounds was performed using fast Fourier transform to determine the frequency content. The intensity of the sounds was uniformly greater over the chest wall than inside the left ventricle. Diastolic sounds were visible on the external recordings and could not be discerned on the internal recording. This new method of analyzing quantified internal and external heart sounds gives valuable information on the mode of generation and transmission of these sounds. (15 refs.)

Medical biophysics in Manchester .... See Entry 105059

Proceedings of Workshops III and IV and of the Topical Meeting of the COSPAR Interdisciplinary Scientific Commission F (Meeting F2) of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 110195

Proceedings of Workshop VII and of the Topical Meeting of the COSPAR Interdisciplinary Scientific Commission F (Meetings F1 and F4) of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 110196

90.00 GEOPHYSICS, ASTRONOMY AND ASTROPHYSICS

91.00 SOLID EARTH GEOPHYSICS

91.10 GEODESY AND GRAVITY

(for relations of gravity observations to tectonics and isostasy, see 91.45 Physics of plate tectonics)

110274 An updated Bouguer anomaly map of south-central West Africa. D.A.Hastings (Technicolor Government Services Inc., Sioux Falls, SD, USA).
Geophysics (USA), vol.48, no.8, p.1120-8 (Aug. 1983).
A new Bouguer gravity anomaly map compiled for western Africa adds data for Ghana, Guinea, and Liberia. The new data add detail to a key part of the Eburnean shield and assist in the development of a model of rifting at the time of the Eburnean orogeny, 2000 million years ago. This model includes a framework for the deposition of the region's mineral deposits. The model and existing field data can be used to guide future minerals exploration in the region. (56 refs.)

110275 Gravity interpretation of two dimensional fault structures using Hilbert transforms. N.Sundararajan, N.L.Mohan, S.V.Seshagiri Rao (Centre of Exploration Geophys., Osmania Univ., Hyderabad, India).
J. Geophys. (Germany), vol.53, no.1, p.34-41 (1983).
The Hilbert transform of the second order horizontal gradient of the gravity effect of a two dimensional dipping fault is derived. Using the derivatives of the horizontal gradient of the gravity effect and the Hilbert transform, the parameters of the dipping fault, namely the dip, the depths to the top and bottom and the density contrast, are obtained. The gravity effect of the vertical fault has also been analysed treating it as a particular case of the dipping fault. (9 refs.)

110276 Inertial surveying and geodesy. K.P.Schwarz (Div. of Surveying Engng., Univ. of Calgary, Calgary, Alberta, Canada).
Rev. Geophys. & Space Phys. (USA), vol.21, no.4, p.878-90 (May 1983).
Outlines the basic theory of using the output of an inertial measuring unit to obtain geodetically meaningful results. Emphasis is on the development of appropriate mathematical models and estimation procedures rather than on hardware aspects. A discussion of results to date and an outlook on future applications concludes the presentation. (42 refs.)

110277 Nonuniformity of the Earth's rotation within a day. G.P.Pil'nik (P.K. Shternberg State Astron. Inst., Moscow, USSR).
Sov. Astron. (USA), vol.26, no.6, p.712-15 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1184-9 (Nov.-Dec. 1982).
The possibility of using astronomical observations of the International Time Service to study the intradiurnal nonuniformity of the Earth's rotation is discussed. A spectral analysis of data for 1968-1978 shows that waves with diurnal and semidiurnal periods are contained in these observations. Attention is drawn to the necessity of improving the organization of Time Service observations in connection with the formulation of the new scientific problem. (7 refs.)

Induction of currents in long submarine cables by natural phenomena .... See Entry 110296

Gravity and height variations connected with the recent rifting process in Northern Iceland 1975-1981 .... See Entry 110356

Automatic three-layer, three-dimensional deconvolution of the Pays de Bray anticline .... See Entry 110367

Combination and comparison of various filtering techniques in processing gravity data .... See Entry 110685

The effect of oceanic whitecaps and foams on pulse-limited radar altimeters .... See Entry 110720

Near-circular satellite orbits in an oblate, diurnally varying atmosphere .... See Entry 110860

91.25 GEOMAGNETISM AND PALAEOMAGNETISM; GEOELECTRICITY

110278 Interpretation of aeromagnetic data of Damanhour area west of the Nile Valley, Egypt. R.I.Rizkalla (Dept. of Geology, Univ. of Baghdad, Baghdad, Iraq).
Iraqi J. Sci., vol.23, no.1, p.107-26 (1982). [received: Aug. 1983]
Both qualitative and quantitative interpretation of magnetic data in the area under investigation is tried. The quantitative analysis of the magnetic data results in the construction of a tentative basement relief map which illustrates the general geological setup of the basement rocks in the area. This mainly shows the presence of two sets of faults affecting the area. The depth to the basement surface is found to range between 2 to 5 km. (7 refs.)

110279 Changes in the geomagnetic total force intensity associated with the anomalous crustal activity in the eastern part of the Izu Peninsula. IV. Anomalous change observed in the north-eastern area in 1981. Y.Sasai, Y.Ishikawa (Earthquake Res. Inst., Univ. of Tokyo, Tokyo, Japan).
Bull. Earthquake Res. Inst. Univ. Tokyo (Japan), vol.57, pt.4, p.739-57 (1982). In Japanese.
For pt.III see ibid., vol.55, no.4, p.1101-13 (1980). The eastern-Izu magnetometer array detected a transient decrease in the total intensity in the north-eastern area of the Izu Peninsula during the period from July to October, 1981. The anomaly was found within an area with a 10 km radius, centered on Ito city, where the crustal uplift is still continuing. The total field differences showed spurious bay-like variations from Dec., 1980, to Feb.,

1981, and from Dec., 1981, to Jan., 1982, owing to transient increase of the F component at reference station KNZ. The total field variations at 11 standard observatories in the Kanto and Tokai districts are plotted. In order to interpret the transient anomaly on Izu, the piezomagnetic field associated with a macroscopic model by crustal dilatancy is investigated. (27 refs.)

110280 Palaeomagnetism of Carboniferous rocks of the central Sahara; analysis of juxtaposed magnetisations; configuration of Pangea. L.Daly (Lab. de Geomagnetisme, Univ. de Paris 6, Saint-Maur-des-Fosses, France), E.Irving.
Ann. Geophys. (France), vol.1, no.3, p.207-15 (May-June 1983). In French.
Two rock-units of red-beds (Ain Ech Chebbi and Hassi Bachir Formations) of middle Carboniferous age from the central Sahara have been studied. Three components have been identified. The first has been acquired in the recent geomagnetic field. The second is a strong and pervasive magnetization in the Hassi Bachir Formation that seems to have been acquired during a period of weak folding in the early Permian; it gave a paleopole before correction for tilting of beds at 35.5°S, 60.0°E, $A_{95}=4.6°$. The third is thought to date from the time of the diagenesis; the Ain Ech Chebbi Formation (lower Moscovian) yielded a paleopole (after correction for tilting of beds) at 22.9°S, 51.8°E $A_{95}=6.3°$; the Hassi Bachir Formation (lower Moscovian to upper Namurian) yielded a paleopole after correction for tilting of beds at 26.8°S, 56.6°E, $A_{95}=3.7°$. The overall mean paleopole for the two units based on 11 sites is 25.4°S, 54.8°E, $A_{95}=3.5°$, $K=149$. The paleopoles when compared with results from North America and Europe are inconsistent with Wegener-type reconstructions but are consistent with the reconstructions of Van der Voo and French (1974) and Irving (1977) in which Gondwana is rotated by different amounts relative to the northern continents. (28 refs.)

110281 Analytic comparison of apparent polar wander paths. B.J.J.Embleton (CSIRO Div. of Mineral Phys., North Ryde, Australia), N.I.Fisher, P.W.Schmidt.
Earth & Planet. Sci. Lett. (Netherlands), vol.64, no.2, p.276-82 (Aug. 1983).
Develops an iterative technique which can be used to match paths on the surface of a sphere on an objective basis. The notion of a minimum combined path length from a comparison of two data sets is used to determine the optimal match-up. The technique is appropriate to cases where the only dating available for the points on each path is their relative chronology. (27 refs.)

110282 The harmonic and transient electromagnetic response of a thin dipping dike. P.Weidelt (Bundesanstalt fur Geowissenschaften & Rohstoffe, Hannover, Germany).
Geophysics (USA), vol.48, no.7, p.934-52 (July 1983).
An exact solution is given for the electromagnetic induction in a dipping dike of finite conductivity, represented as a thin half-sheet in a nonconducting surrounding. The problem is formulated for arbitrary dipole or circular loop T_x-R_x configurations. The formal solution obtained by the Wiener-Hopf technique is cast into a rapidly convergent triple integral suitable for an effective numerical treatment. A good agreement is found between numerical results and analog measurements available for harmonic excitation. The transient response is obtained as a superposition of the half-sheet free-decay modes and is illustrated by some numerical examples for coincident loops, including a diagram for the approximate determination of conductance and depth of a vertical dike. (31 refs.)

110283 Finite-difference calculations of the transient field of an axially symmetric Earth for vertical magnetic dipole excitation. M.M.Goldman (Inst. for Petroleum Res. & Geophys., Holon, Israel), C.H.Stoyer.
Geophysics (USA), vol.48, no.7, p.953-63 (July 1983).
A finite-difference formulation of the coaxial-loop or wire-loop transient electromagnetic prospecting systems is used to model the fields from a buried cylindrical conductor whose axis is coincident with that of the field system. Solutions are obtained directly in the time domain. The variable-directions method reduces each advance of one step in time from one 2-D problem to a large number of one-dimensional (1-D) problems. In order to avoid including the air in the finite-difference grid, an integral equation approach is used to formulate the surface boundary condition. All computations are carried out for a perfectly conducting basement. (19 refs.)

110284 Airborne resistivity mapping using a multifrequency electromagnetic system. A.K.Sinha (Geological Survey of Canada, Ottawa, Ontario, Canada).
Geophys. Prospect. (Netherlands), vol.31, no.4, p.627-48 (Aug. 1983).
A three-frequency airborne EM survey carried out over an area northwest of Timmins, Ontario, was interpreted in terms of thickness and resistivity of the layers of a two-layer Earth section. Based on prior geological information and a preliminary interpretation of the field records, two two-layer models of the subsurface seemed to be appropriate for most of the survey area. An automatic computerized interpretation procedure was devised to interpret the field data at each point in terms of thickness and resistivity parameters of those two models. (28 refs.)

110285 The integral-finite-difference method for calculating transient electromagnetic fields in a horizontally stratified medium. M.M.Goldman (Inst. for Petroleum Res. & Geophys., Holon, Israel).
Geophys. Prospect. (Netherlands), vol.31, no.4, p.664-86 (Aug. 1983).
A finite-difference solution and an integral algorithm are developed for computing time-domain electromagnetic fields generated by an arbitrary source located in a horizontally stratified earth. The finite-difference problem is first solved for the kernel of an integral Bessel transform of the desired field and then an inverse transformation is performed either by numerical integration or by linear filtering. A description of the appropriate algorithm as well as numerical results are presented for two cases: an axially symmetric source placed on the surface of a horizontally layered section overlying either an insulating or an ideally conducting basement. (25 refs.)

110286 Application of mantle filter theory to the magnetic jerk of 1969. G.E.Backus (Inst. of Geophys. & Planetary Phys., Scripps Inst. of Oceanography, Univ. of California, San Diego, La Jolla, CA, USA).
Geophys. J. R. Astron. Soc. (GB), vol.74, no.3, p.713-46 (Sept. 1983).
Data relevant to the electrical conductivity κ in the lower mantle are rare, hard to interpret, and often not very precise. Current estimates of that conductivity disagree by two orders of magnitude. The data are certainly too sparse to support any particular conductivity profile in the lower half of the mantle. The present paper is an attempt to obtain certain averages or other coarse properties of that profile by refining Runcorn's (1955) theory of geomagnetic impulses and applying the results to the 1969 impulse. (31 refs.)

110287 On multifrequency magnetotelluric sounding over the Himalayan type colliding plate boundaries. P.D.Saraf, J.G.Negi (Theoretical Geophys. Group, Nat. Geophys. Res. Inst., Hyderabad, India).
Geophys. J. R. Astron. Soc. (GB), vol.74, no.3, p.809-17 (Sept. 1983).
Deep linear structures and deep parallel fractures often signify the tectonic zones of colliding plate boundaries of the Himalayan type. Knowledge of the electrical properties of the upper mantle in such areas can provide a good understanding of tectonic processes in these zones. However, the electrical anisotropy in these crustal formation introduces uncertainties in the interpretation of the magnetotelluric data. Hence, an attempt is made to estimate the effects of dipping anisotropy in probing such tectonically active areas. Numerical results in comparison with isotropic and non-dipping conditions display the extent of change in the surface impedance parameter, at different frequencies, for several dipping anisotropic conditions usually occurring at the plate boundaries. It is also shown that the multifrequency measurements provide fairly good estimates of resolving such complex crustal formations. (6 refs.)

110288 Boundary conditions for a rapidly rotating hydromagnetic system in a cylindrical container. D.R.Fearn (Dept. of Appl. Math. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
Geophys. & Astrophys. Fluid Dyn. (GB), vol.25, no.1-2, p.65-75 (1983).
A conducting fluid is contained in a cylindrical annulus with rigid, perfectly conducting boundaries and is permeated by a magnetic field $\mathbf{B}_0=B_0(s)\phi$ (where (s,ϕ,z) are cylindrical polar coordinates). The equations governing the linear stability of this system are separable in ϕ,z, and time t, and form a tenth-order boundary-value problem in s. The five conditions which must be satisfied at each boundary are $\mathbf{u}.\hat{\mathbf{s}}=0$, $\mathbf{u}\times\hat{\mathbf{s}}=0$ and $\mathbf{e}\times\hat{\mathbf{s}}=0$ where $\mathbf{u}$ is the fluid velocity and $\mathbf{e}$ the electric field. The system of equations reduces to sixth order and the noslip conditions can no longer be applied. A complication arises when waves on a timescale long compared with the rotation period are of interest, because then the equations reduce to fourth order and it is unclear what are the correct boundary conditions to be applied. A boundary-layer analysis shows that the normal magnetic field and a linear combination of the normal velocity and tangential current must vanish at the edge of the mainstream. (6 refs.)

110289 The Rikitake two-disc dynamo system and the Painleve property [Earth MHD dynamo]. W.-H.Steeb (Theoretische Phys., Univ. Paderborn, Paderborn, Germany), A.Kunick, W.Strampp.
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2649-53 (Aug. 1983).
To find integrable and nonintegrable regions of the Rikitake two-disc dynamo system the authors investigate its Painleve property. This means they perform a singular point analysis. This analysis gives one a hint where global constants of motion exist. Related systems are also investigated. (15 refs.)

110290 Palaeomagnetism of alkali basalts occurring in Takakusayama and Ryuso districts, south-central Honshu, Japan. S.Tonouchi, K.Kobayashi (Ocean Res. Inst., Univ. of Tokyo, Tokyo, Japan).
J. Geomagn. & Geoelectr. (Japan), vol.34, no.11-12, p.587-600 (1982).
Directions of stable natural remanent magnetisation as well as thermomagnetic and opaque-mineralogical characteristics of alkali basalts occurring in Takakusayama and Ryuso districts immediately east (in the oceanside) of the Setogawa ophiolite belt indicate that the alkali basalts were formed as seamounts for post-spreading volcanics, partly emerged at one time, at a site not far from the present location. The masses of alkali rocks were dissected by the normal faults with a strike of N40°E and then accreted along the outer margin of the Setogawa ophiolite belt. (9 refs.)

110291 Geomagnetic paleointensities for the period 6000 to 3000 years BP determined from lavas and pyroclastic flows in Japan. H.Tanaka (Dept. of Appl. Phys., Tokyo Inst. of Technol., Tokyo, Japan).
J. Geomagn. & Geoelectr. (Japan), vol.34, no.11-12, p.601-17 (1982).
Paleointensity of the geomagnetic field was studied with precisely dated lava flows and pyroclastic flows in Japan older than 3000 years BP by the Thellier's (1959) stepwise heating method. The errors inherent in the ages of the rocks are fully evaluated. Samples collected from five lava flows and three pyroclastic flows provide successful results. Two examples are found indicating that the apparent linear NRM-TRM relation in the Arai (1963) diagram is probably due to the effect of TCRM produced during heat treatment. This phenomenon is detected by comparing the result with with those from other specimens taken from the same flow and treated with the same procedure in the Thellier's experiment simultaneously with two samples mentioned above. This result strongly suggests that the Thellier's experiment should be done by using multiple at least three specimens. (36 refs.)

110292 Peninsula effects in central Japan and their relation to the electrical conductivity structure. Y.Honkura (Dept. of Appl. Phys., Tokyo Inst. of Technol., Tokyo, Japan).
J. Geomagn. & Geoelectr. (Japan), vol.35, no.2, p.39-56 (1983).
Unusually large amplitudes of the Z-component of short-period geomagnetic variation have often been observed at coastal areas. In most cases, this type of anomaly is associated with an irregular shape of coastline particularly like a peninsula-like jut. In this sense the anomaly may be called the peninsula effect. The difference between the coast and peninsula effects arises from local perturbation of induced electric currents flowing in a conducting sea due to the presence of a less conducting peninsula. A method is put forward to estimate numerically such perturbation. Basically it is a combination of numerical methods used for the coast and island effects. This method is then applied to the peninsula effects observed in the Izu and Kii Peninsulas, central Japan. (26 refs.)

110293 Electrical conductivity beneath Iceland—constraints imposed by magnetotelluric results on temperature, partial melt, crust-and mantle structure. M.Beblo (Inst. fur Allgemeine und Angewandte Geophys., Univ. Munchen, Munchen, Germany), A.Bjornsson, K.Arnason, B.Stein, P.Wolfgram.
J. Geophys. (Germany), vol.53, no.1, p.16-23 (1983).
Magnetotelluric results from 38 sites in North Iceland yield a detailed spatial distribution of conductivity versus depth. A high-conductivity layer, about 10 Ωm, marking the transition between crust and upper mantle is detected throughout the surveyed area. The high conductivity layer indicates some basaltic melt fraction at temperatures around 1000°C. Below this anomalous zone down to 150 km depth, the conductivity increases to 100 Ωm. However, a highly conducting asthenosphere exists below 150 km depth. A petrological model for Iceland is suggested. (29 refs.)

110294 Computer synthesis of geomagnetic palaeosecular variations. K.M.Creer (Dept. of Geophys., Univ. of Edinburgh, Edinburgh, Scotland).
Nature (GB), vol.304, no.5928, p.695-9 (25 Aug. 1983).
Computer models, designed to synthesize palaeosecular variations of the geomagnetic field, cast doubt on some widely accepted palaeomagnetic dogmas. Westward (or eastward) drift cannot be uniquely deduced from the sense of rotation of the geomagnetic vector: the use of unit vectors in statistical analyses leads to systematic errors which render investigation of the global symmetry of the palaeofield more difficult than previously supposed. At least some geomagnetic 'excursions' may be regarded as large-amplitude secular variations. (30 refs.)

110295 Tectonomagnetism. P.M.Davis (Dept. of Earth & Space Sci., Univ. of California, Los Angeles, CA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.685-93 (April 1983).
The magnetization of crustal rock is influenced by stress by virtue of piezomagnetic effects in crystals of magnetic minerals. Crustal stress changes in

tectonic zones are therefore expected to generate changes in the crustal component of the geomagnetic field and so provide a mechanism for monitoring stresses. Observations of several tectonomagnetic effects were reported and the method of observation improved using predictive filtering techniques to remove the disturbing influence of ionospheric and magnetospheric activity. The possibility that fluid flow in the crust might generate magnetic fields comparable to those due to stress changes was evaluated. (43 refs.)

110296 Induction of currents in long submarine cables by natural phenomena. S.Meloni (Istituto Nazionale di Geofisica, Osservatorio Geofisico Monte Porzio, Rome, Italy), L.J.Lanzerotti, G.P.Gregori.
Rev. Geophys. & Space Phys. (USA), vol.21, no.4, p.795-803 (May 1983).
The influence of induced currents on long submarine cables has been observed for nearly a century. The currents originate from time variations in the magnetic field of external origin (magnetospheric, atmospheric tides) and Earth and ocean tides. Steady Earth currents of internal origin have also been proposed as a possible source. The induced currents will depend upon the length, depth, and geomagnetic location of the cables. Present understanding of the phenomena is reviewed. Potential scientific problems which might be addressed with data from such long cables are also discussed. (92 refs.)

110297 Interpretation methods for magnetometer arrays. D.I.Gough, M.R.Ingham (Inst. of Earth & Planetary Phys., Univ. of Alberta, Edmonton, Alberta, Canada).
Rev. Geophys. & Space Phys. (USA), vol.21, no.4, p.805-27 (May 1983).
The authors review interpretation methods for magnetometer array studies. Such studies investigate structure in the Earth to depths of about 600 km using induction by various external current systems. The use of magnetograms and Fourier transform anomaly maps for identification and location of induced currents is discussed. Characteristics of various types of anomalies are considered. This is followed by a discussion of the separation of time-varying fields into external and internal parts by the use of surface integration. Transfer function analysis is discussed in detail. Methods of one-dimensional modeling and inversion are followed by a discussion of four methods of numerical modeling of two-dimensional structures. (115 refs.)

110298 On a basic model in magnetotelluric field theory and some applications. J.Pecaric (Gradevinski Fakultet, Beograd, Yugoslavia).
Tehnika (Yugoslavia), vol.38, no.6-7, p.E1-5 (1983). In Croatian.
Evaluates formulae for the magnetotelluric field of an n-layer media having some high resistance layers. The results have application to an Earth model with periodical two-layer repetition. Magnetotelluric sounding in the Alibunar region of Yugoslavia is also presented. (4 refs.)

1982 Meeting of the European Geophysical Society Symposium on Palaeomagnetism of Orogenic Belts .... See Entry 105023

Geoelectromagnetic investigation of the Earth's crust and mantle .... See Entry 105054

A tear fault system beneath the Atlantis-Meteor seamount group .... See Entry 110327

Three-dimensional model of the Koyna area of Maharashtra State (India) based on the spectral analysis of aeromagnetic data .... See Entry 110330

Opening of the Red Sea: constraints from a palaeomagnetic study of the As Sarat volcanic field, south-western Saudi Arabia .... See Entry 110354

Viscous magnetization of 0.04-100 μm magnetites .... See Entry 110364

The estimation and removal of a linear drift from stacked data .... See Entry 110661

Experience with the EM-60 electromagnetic system for geothermal exploration in Nevada .... See Entry 110694

Recent developments in the use of surface electrical methods for oil and gas exploration in the Soviet Union .... See Entry 110695

Electrode configuration influence on resistivity measurements about a spherical anomaly .... See Entry 110696

Transformation of resistivity sounding measurements obtained in one electrode configuration to another configuration by means of digital linear filtering .... See Entry 110699

Mapping and analysis of aerial conductivity measurements from INPUT system over geothermal areas .... See Entry 110705

Asymptotic solution of the α^2-dynamo problem .... See Entry 110895

91.30 SEISMOLOGY

110299 Microseismic recording at Hemren Dam area—east central Iraq. S.A.Alsinawi, T.K.Al-Nasiri (Dept. of Geology, Univ. of Baghdad, Baghdad, Iraq).
Iraqi J. Sci., vol.23, no.2, p.238-50 (1982). [received: Aug. 1983]
A local triangular seismograph network consisting of three single (Z) component short period seismic systems (Kinemetrics PS 1A) was used to investigate the microseismicity of Hemren Dam area during the period from April 4th to May 16th, 1979. Statistical analysis is used to determine parameters such as the average rate of microearthquake occurrence (2.74 event/day), the change of seismicity with time and amplitude-duration relation. (12 refs.)

110300 Spectra of the first higher mode of simulated oceanic Rayleigh waves generated by deep earthquakes of the dip-slip type. M.Yoshida (Earthquake Res. Inst., Univ. of Tokyo, Tokyo, Japan).
Bull. Earthquake Res. Inst. Univ. Tokyo (Japan), vol.57, pt.4, p.609-24 (1982).
For the purpose of understanding the excitation of the first higher mode of oceanic Rayleigh waves, the waves are simulated for seismic sources with a pure dip-slip motion along a vertical fault plane, for various focal depths from 10 to 500 km. It is suggested that the first higher mode of oceanic Rayleigh waves generated by deep earthquakes with focal depth of about 200 or 300 km can be observed in the period range from 20 to 50 seconds, with amplitude exceeding that of the fundamental mode. The optimum filtering parameters for the analysis of dispersed oceanic Rayleigh waves are determined. (36 refs.)

110301 Accuracy of the initial phase and the phase velocity of surface waves with special reference to the single-station method. M.Yoshida (Earthquake Res. Inst., Univ. of Tokyo, Tokyo, Japan).
Bull. Earthquake Res. Inst. Univ. Tokyo (Japan), vol.57, pt.4, p.627-52 (1982).
The initial phase of surface waves, which depends on such earthquake source parameters as depth, source-type and -orientation, source time function and medium property near the source, is investigated specially with respect to accuracy. The effects of small errors in the solution of the earthquake mechanism and uncertainties of the local underground structure near the source region on the initial phase of surface waves are quantitatively examined on the basis of dislocation theory. By assuming the errors of source parameters and by using different medium models, the errors of the initial phase and surface wave velocity are evaluated. (48 refs.)

110302 Wave magnitudes of the Kurile—Kamchatka tsunamis—Tsunami effect in Japan. T.Hatori (Earthquake Res. Inst., Univ. of Tokyo, Tokyo, Japan).
Bull. Earthquake Res. Inst. Univ. Tokyo (Japan), vol.57, pt.4, p.687-99 (1982).
Based on tide-gauge records of Japan and other far-field data, the magnitudes of the Kurile-Kamchatka tsunamis during the past 77 years (1904-1980) are investigated. The Kamchatka tsunami (April 13, 1923) and the Kurile tsunami (October 20, 1963) are discussed. The magnitudes (Imamura-Iida scale, *m*) of these tsunamis are estimated. The wave heights (above ordinary tides) are considered. In order to predict the travel times of tsunami along the Kurile and Japanese coasts, the refraction diagrams of two imaginary sources are drawn. (25 refs.)

110303 Explosion seismic observation in Izu Peninsula, central Japan. II. Ito-Matsuzaki profile.
Bull. Earthquake Res. Inst. Univ. Tokyo (Japan), vol.57, pt.4, p.701-38 (1982). In Japanese.
For pt.I see ibid., vol.56, no.3, p.484-534 (1981). The second experiment of explosion seismic observations in performed Izu Peninsula, within the Japanese Earthquake Prediction Project, was performed in December 1980 along a profile from Ito to Matsuzaki which obliquely crosses the previous profile from Mishima to Shimoda. Five shot points and about 70 temporary stations were arranged on this profile and an additional shot point was set up at Yumenoshima, Tokyo, about 100 km northeast of the Izu Peninsula. Observations were also made of two other shots at Kawane, Shizuoka Prefecture and Izu Ohshima these were fired by the geological survey of Japan. An outline of the experimental and some fundamental data such as seismograms and travel times are presented. (5 refs.)

110304 Interpretation of a stress profile across the San Andreas fault. M.Bonafede, E.Boschi, M.Dragoni (Dipartimento di Fisica, Univ. di Bologna, Bologna, Italy).
Ann. Geophys. (France), vol.1, no.3, p.195-8 (May-June 1983).
The results of recent stress measurements along the San Andreas fault near Palmdale, California, which show a rapid decrease in shear stress in the proximity of the fault, may be due to the stress drop connected with the great 1857 earthquake, superimposed onto a preseismic ground deformation. This suggestion is made on the basis of a fault model where a preseismic phase of stable sliding at depth is responsible, through stress concentration, for the occurrence of seismic rupture in the upper lithosphere. (18 refs.)

110305 Seismicity pattern before the 1980 Irpinia, Italy, earthquake. P.Suhadolc, G.F.Panza (Istituto di Geodesia e Geofisica, Univ. di Trieste, Trieste, Italy).
Ann. Geophys. (France), vol.1, no.3, p.217-22 (May-June 1983).
Seismicity patterns and precursors before the 23.11.1980 Irpinia, Italy, earthquake are searched for in the ENEL-CNEN Italian earthquake catalogue. By subdividing the region into several seismogenetic areas, some well defined seismicity features are found, which might be taken as precursory to the 1980 event. The space-time seismicity pattern contains features already pointed out as precursory in the literature. By grouping the seismogenetic areas into a seismically homogeneous region, the precursory swarm hypothesis permits prediction of the approximate location where the rupture is bound to occur. (20 refs.)

110306 Single-station Q: attenuation of 2 Hz Rayleigh waves along single isolated propagation paths in Scotland. C.D.Macbeth (Dept. of Geophys., Univ. of Edinburgh, Edinburgh, Scotland), P.W.Burton.
Ann. Geophys. (France), vol.1, no.3, p.223-7 (May-June 1983).
Q_β^{-1} for shear waves in the upper crust of Scotland is determined from fundamental mode. Rayleigh waves of frequency 0.5-5.2 Hz using a single event-station technique. The Rayleigh wave data is obtained from underground and underwater explosions recorded on a linear array and local network respectively. The method maps the Fourier amplitude spectrum recorded along an isolated propagation path to a depth distribution of the specific attenuation factor Q_β^{-1}. (20 refs.)

110307 Effect of topography and subsurface inhomogeneities on seismic SV waves. A.Ohtsuki (Ohsaki Res. Inst., Shimizu Construction Co. Ltd., Tokyo, Japan), K.Harumi.
Earthquake Eng. & Struct. Dyn. (GB), vol.11, no.4, p.441-62 (July-Aug. 1983).
The effect of topography and subsurface inhomogeneity on surface motion is investigated in the case of incident SV waves. Several types of topography, such as a cliff, a cliff with a soft layer and filled land, are considered. Computations are made using a new method combining a particle model with a finite element method. The accuracy of this method is discussed through comparisons with Wong's solutions, which are in good agreement. It is found that the surface displacement is very much influenced by surface irregularities when the incident wavelengths are comparable to the size of the topographic features. Rayleigh waves are strongly produced in the neighbourhoods of the slopes of a cliff and a cliff with a soft layer, the latter being a cliff adjacent to and covered at its foot by a soft layer. Thus, a zone of large amplification takes place near a slope, combining incident SV waves and Rayleigh waves. (31 refs.)

110308 Elliptical anisotropy—its significance and meaning. K.Helbig (Inst. voor Aardwetenschappen, Utrecht, Netherlands).
Geophysics (USA), vol.48, no.7, p.825-32 (July 1983).
Addresses three questions: (1) under what conditions can wavefronts of elastic waves in transversely isotropic media be elliptical?; (2) what are the consequences of elliptical wavefronts for exploration seismics based on surface observations?, and (3) to what degree can an elliptical wavefront be regarded as an approximation of the actual wavefront (in cases where it cannot be truly elliptical)? Another point that will be touched briefly is whether amplitude observations can be used to determine the degree of elliptical anisotropy. (13 refs.)

110309 Numerical study of Love wave propagation. K.R.Kelly (Amoco Production Co., Tulsa, OK, USA).
Geophysics (USA), vol.48, no.7, p.833-53 (July 1983).
Love wave propagation is studied by investigating numerical modeling results for several examples of geologic interest. The modal characteristics of the results are clarified by the use of narrow band-pass filters and two-dimensional Fourier transforms in range and time. Such processing makes it possible to study changes in phase and group velocity for the various modes and to locate points of reflection. This permits one to gain insight into changes in the physical properties of the surface channel supporting the waves. (10 refs.)

110310 Coherent noise in marine seismic data. K.Larner, R.Chambers, M.Yang, W.Lynn, W.Wai (Western Geophys. Co., Houston, TX, USA).
Geophysics (USA), vol.48, no.7, p.854-86 (July 1983).
Despite significant advances in marine streamer design, seismic data are often plagued by coherent noise having approximately linear moveout across stacked sections. With an understanding of the characteristics that distinguish such noise from signal, it is possible to decide which noise-suppression techniques to use and at what stages to apply them in acquisition and processing. Three general mechanisms that might produce such noise patterns on stacked sections are examined: direct and trapped waves that propagate outward from the seismic source, cable motion caused by the tugging action of the boat and tail buoy, and scattered energy from irregularities in the water bottom and sub-bottom. (13 refs.)

110311 Resolution performance of Wiener filters. S.H.Bickel, D.R.Martinez (ARCO Oil & Gas Co., Dallas, TX, USA).
Geophysics (USA), vol.48, no.7, p.887-99 (July 1983).
To improve the resolution of seismic events, one often designs a Wiener inverse filter that optimally (in the least-squares sense) transforms a measured source signature into a spike. When this filter is applied to seismic data, the bandwidth of any noise which is present increases along with the bandwidth of the signal. To reduce signal ambiguity it is common practice to prewhiten the Wiener filter which improves the output signal-to-ambient noise ratio, but at the same time it reduces resolution. The ability to resolve the temporal separation between events is determined by the resolution time constant which the authors define as the ratio of signal energy to peak signal power from the filter. The implications of this definition for unfiltered wavelets and for matched filter signal are discussed. (12 refs.)

110312 Case history of the exploration of the Grand Isle 95 Field in the Gulf of Mexico. P.-H.Pan (Mobil Exploration & Production Services Inc., Dallas, TX, USA).
Geophysics (USA), vol.48, no.7, p.900-9 (July 1983).
Grand Isle 95 Field is located 40 miles offshore Louisiana in 200 ft of water. First stage seismic exploration work was completed by Mobil in 1972. High-amplitude events were observed on the seismic sections which were believed to be related to the existence of hydrocarbons. Reprocessed seismic lines showed some amplitude change near two questionable flat spots which were thought to be the gas-oil and oil-water sand contacts. Careful examination of the original seismic record proved that one of the flat events was caused by noise or distortions under the fault. Subsequent seismic modeling studies led to the success of exploration and exploitation of the field. (2 refs.)

110313 Structural inversion of salt dome flanks. B.T.May (Compass Exploration Inc., Golden, CO, USA), J.D.Covey.
Geophysics (USA), vol.48, no.8, p.1039-50 (Aug. 1983).
Accurate location of the salt-sediment interface is one of the first problems to be solved during exploration around salt domes. However, determination of salt boundaries from seismic data has been notoriously missing even though forward modeling has shown that the salt flank reflection can be one of the highest amplitudes on a seismic record. The sources of difficulty are that conventional data acquisition and processing are usually designed to attenuate any signal that arrives at high incidence angles, including reflections originating from steeply dipping structures such as salt flanks. Inverse modeling by ray methods is known to be a suitable technique for reconstruction of steeply dipping structures, provided key marker reflections are identified. Salt flank reflections have been recovered in two field-recorded examples through application of unusually high stacking velocities; the reflections characteristically have very large migration distances and cross other reflections at high angles. The inverse model computed for one example produced a salt flank with dip rates up to 70 degrees, and the computed structure compared to drilling data is accurate to within 1 percent. (9 refs.)

110314 Computing true amplitude reflections in a laterally inhomogeneous Earth. P.Hubral (Inst. de Geosci., Univ. Faderal da Bahia, Bahia, Brazil).
Geophysics (USA), vol.48, no.8, p.1051-62 (Aug. 1983).
Recently Bortfeld (1982) gave a cursory nonmathematical introduction to a procedure for computing the geometrical spreading factor of a primary zero-offset reflection from the common datum point traveltime measurements of the event. To underline the significance and consequences of this method, a derivation and discussion of geometrical spreading factors is now given for two- and three-dimensional Earth models with curved reflecting boundaries. The spreading factors can be used easily to transform primary reflections in a zero-offset seismic section to true amplitude reflections. These permit an estimation of interface reflection coefficients, either directly or in connection with a true amplitude migration. A seismic section with true amplitude reflections can be described by one physical experiment: the tuned reflector model. Hence the application of the wave equation (in connection with a migration after stack) is justified on such a seismic section. (22 refs.)

110315 Review of elastic and electromagnetic wave propagation in horizontally layered media. B.Ursin (SINTEF, Petroleum Technol. Res. Inst., Trondheim, Norway).
Geophysics (USA), vol.48, no.8, p.1063-81 (Aug. 1983).
Provides a unified treatment of elastic and electromagnetic (EM) wave propagation in horizontally layered media for which the parameters in the partial differential equations are piece-wise continuous functions of only one spatial variable. By applying a combination of Fourier, Laplace, and Bessel transforms to the partial differential equations describing the elastic or EM wave propagation a system of $2n$ linear ordinary differential equations is obtained. The $2n\times 2n$ coefficient matrix is partitioned into 4 $n\times n$ submatrices. By a proper choice of variables, the diagonal submatrices are zero and the off-diagonal submatrices are symmetric. All the results are derived from the symmetry properties of this general equation. It is shown that three-dimensional elastic waves, cylindrical *P-SV* waves, acoustic waves, and electromagnetic waves in isotropic layered media can all be represented by an equation with the same properties. The symmetry properties of the system matrix are used to derive simplified equations for computing the propagator matrix for a stack of inhomogeneous layers. The wave field is also decomposed into upgoing and downgoing waves by an eigenvector decomposition. (56 refs.)

110316 Migration in the presence of a rugged interface with high velocity contrast. L.Ameely, T.Krey, F.Muhtadie, H.-F.Rau, H.Rist.
Geophys. Prospect. (Netherlands), vol.31, no.4, p.561-73 (Aug. 1983).
Three types of migration are presented: (f,x)-time migration with vertical time-to-depth conversion as a second step; Kirchhoff migration down to 0.35 s and Kirchhoff-downward continuation for all times exceeding 0.35 s; and direct depth migration in the (f,x)-domain using three interval velocitiesl. In all cases an intermediate picking of the velocity interfaces is necessary. The results of the second and third migration procedures are superior to those of the first. Possibilities for misinterpretation of faults are reduced considerably when the second or third migration procedure is applied. (6 refs.)

110317 On the principle of maximum entropy and the earthquake frequency-magnitude relation. P.Y.Shen, L.Mansinha (Dept. of Geophys., Univ. of Western Ontario, London, Ontario, Canada).
Geophys. J. R. Astron. Soc. (GB), vol.74, no.3, p.777-85 (Sept. 1983).
The entropy S for a continuous distribution $p(x)$ is defined by $S=-\int_{x1}^{x2}p(x)\ln(p(x)/m(x))dx$, $x_1\leq x\leq x_2$ where $m(x)$ is the 'prior distribution' representing the 'complete ignorance' about x. The difficulty in using this definition arises from the problem of 'arbitrariness' or 'subjectiveness' in assigning the prior distribution $m(x)$. Thus in maximum entropy inference, it is customary to arbitrarily adopt a uniform prior distribution and write the entropy as $S=-\int_{x1}^{x2}p(x)\ln p(x)dx$. This expression, however, is a measure of uncertainty relative to the coordinate x so that the probability distribution $p(x)$ generated from the principle of maximum entropy depends on the choice of x. Only when the chosen parameter actually has a uniform prior distribution, can the generated distribution be expected to conform with the empirical data. For a physical system in which the independent variable x is measured to only limited accuracy, the prior distribution $m(x)$ can be shown to be inversely proportional to the measurement error of x. A parameter with uniform prior distribution, then, is one that can be measured with equal accuracy throughout its range. In this context, the magnitude of an earthquake is such a parameter because using this parameter in the principle of maximum entropy leads to the empirically determined Gutenberg-Richter frequency-magnitude relation. Other proposed frequency-magnitude relations can also be generated from the principle of maximum entropy by imposing appropriate constraints. (34 refs.)

110318 Descriptive statistical model of earthquake source radiation and its application to an estimation of short-period strong motion. A.A.Gusev (Inst. of Volcanology, Petropavlovsk-Kamchatsky, USSR).
Geophys. J. R. Astron. Soc. (GB), vol.74, no.3, p.787-808 (Sept. 1983).
A wide-band source spectrum scaling law is derived from various data sources; its main features are: a lack of similitude and two characteristic frequencies of about 0.2 to 5-10 Hz. An average short-period radiation flux from the source surface does not greatly depend on magnitude; it is about 3×10^7 erg cm^{-2}s and short-period efficiency is about 10 per cent. For sources of great earthquakes a short-period radiation flux is relatively low. The spectrum scaling law is used to determine near-field accelerations. Formulae to estimate 'static' and wavefield accelerations of incoherently radiating sources are derived and applied to calculate the average relation between maximum acceleration and intensity, and distance and magnitude. Theoretical relations agree well with the empirical ones. (58 refs.)

110319 Source parameter inversion of a reservoir-induced seismic sequence: Lake Kariba, Africa (1963 September). G.B.Pavlin, C.A.Langston (Pennsylvania State Univ., University Park, PA, USA).
Geophys. J. R. Astron. Soc. (GB), vol.74, no.3, p.819-41 (Sept. 1983).
The depth and seismic source parameters of the three largest reservoir-induced earthquakes associated with the impoundment of Lake Kariba, Africa, were determined, using a moment tensor formalism of the generalized inverse technique. The events, characterized by $m_b>5.5$, consisted of the foreshock and main event (0640 and 0901 GMT, 1963 September 23) and the principal aftershock (0703 GMT, 1963 September 25). From the analysis of analogue rift valley source crustal models, a three-layer over a half-space model were selected for the analysis of the Lake Kariba events. The epicentral proximity and the comparable source parameters of the three large events suggest a common source fault with an approximate strike of S9°W±4°, dip of $62°\pm 10^D$, and rake of 266°±4°. The Lake Kariba events occurred at depths of less than 10 km. The inferred source parameters, complemented by the structural maps derived from the photo-interpretation of Landsat imagery of the region, indicate a normal fault that uniquely transects the reservoir's deep Sanyati Basin in a north-south heading. (52 refs.)

110320 A hybrid approach to mode conversion. R.Szelwis (Inst. fur Geophys., Univ. Hamburg, Hamburg, Germany).
Geophys. J. R. Astron. Soc. (GB), vol.74, no.3, p.887-904 (Sept. 1983).
Presents a method of investigating seismic surface waves in (two-dimensional) layered media involving lateral heterogeneities. The method combined forward modelling by computation of synthetic seismograms for the distributed layering and subsequent inversion of the seismogram spectra with respect to the wave modes. In terms of 'L region' and 'R region', denoting the laterally homogeneous regions of the waves before and after propagation across the distributed region, the method is described as follows. (1) Analytical definition of the wave in the L region. A time-dependent wavelet is assumed at some surface point, and the spatial displacement field corresponding to a free plane surface wave is computed from the eigenfunctions of the waveguide. (2) Numerical propagation of the wave across the laterally heterogeneous region. The general heterogeneous wave equation is approximated by a finite difference time marching scheme, where the analytical wave motion enters as initial value. (3) Inversion of seismograms 'observed' at a number of locations in the R region. The seismogram Fourier spectra are modelled by a linear combination of modes, contaminated by random noise. Least-squares fitting between the modelled and the observed seismogram spectra yields estimates of the 'mode participation factors'. The method is applied to Love waves of an elastic upper crustal model. (16 refs.)

110321 The effects of initial stress and irregularity on the propagation of SH-waves. M.Chakraborty, A.Chattopadhyay, S.Dey (Dept. of Phys. & Maths., Indian School of Mines, Dhanbad, India).
Indian J. Pure & Appl. Math., vol.14, no.7, p.850-63 (July 1983).
Studies effects on SH-waves due to the presence of initial stresses in a sandwiched layer with parabolic irregularity in the lower interface. The dispersion curves for different values of initial stresses and irregularity of different sizes have been drawn for the fundamental mode and are compared with that for the medium without any initial stress and irregularity. It has been observed that the presence of either the initial compressive stress or the irregularity in the interface has the effect of lowering the phase velocity of the waves, particularly in the low period range. (15 refs.)

110322 The reflection of obliquely incident tsunami. G.F.Carrier, C.F.Noiseux (Div. of Appl. Sci., Harvard Univ., Cambridge, MA, USA).
J. Fluid Mech. (GB), vol.133, p.147-60 (Aug. 1983).
When a tsunami is incident on a plane shelf, the waveform and amplitude of the reflected wave differ significantly from those of the incident wave, and, when the shelf has the extremely irregular character of real continental shelves, the contrast between the two amplitudes is even greater. The authors quantify these statements and they also give an account of the manner in which the run-up depends on the obliquity and on other parameters characterizing the incident wave. (2 refs.)

110323 Gaussian beams and paraxial ray approximation in three-dimensional elastic inhomogeneous media. V.Cerveny (Inst. of Geophys., Charles Univ., Praha, Czechoslovakia), I.Psencik.
J. Geophys. (Germany), vol.53, no.1, p.1-15 (1983).
The elastodynamic Gaussian beams in 3D elastic inhomogeneous media are derived as asymptotic high-frequency one-way solutions of the elastodynamic

equation concentrated close to rays of P and S waves. In this case, the elastodynamic equation is reduced to a parabolic (Schrodinger) equation which further leads to a matrix Riccati equation and the transport equation. The amplitude profile of the principal displacement component of the elastodynamic Gaussian beams is Gaussian in the plane perpendicular to the ray, with its maximum at the ray. As a limiting case of infinitely broad Gaussian beams, the paraxial ray approximation is obtained. (23 refs.)

110324 Wide angle seismic profiling in the ocean using a towed sonobuoy. Yu.P.Neprochnov (Shirshov Inst. of Oceanology, Acad. of Sci., Moscow, USSR).
Oceanology (USA), vol.22, no.2, p.236-8 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.2 (1982). [received: Aug. 1983]
A new method is proposed for seismic profiling in the ocean using a towed sonobuoy and air gun. The distance between the gun and the sonobuoy is selected to provide optimal conditions for tracing the reflecting boundaries, by recording waves reflected in the critical-angle range. On individual legs of the profile it is possible to get the long travel time curves necessary for determining velocity parameters of the medium. Results of tests of this method, done in the Atlantic Ocean on the 24th cruise of the R/V Akademik Kurchatov are presented. (5 refs.)

Mapping of an unusual crustal discontinuity by microearthquake reflections in the earthquake swarm area near Ashio, northwestern part of Tochigi Prefecture, central Japan .... See Entry 110326

A tear fault system beneath the Atlantis-Meteor seamount group .... See Entry 110327

Structure of the inner core boundary .... See Entry 110334

Possible heterogeneity of the Earth's core deduced from PKIKP travel times .... See Entry 110339

BIRPS deep seismic reflection studies of the British Caledonides .... See Entry 110340

Seismic stratigraphy and sedimentation history of the East Mariana Basin, western Pacific .... See Entry 110360

Pressure fluctuations on the open-ocean floor off the Gulf of California: tides, earthquakes, tsunami .... See Entry 110461

Ground-water microtemperature measurements, coseismic signals and atmospheric pressure effects .... See Entry 110493

Compensation of marine seismic data for the effects of highly variable water depth using ray-trace modeling—A case history .... See Entry 110690

Butterworth dip filters .... See Entry 110692

The resonant acoustic pulser—a continuous-frequency marine seismic source .... See Entry 110693

Theoretical and experimental approaches to the geophone spurious frequency .... See Entry 110697

The autobalancer—an automatic system for the reduction of power-line interference with seismic signals .... See Entry 110698

91.35 EARTH'S INTERIOR STRUCTURE AND PROPERTIES

110325 Geothermal measurements in the upper Euphrates Valley—W Iraq. S.A.AlSinawi, D.S.Mahmood (Dept. of Geology, Univ. of Baghdad, Baghdad, Iraq).
Iraqi J. Sci., vol.23, no.1, p.94-106 (1982). [received: Aug. 1983]
The Hit-Kubaisa area in the upper Euphrates river valley was chosen for a shallow temperature measurement using the GT-2 geophysical thermometer. The area is typified with major faulting and a line of hot springs. An isogeothermal map is constructed after correcting the data for datum date and interpreted qualitatively and quantitatively. A definite relation is established between the springs and the tectonic setting of the area. Depth to groundwater is constructed utilizing thermal data measured near water wells dug in the area. (11 refs.)

110326 Mapping of an unusual crustal discontinuity by microearthquake reflections in the earthquake swarm area near Ashio, northwestern part of Tochigi Prefecture, central Japan. M.Mizoue, I.Nakamura (Earthquake Res. Inst., Univ. of Tokyo, Tokyo, Japan), T.Yokota.
Bull. Earthquake Res. Inst. Univ. Tokyo (Japan), vol.57, pt.4, p.653-85 (1982).
Microearthquake seismograms recorded by the stations in the earthquake swarm area near Ashio on the western border of Tochigi Prefecture, central Japan, frequently have two sharp phases following the direct S-wave. They are identified as near vertical S to P-wave and S to S-wave reflections from an unusual deep crustal discontinuity. Reflection points calculated on the basis of hypocentral coordinates in combination with the travel time data of the reflections are mapped with contour lines at 1 km intervals. The discontinuity is estimated to have a depth of about 14 km beneath Ashio dipping southeastward with considerable local irregularities. It is suggested from the analysis that the discontinuity is underlain by a material of very low rigidity. (16 refs.)

110327 A tear fault system beneath the Atlantis-Meteor seamount group. J.Verhoef, B.J.Collette (Vening Meinesz Lab., Utrecht, Netherlands).
Ann. Geophys. (France), vol.1, no.3, p.199-206 (May-June 1983).
Seismic and magnetic profiling in the area south of the Azores revealed that the Atlantis-Meteor seamount group consists of elongate structures of a typical length of about 100 km in a general NW-SE direction. Plato seamount has slightly different directions. The complex is superimposed on older oceanic crust and partly conceals the fracture zone pattern which otherwise is well developed. The whole area is too shallow compared to the depth-age curve of Sclater. The seamount group can be divided into four subgroups or blocks, together forming a mosaic pattern and suggesting a tear fault system. The blocks underwent extension in a NE-SW direction and are separated by transform zones. This may imply that the volcanism is not due to the presence of a primary mantle hot spot, but that it occurred as a result of a breaking-up of the area, thus creating a secondary hot spot. It is speculated that the cause of the extension must not be sought within the seamount area. (57 refs.)

110328 ^{40}Ar/^{39}Ar age spectrum analysis of detrital microclines from the southern San Joaquin Basin, California: an approach to determining the thermal evolution of sedimentary basins. T.M.Harrison, K.Be (Dept. of Geological Sci., State Univ. of New York, Albany, NY, USA).
Earth & Planet. Sci. Lett. (Netherlands), vol.64, no.2, p.244-56 (Aug. 1983).
Microcline separates from deep drill hole intersections with Eocene to Miocene sediments in the Basin and Tejon Blocks of the southern San Joaquin Valley, California, analysed by the age spectrum approach show radiogenic ^{40}Ar (^{40}Ar*) gradients that record both the slow cooling of the uplifting sediment source ~65 Ma ago, and a recent thermal event. This information, in conjunction with the observation of fission track annealing in the coexisting apatites, allows estimation of the temperature-time conditions of this thermal event at about 140°C for ~200 ka. ^{40}Ar/^{39}Ar analysis of detrital microcline crystals yields thermochronological information in the temperature-time range of petroleum maturation and provides this technique with potential as both a useful exploration tool and as a means of probing the fundamental geodynamic processes of basin evolution. (48 refs.)

110329 The deep structure of ocean ridges in a convecting mantle. G.A.Houseman (Dept. of Geological Sci., Harvard Univ., Cambridge, MA, USA).
Earth & Planet. Sci. Lett. (Netherlands), vol.64, no.2, p.283-94 (Aug. 1983).
A moving ocean ridge which initially is situated on top of a rising sheet in a convecting layer is modelled. The equations are solved numerically to obtain temperature and velocity fields as the ridge moves horizontally. Thus, the evolution of the hot rising sheet can be observed in the temperature and velocity fields as the solution is stepped forward in time. (22 refs.)

110330 Three-dimensional model of the Koyna area of Maharashtra State (India) based on the spectral analysis of aeromagnetic data. J.G.Negi, P.K.Agrawal, K.N.N.Rao (Nat. Geophys. Res. Inst., Hyderabad, India).
Geophysics (USA), vol.48, no.7, p.964-74 (July 1983).
The estimation of thickness of trap rocks in the earthquake-affected Koyna area is an important parameter for revealing the topography that existed before the Deccan volcanism. A case history is presented delineating a three-dimensional block model for the Koyna area by the spectral analysis of aeromagnetic data. The thickness in the area was found to vary from 700 to 2200 m, which correlates well with the results of other geophysical investigations. (24 refs.)

110331 Structure and evolution of the intracratonic basins of central Australia. K.Lambeck (Res. School of Earth Sci., Australian Nat. Univ., Canberra, Australia).
Geophys. J. R. Astron. Soc. (GB), vol.74, no.3, p.843-86 (Sept. 1983).
The central Australian geology is dominated by a series of parallel sedimentary intracratonic basins whose history spans time from the Late Proterozoic to the Carboniferous. The basins are separated by regions of exposed Proterozoic crust that have a history of significant uplift. The formation of the basins cannot be explained by conventional thermal or stretching mechanisms. Nor does the foreland basin model provide an adequate explanation for their occurrence. The geophysical observations, particularly gravity, point to a structure whereby the crust is considerably thicker under the basins than it is under the regions where basement rock is exposed. This suggests that the crust as a whole is involved in the process that led to the basin formation. A mechanical model is developed which is based on the supposition that the lithosphere has been in a state of horizontal compression for long time intervals. The lithosphere is considered as a viscoelastic plate that has been subjected to a small normal load, distributed in an irregular manner. The model is used to explain the structure and evolution of the Officer, Amadeus and Ngalia basins and the Arunta and Musgrave blocks. (70 refs.)

110332 Visco-elastic modelling of lithospheric stresses arising from density contrasts. M.J.M.Park, G.K.Westbrook (Dept. of Geological Sci., Univ. of Durham, Durham, England).
Geophys. J. R. Astron. Soc. (GB), vol.74, no.3, p.905-14 (Sept. 1983).
A method has been developed for application in conjunction with finite element analyis which can be used to model the stress distributions arising from lateral changes in thickness and density of lithospheric layers. It is especially applicable to those situations where there are large lateral variations in density and rock materials are comparatively weak such as the upper crust of active and passive continental margins. The full effect of gravitational body forces is incorporated in a visco-elastic finite element model which is solved within an iterative scheme that preserves the observed or designed shape of the model. If so desired, further deformations can be studied in the 'prestressed' model. To compare the method with others used previously, it was applied to a passive continental margin. (14 refs.)

110333 Pb isotope geochemistry of a massif-type anorthositic-charnockitic body: the Hidra Massif (Rogaland, SW Norway). D.Weis, D.Demaiffe (Univ. Libre de Bruxelles, Brussels, Belgium).
Geochim. & Cosmochim. Acta (GB), vol.47, no.8, p.1405-13 (Aug. 1983).
The Hidra Massif is a massif-type anorthositic-charnockitic body. It consists of undeformed anorthosites and leuconorites, grading into fine-grained jotunites at the contact with the granulite facies gneisses of the metamorphic envelope. A stockwork of charnockitic dykes cross-cuts the massif. The Pb isotopic compositions of the anorthosites and leuconorites are comparable or slightly less radiogenic than those of the jotunites. These values are compatible with an upper mantle origin for the parental magma of jotunitic composition and for the plagioclasic cumulates, but show the incorporation of lower crustal material. The charnockitic dykes have significantly less radiogenic Pb isotope compositions which can be explained by a larger proportion of lower crustal contamination material. The contaminant could be the granulite facies gneisses of the metamorphic envelope. This interpretation is compatible with the K-Rb relationships of these rocks and with the O and Sr isotopic geochemistry. (48 refs.)

110334 Structure of the inner core boundary. D.E.Loper (Geophys. Fluid Dynamics Inst., Florida State Univ., Tallahassee, FL, USA).
Geophys. & Astrophys. Fluid Dyn. (GB), vol.25, no.1-2, p.139-55 (1983).
A model of the inner-core boundary (ICB) is constructed which is consistent with current ideas of the dynamic and thermodynamic state of the core and which is capable of reflecting seismic waves with period of one second. This requires the mass fraction of solid below the ICB to grow to an appreciable fraction in roughly one kilometer. This rapid growth of solid with depth is a result of downward fluid flow from the outer core which is a part of the convective motions which sustain the geodynamo. The solid which crystallizes from this descending fluid after it crosses the ICB continually coats the dendrites which occur there. The gradual cooling of the outer core causes the ICB to advance by growth of dendrites at their tips. The balance of these two effects gives an equilibrium profile for the mass fraction of solid with depth below the ICB which is capable of yielding sharp reflection of seismic waves. (36 refs.)

110335 Isotopes in geothermal energy exploration. E.Barbier, M.Fanelli (Istituto Internat. per le Ricerche Geotermiche, Pisa, Italy), R.Gonfiantini.
Int. At. Energy Agency Bull. (Austria), vol.25, no.2, p.31-6 (June 1983).
Briefly illustrates how geothermal energy arises and the role of isotope investigations in geothermal exploration, just one part of the vast range of isotope applications in hydrology, in geochemistry, and in geology. (no refs.)

110336 On the thermal state of the Earth's mantle. A.C.Fowler (Dept. of Math., MIT, Cambridge, MA, USA).
J. Geophys. (Germany), vol.53, no.1, p.42-51 (1983).
An apparent paradox is discussed, arising from the contrast between an inferred constant mantle viscosity profile and theoretical and experimental rheological flow laws, which predict a mantle viscosity function varying strongly as a function of both temperature and pressure. It is found that the

observed constant viscosity is, in effect, demanded by the interplay of the rheology with the convective process, the mantle temperature is not necessarily adiabatic, and some form of layering effect may be expected. (48 refs.)

110337 Timing, trace and origin of basaltic migration in eastern Australia. F.L.Sutherland (Dept. of Mineralogy & Petrology, Australian Museum, Sydney, Australia).
Nature (GB), vol.305, no.5930, p.123-6 (8 Sept. 1983).
Eastern Australian Cenozoic volcanism includes a prominent southward migration of activity. Varied explanations have invoked hotspot or linear magma sources in the asthenosphere, the movement of Australia over old seafloor spreading zones—with direct or delayed response in volcanism, or changes in stress fields. The present appraisal, using new data, contradicts some ideas and favours volcanism triggered directly by passage of lithosphere over initial sites of Coral Sea spreading. The conclusions suggest that eastern Australia has a major, complex hotspot trail established for the past 65 Myr. It forms an independent and key continental reference to the Hawaiian-Emperor oceanic trail. It raises the notion that both continental and oceanic trails can mark the ghosts of former spreading sites. (51 refs.)

110338 Thermally-activated creep and flexure of the oceanic lithosphere. R.C.Courtney, C.Beaumont (Dept. of Oceanography, Dalhousie Univ., Halifax, Nova Scotia, Canada).
Nature (GB), vol.305, no.5931, p.201-4 (15 Sept. 1983).
Thermal models of the oceanic lithosphere explain ocean floor bathymetry, heat flux and gravity and geoid anomalies by the cooling and thickening of the lithosphere as it ages away from ocean ridges. Surface wave studies tend to confirm that thickness increases with thermal age. Thickness estimates based on the lithosphere's flexural response, parameterized in terms of an elastic model floating on an inviscid substratum, are, however, factors of two to three times less than those from the thermal and seismic models. It is shown that a unification of estimates can be achieved by a different, yet simple, parameterization of the bending response of the lithosphere. (22 refs.)

110339 Possible heterogeneity of the Earth's core deduced from PKIKP travel times. G.Poupinet (IRIGM, Univ. of Grenoble, Grenoble, France), R.Pillet, A.Souriau.
Nature (GB), vol.305, no.5931, p.204-6 (15 Sept. 1983).
Station residuals of the seismic core phase PKIKP have been computed for 400 seismological observatories. PKIKP travel times can be corrected for upper mantle propagation by subtracting P delays; thus PKIKP-P residuals are a measurement of the average vertical travel times in the lower mantle and in the core of the Earth beneath seismic stations. PKIKP-P exhibit a latitudinal dependence: polar stations tend to be faster than equatorial stations. It is shown that this pattern may reflect a departure from spherical symmetry in the P-velocity distribution in the vicinity of the inner core boundary of the Earth. (23 refs.)

110340 BIRPS deep seismic reflection studies of the British Caledonides. J.A.Brewer, D.H.Matthews, M.R.Warner (Dept. of Earth Sci., Univ. of Cambridge, Cambridge, England), J.Hall, D.K.Smythe, R.J.Whittington.
Nature (GB), vol.305, no.5931, p.206-10 (15 Sept. 1983).
The Western Isles-north Channel traverse, an extension of the successful MOIST profile, was recorded in 1982 at sea along the west coast of Britain for BIRPS (British Institutions Reflection Profiling Syndicate) by the Geophysical Company of Norway. The data are of very good quality and contain clear Moho and upper mantle reflections. The lower crust is surprisingly reflective, deeply penetrative thrusts are observed and there is firm evidence that several of the Mesozoic basins round the shores of the United Kingdom were formed by reactivation of older features. (17 refs.)

110341 The relationship between the location of oil and gas provinces and zones of subduction of lithospheric plates. O.G.Sorokhtin, I.Ye.Balanyuk (Shirshov Inst. of Oceanology, Acad. of Sci., Moscow, USSR).
Oceanology (USA), vol.22, no.2, p.169-75 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.2 (1982). [received: Aug. 1983]
The origin of some of the world's largest oil and gas basins (such as those of the Persian Gulf, Venezuela, Algeria, Canada, the Alaskan North Slope, etc.) is considered from the standpoint of the theory of lithospheric plate tectonics. It is shown that most of the basins that are located in pericratonic foredeeps, basins that contain as much as 80% of the world's oil and gas reserves, may have been formed by immigration of hydrocarbons from Recent and old zones of underthrusting of lithospheric plates (subduction zones). The hydrocarbons are generated in these zones via thermolysis or organic matter locked in sediments overriden by island arcs that are thrust over the passive continental margins. This mechanism explains the enormous productivity of the process of oil and gas formation in the subduction zones, compensating for the hydrocarbon losses during their migration into the pericratonic foredeeps. (25 refs.)

110342 A petrographic description of the tholeiitic basalts in the central zone of the Red Sea rift. V.V.Matveyenkov (Shirshov Inst. of Oceanology, Acad. of Sci., Moscow, USSR), A.I.Al'Mukhamedov, G.L.Kashintsev.
Oceanology (USA), vol.22, no.2, p.182-7 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.2 (1982). [received: Aug. 1983]
Petrographic study of the young tholeiitic basalts that form a new oceanic crust in the zone of seafloor spreading in the Red Sea has revealed three generations of phenocrysts. The first generation, consisting of phenocrysts of plagioclase and rare olivine grains, was segregated in a magma chamber at shallow depth. The thorough differentiation of the Red Sea tholeiites is typical of igneous activity in rifts with low rates of spreading. (12 refs.)

110343 Speleothems, travertines, and paleoclimates. G.J.Hennig, R.Grun, K.Brunnacker (Geologisches Inst., Univ. zu Koln, Koln, Germany).
Quaternary Res. (USA), vol.20, no.1, p.1-29 (July 1983).
Age data for about 600 speleothems and about 140 spring-deposited travertines were collected, including many unpublished results. These data were plotted as histograms and also as error-weighted frequency curves on a 350000-yr scale. These plots clearly show periods of increased speleothem/travertine growth as well as times of cessation. The periods of most frequent speleothem growth were between approximately 130000 and 90000 yr ago and since about 15000 yr ago. A comparison with the oxygen-isotope record of deep-sea core V28-238 shows a clear relationship, indicating that terrestrial calcite formation is controlled by paleoclimatic fluctuations. (66 refs.)

110344 Cation-ratio dating: a new rock varnish age-determination technique. R.I.Dorn (Dept. of Geography, Univ. of California, Berkeley, CA, USA).
Quaternary Res. (USA), vol.20, no.1, p.49-73 (July 1983).
Rock varnish coats many surfaces of geomorphic and achaeologic interest in arid lands. The premise of a new age-determination method, cation-ratio dating, is that the ratio of the more mobile cations (e.g. K and Ca) to titanium in varnish decreases with time. Although there are many inherent assumptions and potential limitations, cation-ratio dating has been verified on relative age-sequences from a Death Valley debris cone, Negev Desert talus flatirons, and prehistoric lake levels at Searles Lake in California. Varnish cation ratios have been calibrated to independently dated surfaces in the Coso volcanic field and vicinity in California. (69 refs.)

110345 Quantitative measurement of the mass-color of zircon in igneous rocks from the Kujyu volcanic region, central Kyushu. M.Hayashi, S.Furuya, T.Yamasaki.
Rep. Res. Inst. Ind. Sci. Kyushu Univ. (Japan), no.74, p.39-47 (1983).
The mass-color of zircon contained in igneous rocks of Neogene and Pleistocene ages from the Kujyu volcanic region, central Kyushu, has been quantitatively measured by a color difference meter with the object of clarifying the relation between the mass-color of zircon and the age of formation of the rocks. It has been confirmed that the degree of coloration of zircon gradually increases with the lapse of time after the formation of the rocks. However, there are also a considerable number of exceptions, probably due to unusual concentrations of radioactive elements such as uranium and thorium. (10 refs.)

110346 Fission-track ages of some volcanic rocks from the Kirishima geothermal region. S.Taguchi (Res. Inst. of Industrial Sci., Kyushu Univ., Fukuoka, Japan), M.Okaguchi, T.Yamasaki.
Rep. Res. Inst. Ind. Sci. Kyushu Univ. (Japan), no.74, p.49-54 (1983).
Fission-track dating of five volcanic rocks from the Kirishima geothermal region has been carried out to clarify the stratigraphy of the region. As a result of the dating, it has been revealed that the 'Pliocene' Kakuto Andesites (Mekura, Nanatsudan and Kunimi Lavas) were formed in the Pleistocene, and the Kurinodake Lava and the Kakuto Welded Tuff in the late Pleistocene. The data obtained are as follows: Kakuto Welded Tuff; 9.1×10^4 years; Kurinodake Lava; 1.5×10^5 years; Mekura Lava; 1.1 ± 0.2 Ma; Nanatsudan Lava; 1.2 ± 0.2 Ma; and Kunimi Lava; 1.5×0.3 Ma. (14 refs.)

110347 Geotectonics of some geothermal fields associated with the Quaternary volcanic zone. T.Yamasaki.
Rep. Res. Inst. Ind. Sci. Kyushu Univ. (Japan), no.74, p.55-76 (1983).
In view of its volcanic history and geotectonics, the Kujyu Volcanic district including the Otake area, is most important for standard studies on the geological background of geothermal fields in north central Kyushu. It seems probable that some kind of depressions, such as grabens, fault troughs, and rift zones frequently occur along the crests of warping patterns, and, are closely associated with volcanic activities in most cases. The author discusses the striking similarities which exist between the Otake geothermal field and certain other geothermal fields of the world which are within the Quaternary volcanic zones. (29 refs.)

Application of Nuclear Techniques in Geothermal Investigations Consultants Meeting .... See Entry 105018

Geoelectromagnetic investigation of the Earth's crust and mantle .... See Entry 105054

An updated Bouguer anomaly map of south-central West Africa .... See Entry 110274

Gravity interpretation of two dimensional fault structures using Hilbert transforms .... See Entry 110275

Changes in the geomagnetic total force intensity associated with the anomalous crustal activity in the eastern part of the Izu Peninsula. IV. Anomalous change observed in the north-eastern area in 1981 .... See Entry 110279

Application of mantle filter theory to the magnetic jerk of 1969 .... See Entry 110286

On multifrequency magnetotelluric sounding over the Himalayan type colliding plate boundaries .... See Entry 110287

Boundary conditions for a rapidly rotating hydromagnetic system in a cylindrical container .... See Entry 110288

Palaeomagnetism of alkali basalts occurring in Takakusayama and Ryuso districts, south-central Honshu, Japan .... See Entry 110290

Geomagnetic paleointensities for the period 6000 to 3000 years BP determined from lavas and pyroclastic flows in Japan .... See Entry 110291

Electrical conductivity beneath Iceland—constraints imposed by magnetotelluric results on temperature, partial melt, crust-and mantle structure .... See Entry 110293

Tectonomagnetism .... See Entry 110295

Spectra of the first higher mode of simulated oceanic Rayleigh waves generated by deep earthquakes of the dip-slip type .... See Entry 110300

Interpretation of a stress profile across the San Andreas fault .... See Entry 110304

Single-station Q: attenuation of 2 Hz Rayleigh waves along single isolated propagation paths in Scotland .... See Entry 110306

Migration in the presence of a rugged interface with high velocity contrast .... See Entry 110316

The effects of initial stress and irregularity on the propagation of SH-waves .... See Entry 110321

Krakatoa! The decapitation of a volcano .... See Entry 110350

Geochemical forecast of volcanic eruptions using mercury as an indicator; Mt. Aso .... See Entry 110351

The structure of the western margin of the Subalpine Basin (south-eastern France) .... See Entry 110352

Initiation of subsidence in a sedimentary basin underlain by a phase change .... See Entry 110355

Tectonics of the Acadian Orogeny in New England and adjacent Canada .... See Entry 110357

Phase relations of amphibole, amphibole-carbonate, and phlogopite-carbonate peridotite: petrologic constraints on the asthenosphere .... See Entry 110363

Pore structure of hydrothermally altered rocks in the Otake geothermal area .... See Entry 110365

Automatic three-layer, three-dimensional deconvolution of the Pays de Bray anticline .... See Entry 110367

Origin of the Ilmenogorsk-Vishnevogorsk nepheline syenites, Urals, USSR, and their time of emplacement during the history of the Ural fold belt: a Rb-Sr study .... See Entry 110368

Major southward thrusting of the Dalradian rocks of Connemara, western Ireland .... See Entry 110371

Ground-water microtemperature measurements, coseismic signals and atmospheric pressure effects .... See Entry 110493

Ice-age simulations with a calving ice-sheet model .... See Entry 110498

The geologic record of climatic change .... See Entry 110646

Method for investigating the abundance of elements in the Earth's interior .... See Entry 110681

Geothermal prospecting with Shallo-Temp surveys .... See Entry 110691

Experience with the EM-60 electromagnetic system for geothermal exploration in Nevada .... See Entry 110694

Estimation of formation temperature from borehole measurements .... See Entry 110700

Mapping and analysis of aerial conductivity measurements from INPUT system over geothermal areas .... See Entry 110705

91.40 VOLCANOLOGY

110348 The eruption of Mount Etna, begun on March 28, 1983: its meaning in the framework of the present eruptive cycle (1971-1983). G.Kieffer (Univ. de Clermont II, Clermont-Ferrand, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.21, p.1689-92 (13 June 1983). In French.
The eruption of Mount Etna in spring 1983 was a typical lateral one. It took place on the 1910 eruption fissural network governed by the magna supply channel at the ESE base of the central core. It confirms the significance of this particular supply channel. It occurs in an exceptionally active eruptive cycle which implies the volcano is in an important stage of deep and dynamic disturbance. (8 refs.)

110349 Mixing basaltic and dacitic magmas by forced convection. A.Kouchi, I.Sunagawa (Inst. of Mineralogy, Petrology & Economic Geology, Tohoku Univ., Sendai, Japan).
Nature (GB), vol.304, no.5926, p.527-8 (11 Aug. 1983).
Presents the results of experiments demonstrating that basaltic and dacitic magmas can be easily mixed by forced convection to form both banded dacite and homogeneous andesite in less than a few hours. (18 refs.)

110350 Krakatoa! The decapitation of a volcano. A.Woolley, C.Bishop (Dept. of Mineralogy, Natural History Museum, London, England).
New Sci. (GB), vol.99, no.1372, p.561-7 (25 Aug. 1983).
Discusses the events leading up to and around the 1883 eruption. The mechanism involved is considered together with meteorological aspects. (no refs.)

110351 Geochemical forecast of volcanic eruptions using mercury as an indicator; Mt. Aso. A.Koga.
Rep. Res. Inst. Ind. Sci. Kyushu Univ. (Japan), no.74, p.175-9 (1983). In Japanese.
Continuous determination of mercury is being conducted since May, 1981 on Mt. Aso to forecast its volcanic eruption geochemically. The total amount of mercury captured on the gold needles at the 4 sampling stations around the crater lip appears to correspond to the eruptive manifestations during the collection time. Monitoring of mercury is a superior way of forecasting the volcanic eruption. (6 refs.)

Basaltic volcanism on the terrestrial planets .... See Entry 105038

Timing, trace and origin of basaltic migration in eastern Australia .... See Entry 110337

Fission-track ages of some volcanic rocks from the Kirishima geothermal region .... See Entry 110346

Gravity and height variations connected with the recent rifting process in Northern Iceland 1975-1981 .... See Entry 110356

Composition of pumice layers in Aegean deep-sea sediments and correlation with Minoan eruption .... See Entry 110359

Circumglobal transport of the El Chichon volcanic dust cloud .... See Entry 110600

Analysis of Mount St. Helens ash from optical photoelectric photometry .... See Entry 110658

91.45 PHYSICS OF PLATE TECTONICS

110352 The structure of the western margin of the Subalpine Basin (south-eastern France). S.Elmi (Univ. Claude-Bernard, Villeurbanne, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.20, p.1615-20 (6 June 1983). In French.
Along the ardescian margin, thickness variations of the Triassic-Bathonian series, synsedimentary faults, and sedimentary disturbances, are indicative of a structure network made of tilted blocks limited by NNE, SE and ENE faults. This canvas was a prefiguration of the bending of the Western Alps. (10 refs.)

110353 The Lizard front (Cornwall, England): a main tectonic contact underlain by Paleozoic limestone slices. B.Le Gall, J.Poncet (Univ. de Bretagne Occidentale, Brest, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.21, p.1683-8 (13 June 1983). In French.
The existence of Paleozoic calcareous tectonic chips pinched under complex amphibolites proves the allochtoneity of the Lizard front. This thrusting tectonic event is related to the 'Bretonian phase' (Upper Devonian). (16 refs.)

110354 Opening of the Red Sea: constraints from a palaeomagnetic study of the As Sarat volcanic field, south-western Saudi Arabia. K.S.Kellogg (US Geological Survey, New York, NY, USA), R.L.Reynolds.
Geophys. J. R. Astron. Soc. (GB), vol.74, no.3, p.649-65 (Sept. 1983).
Four stratigraphic sections through alkali basalt flows of Oligocene to Miocene age (29-24 Ma) in the As Sarat volcanic field, south-western Saudi Arabia, were sampled for palaeomagnetic study. A mean direction of magnetization of $D=355.3°$, $I=15.2°$ ($\alpha_{95}=4.3°$) was found which defines a palaeomagnetic pole at 78.8°N, 247.8°E. Part of one section was apparently erupted during the early phases of a polarity reversal of the Earth's field. The hypothesis of a displaced dipole source for the Earth's field in late Oligocene to early Miocene time is supported by the data. A comparison of the results from As Sarat with palaeomagnetic results from upper Tertiary rocks in Africa indicates that the Red Sea has opened 12° (estimated ±8° at the 95 per cent confidence level). These results indicate that most of the counter-clockwise rotation of Arabia relative to Africa occurred since the eruption of the As Sarat volcanics, in disagreement with proposed models for main-stage Red Sea spreading from late Eocene to early Oligocene time. The palaeomagnetic results also indicate that the Arabian Peninsular was more equatorial in late Oligocene to early Miocene time than it is now. (45 refs.)

110355 Initiation of subsidence in a sedimentary basin underlain by a phase change. J.-C.Mareschal, C.-K.Lee (School of Geophys. Sci., Georgia Inst. of Technol., Atlanta, GA, USA).
Geophys. J. R. Astron. Soc. (GB), vol.74, no.3, p.689-712 (Sept. 1983).
A mechanism of subsidence for axisymmetric sedimentary basins is investigated; it is assumed that the subsidence is caused by the superposition of the motion of a phase boundary and of the flexure of an elastic lithosphere in response to the loading of the Earth's surface by sediment. An approximate solution, describing the motion of the phase boundary when it is subjected to changes in pressure, is used to describe the early stages of the subsidence history of the basin. Several models have been investigated and are presented to demonstrate how the spatial and temporal characteristics of the sediment deposition affect the suggested mechanism. If the basin is wide and the sediment deposition is slow the subsidence can proceed at the same rate or even faster than the sedimentation, resulting in an acceleration of the sediment accumulation. (43 refs.)

110356 Gravity and height variations connected with the recent rifting process in Northern Iceland 1975-1981. W.Torge, E.Kanngieser (Inst. fur Erdmessung, Univ. Hannover, Hannover, Germany).
J. Geophys. (Germany), vol.53, no.1, p.24-33 (1983).
In 1975 rifting started in northern Iceland along the supramarine part of the constructive plate boundary. Regional gravity and height variations have been observed across the neovolcanic zone and the adjoining western and eastern Pleistocene and Tertiary basalt zones. The center of activity is in the Krafla caldera and the rifting has affected the fissure swarm associated with the central volcano. The recent rifting process is characterized by shifting of activity with gravity decrease and uplift at the flanks and gravity increase and subsidence at narrow central parts of the Krafla fissure swarm. (25 refs.)

110357 Tectonics of the Acadian Orogeny in New England and adjacent Canada. D.C.Bradley (Dept. of Geological Sci., State Univ. of New York, Albany, NY, USA).
J. Geol. (USA), vol.91, no.4, p.381-400 (July 1983).
Paleogeographic analysis of Post-Taconian rocks in New England and adjacent parts of Canada has revealed the existence of two volcanic arcs which shut off at the time of the Acadian Orogeny. One was built on arc basement previously accreted to North America during the Taconic Orogeny, the other on Precambrian continental basement of Avalonia. In the intervening Merrimack-Fredericton Trough, metamorphosed and polydeformed turbidites and black shales record deep water conditions in the Silurian. This tract is interpreted as the site of an ocean which closed in the Siluro-Devonian by simultaneous subduction beneath both continental margins. (90 refs.)

110358 Thrusting and duplex formation at Mount Isa, Queensland, Australia. T.H.Bell (Dept. of Geology, James Cook Univ., Queensland, Australia).
Nature (GB), vol.304, no.5926, p.493-7 (11 Aug. 1983).
Large-scale repetition of Mount Isa and Haslingden Group rocks in the anticline north of Mount Isa is interpreted as the core of a thrust duplex which has been subsequently folded parallel to the direction of thrusting. Displacement of Mount Isa Group rocks above the duplex is extremely significant to the regional geology and exploration for more Mount Isa style Pb-Zn and Cu orebodies. Interpretation of the geometry of the thrust belt indicates thrusting on different stratigraphical levels below and above the duplex during its formation, horses formed from a heelwards protruding footwall ridge instead of a trough, and the complex effects on stratigraphical cross-sections through duplexes of sloping lateral footwall ramps on horses. (28 refs.)

1982 Meeting of the European Geophysical Society Symposium on Palaeomagnetism of Orogenic Belts .... See Entry 105023

An updated Bouguer anomaly map of south-central West Africa .... See Entry 110274

Changes in the geomagnetic total force intensity associated with the anomalous crustal activity in the eastern part of the Izu Peninsula. IV. Anomalous change observed in the north-eastern area in 1981 .... See Entry 110279

Palaeomagnetism of Carboniferous rocks of the central Sahara; analysis of juxtaposed magnetisations; configuration of Pangea .... See Entry 110280

On multifrequency magnetotelluric sounding over the Himalayan type colliding plate boundaries .... See Entry 110287

Tectonomagnetism .... See Entry 110295

Interpretation of a stress profile across the San Andreas fault .... See Entry 110304

Geothermal measurements in the upper Euphrates Valley—W Iraq .... See Entry 110325

A tear fault system beneath the Atlantis-Meteor seamount group .... See Entry 110327

Structure and evolution of the intracratonic basins of central Australia .... See Entry 110331

Visco-elastic modelling of lithospheric stresses arising from density contrasts .... See Entry 110332

On the thermal state of the Earth's mantle .... See Entry 110336

Timing, trace and origin of basaltic migration in eastern Australia .... See Entry 110337

Thermally-activated creep and flexure of the oceanic lithosphere .... See Entry 110338

The relationship between the location of oil and gas provinces and zones of subduction of lithospheric plates .... See Entry 110341

A petrographic description of the tholeiitic basalts in the central zone of the Red Sea rift .... See Entry 110342

Geotectonics of some geothermal fields associated with the Quaternary volcanic zone .... See Entry 110347

Krakatoa! The decapitation of a volcano .... See Entry 110350

Major southward thrusting of the Dalradian rocks of Connemara, western Ireland .... See Entry 110371

91.50 MARINE GEOLOGY AND GEOPHYSICS

110359 Composition of pumice layers in Aegean deep-sea sediments and correlation with Minoan eruption. A.Vinci (Inst. of Petrography, Univ. of Parma, Parma, Italy).
Boll. Oceanol. Teor. & Appl. (Italy), vol.1, no.3, p.231-8 (July 1983).
Analyses of pumice clasts from deposits cored within the caldera and outside the island of Santorini (Aegean Sea) reveal a ryodacitic composition and a calcalkaline affinity. Pumices from the cores show some differences in their physical and chemical characteristics. Comparison to the Minoan eruption products allowed to attribute to them only the pumice clasts from outside the caldera. Tephra layers inside the caldera are of uncertain origin, but could be related to the Kaimeni volcanoes. (17 refs.)

110360 Seismic stratigraphy and sedimentation history of the East Mariana Basin, western Pacific. T.H.Shipley, J.M.Whitman (Scripps Instn. of Oceanography, Univ. of California, San Diego, La Jolla, CA, USA), F.K.Duennebier, L.D.Petersen.
Earth & Planet. Sci. Lett. (Netherlands), vol.64, no.2, p.257-75 (Aug. 1983).
Examines seismic reflection and refraction data combined with previous regional synthesis work to describe the seismic stratigraphy and sedimentation

history of this presumably Mesozoic basin. The authors also speculate about the origin of some of the structures observed in the seismic data and as suggested by regional basement depth variations. (29 refs.)

110361 Regional sea level, Southern Oscillation and beach change, New South Wales, Australia. E.Bryant (Dept. of Geography, Wollongong Univ., Wollongong, New South Wales, Australia).
Nature (GB), vol.305, no.5931, p.213-16 (15 Sept. 1983).
The author has studied beach changes for the whole of Stanwell Park beach, New South Wales, Australia, for the period 1895-1980. It is reported that using the average high-tide wave run-up position measured accurate to ±2.5 m from oblique and vertical photographs, changes could be linked to regional sea-level variation and a globally significant climatic variable, the Southern Oscillation. (37 refs.)

110362 On the periglacial regions of the oceans. G.G.Matishov (Murmansk Marine Biology Inst., Acad. of Sci., USSR).
Oceanology (USA), vol.22, no.2, p.176-81 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.2 (1982). [received: Aug. 1983]
Analysis of the latest lithologic and geomorphological data has made it possible to advance and support the concept of the 'oceanic periglacial regions'. This concept encompasses the interrelated phenomena and processes caused by ice sheet glaciations and synchronous with the main stages of their development and degradation, as well as the specific complex of periglacial-marine relief forms of the ocean bottom and the deposits making up these forms, which occupy the ocean floor adjacent to regions of former continental glaciation. The development of periglacial marine formations was determined mainly by two factor—the glacioaquatic discharge that generated underwater glacial-turbidity currents, and iceberg accumulation of morainal material. (17 refs.)

Morphological, sedimentological and chemical aspects of the sediments in the Gulf of Cagliari (Sardinia) ... See Entry 109925

Dispersion and sedimentation of industrial waste of bauxite, blendes, fluorites and phosphorites dumped in the Gulf of Venice, Italy ... See Entry 109926

Fly-ash particles intercepted in the deep Sargasso Sea ... See Entry 109928

A tear fault system beneath the Atlantis-Meteor seamount group ... See Entry 110327

Thermally-activated creep and flexure of the oceanic lithosphere ... See Entry 110338

Rare earth elements in seawater near hydrothermal vents ... See Entry 110487

The bathymetry of Lakes King and Victoria ... See Entry 110497

140000-yr isotope climatic record from raised coral reefs in New Guinea ... See Entry 110644

91.60 PHYSICAL PROPERTIES OF ROCKS AND MINERALS

110363 Phase relations of amphibole, amphibole-carbonate, and phlogopite-carbonate peridotite: petrologic constraints on the asthenosphere. M.Olafsson, D.H.Eggler (Dept. of Geosci., Pennsylvania State Univ., University Park, PA, USA).
Earth & Planet. Sci. Lett. (Netherlands), vol.64, no.2, p.305-15 (Aug. 1983).
The subsolidus mineralogy and the isobarically-invariant solidus of peridotite in the presence of small amounts of H_2O and CO_2 have been determined from 13.5 to 26 kbar pressure. (47 refs.)

110364 Viscous magnetization of 0.04-100 μm magnetites. D.J.Dunlop (Univ. de Paris VI, St-Maur-des-Fosses, France).
Geophys. J. R. Astron. Soc. (GB), vol.74, no.3, p.667-87 (Sept. 1983).
Acquisition and decay of small-field viscous magnetization have been measured as a function of temperature (9-500°C) for four synthetic magnetite dispersions ranging in a mean particle size from 0.04 to 0.22 μm and at room temperature only for an additional six samples (2-100 μm). Room-temperature viscous magnetization is pronounced in the single-domain range, slight between 0.1 and 5 μm, and again substantial in the intermediate multi-domain range (10-15 μm). In all experiments, the acquisition rate exceeded the decay rate, resulting in residual undecayed viscous remanent magnetization (VRM) after a zero-field decay time equal to the time of exposure to a field. Viscous magnetization is enhanced at elevated temperatures but not in direct proportion to absolute temperature. VRM produced isothermally at a given temperature is significantly more difficult to erase by heating to a higher temperature than most thermal activation theories predict. The implications of these observations are that viscous overprinting of natural remanent magnetization in magnetite-bearing rocks, particularly during burial or intrusive reheating, may be more extensive and more difficult to erase then previously believed. (49 refs.)

110365 Pore structure of hydrothermally altered rocks in the Otake geothermal area. K.Gotoh, S.Kawano, N.Takada.
Rep. Res. Inst. Ind. Sci. Kyushu Univ. (Japan), no.74, p.7-16 (1983). In Japanese.
Pore structure of hydrothermally altered rocks in the Otake geothermal area is measured by mercury-intrusion measurements. The pore-size distribution curves show some characteristics and correspond to the alteration degree and alteration ratio proposed by Hayashi. The permeability of the altered rocks is 10-100 times greater than that of the unaltered rocks. (4 refs.)

110366 Rock magnetism. P.N.Shive (Dept. of Geology & Geophys., Univ. of Wyoming, Laramie, WY, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.665-71 (April 1983).
Discusses igneous rocks, thermoremanent magnetisation, sediments, detrital remanent magnetisation, anisotropy, stress, rotational remanent magnetisation, instrumentation, techniques and data analysis. (120 refs.)

Conversion of smectite to illite in hydrothermal systems: A literature review ... See Entry 106147

The application of micro-area X-ray energy dispersive analysis in investigating barium-rare earth fluorocarbonate minerals ... See Entry 107480

The phase transformations and thermal expansion of the solid electrolyte Cu_3BiS_3 between 25 and 300°C ... See Entry 107588

Creep in transforming polycrystalline materials ... See Entry 107813

Biomagnetic geomagnetism ... See Entry 110064

Airborne resistivity mapping using a multifrequency electromagnetic system ... See Entry 110284

Tectonomagnetism ... See Entry 110295

On the thermal state of the Earth's mantle ... See Entry 110336

Quantitative measurement of the mass-color of zircon in igneous rocks from the Kujyu volcanic region, central Kyushu ... See Entry 110345

Automatic three-layer, three-dimensional deconvolution of the Pays de Bray anticline ... See Entry 110367

A method for evaluating the effect of crack geometry on the mechanical behavior of cracked rock masses ... See Entry 110683

The dielectric properties of wet materials ... See Entry 110714

Automatic AF-demagnetiser using a two-axis spin magnetometer ... See Entry 110718

91.65 GEOPHYSICAL ASPECTS OF GEOLOGY, MINERALOGY AND PETROLOGY

110367 Automatic three-layer, three-dimensional deconvolution of the Pays de Bray anticline. E.Alessandrello, M.Bichara, J.Lakshmanan (Compagnie de Prospection Geophys. Francaise, Rueil-Malmaison, France).
Geophys. Prospect. (Netherlands), vol.31, no.4, p.608-26 (Aug. 1983).
Gravity data have been transformed into a three-layer, three-dimensional model by using an automatic procedure based on linear filtering. The Bouguer anomaly is first transformed by linear filtering into density variations located between two planes 1100 and 2500 m deep. These densities are then transformed into thicknesses with a constant density contrast of 0.4 g/cm^3 with two geological constraints for the second and third interface. Differences between measured and computed gravity are then applied by a similar procedure to a layer located between depths of 0 and 500 m. (9 refs.)

110368 Origin of the Ilmenogorsk-Vishnevogorsk nepheline syenites, Urals, USSR, and their time of emplacement during the history of the Ural fold belt: a Rb-Sr study. U.Kramm (Inst. for Mineralogy, Univ. of Munster, Munster, Germany), A.B.Blaxland, V.A.Kononova, B.Grauert.
J. Geol. (USA), vol.91, no.4, p.427-35 (July 1983).
Miaskitic nepheline syenites of the Ilmenogorsk-Vishnevogorsk Alkaline Complex in the Ural Mountains were emplaced approximately 450 Ma ago, as indicated by Rb-Sr whole rock ages. Their intrusion coincided with a dilatation period along the eastern margin of the Russian platform, and predated the compressive stage of the Hercynian orogeny in the Urals which began during the Silurian. Internal mineral isochrons for two nepheline syenites and an alkali-feldspar syenite from different regions of the complex yield consistent Permian ages of 245 Ma. These ages are interpreted as dating the cooling of the alkaline rocks after a final amphibolite grade Hercynian metamorphism. (29 refs.)

110369 An oscillating trend in Phanerozoic non-skeletal carbonate mineralogy. P.A.Sandberg (Dept. of Geology, Univ. of Illinois, IL, USA).
Nature (GB), vol.305, no.5929, p.19-22 (1 Sept. 1983).
Textural and compositional data on ancient ooids and cements suggest the existence of an oscillating Phanerozoic temporal trend in non-skeletal mineralogy. The trend shows good correlation with eustatic-climatic oscillations proposed by others. The most likely mechanism appears to be plate-tectonically influenced oscillation in the vapour pressure of CO_2 rather than change in oceanic Mg/Ca ratio. (45 refs.)

110370 Permian alkaline undersaturated and carbonatite province, and rifting along the West African craton. J.P.Liegeois (Musee Royal de l'Afrique Centrale, Tervuren, Belgium), H.Bertrand, R.Black, R.Caby, J.Fabre.
Nature (GB), vol.305, no.5929, p.42-3 (1 Sept. 1983).
Reports that a Permian radiometric age obtained for an intrusion shows the existence of a hitherto unsuspected important tectono-magmatic event in this part of Africa, which may have far-reaching structural implications as well as economic interest. (12 refs.)

110371 Major southward thrusting of the Dalradian rocks of Connemara, western Ireland. B.E.Leake, P.W.G.Tanner, D.Singh (Dept. of Geology, Univ. of Glasgow, Glasgow, Scotland), A.N.Halliday.
Nature (GB), vol.305, no.5931, p.210-13 (15 Sept. 1983).
The authors propose a model for the Connemara Dalradian, that of an allochthonous thrust sheet, which highlights hitherto unsuspected similarities between the tectonic histories of the south-east margins of the metamorphic Caledonides in the British Isles and Scandinavia. (28 refs.)

BIRPS deep seismic reflection studies of the British Caledonides ... See Entry 110340

Speleothems, travertines, and paleoclimates ... See Entry 110343

Cation-ratio dating: a new rock varnish age-determination technique ... See Entry 110344

Quantitative measurement of the mass-color of zircon in igneous rocks from the Kujyu volcanic region, central Kyushu ... See Entry 110345

Tectonics of the Acadian Orogeny in New England and adjacent Canada ... See Entry 110357

Thrusting and duplex formation at Mount Isa, Queensland, Australia ... See Entry 110358

140000-yr isotope climatic record from raised coral reefs in New Guinea ... See Entry 110644

The geologic record of climatic change ... See Entry 110646

91.90 OTHER TOPICS IN SOLID EARTH GEOPHYSICS

110372 Multispectral remote sensing of saline seeps. L.Chaturvedi, K.R.Carver (New Mexico State Univ., Las Cruces, NM, USA), J.C.Harlan, G.D.Hancock, F.V.Small, K.J.Dalstead.
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.239-51 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
An aircraft experiment was conducted in early summer of 1981 to determine the feasibility of optical and microwave remote sensing techniques for the detection of fully developed and incipient saline seeps in South Dakota and Montana. The NASA C-130 Earth resources aircraft was used to acquire *L*-band and *C*-band scatterometer data (backscattering coefficient profiles), radiometer data (brightness temperature profiles), and color-infrared photography; additional passive microwave data and thermal images were acquired. Intensive soil moisture and salinity data were collected on a uniform 20-m grid spacing and at several depths for the 600×600 m South Dakota site. The two Montana sites were over-flown with flight lines several kilometers in length, and ground truth information was obtained by identifying known geological and geohydrological units with varying soil salinities on a regional basis. In summary, the 1981 data set disclosed no reliable means of remotely sensing potential saline seeps. (7 refs.)

110373 Effects of a rough boundary surface on polarization of the scattered field from an inhomogeneous medium. A.K.Fung, H.J.Eom (Remote Sensing Lab., Univ. of Kansas Center for Res. Inc., Lawrence, KS, USA).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.265-70 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
The effect of surface roughness on the polarization of the microwave scattered field is studied by combining the standard Kirchhoff method for rough surface scattering with the radiative transfer method for volume scattering using the Rayleigh phase function. Corresponding cases of pure surface scattering from a homogeneous layer and volume scattering from a plane inhomogeneous layer are also computed to serve as points of reference. In each case the degree of polarization *DP*, polarization ratio *PR*, locations on the Poincare sphere of copolarization nulls *CN*, and cross-polarization nulls *XN* are computed. It is found that for pure surface scattering *PR* between 0-20° incidence angles is quite sensitive to change in surface roughness. (19 refs.)

110374 Comparison of multifrequency band radars for crop classification. A.J.Sieber (Inst. for Radiofrequency Technol., Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt e.V., Oberpfaffenhofen, Germany).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.285-94 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
A first, systematic experiment with airborne SAR systems working in *X*-, *C*-, and *L*-band took place during the European Convair SAR 580 experiment in 1981. One major topic of the use of SAR images is to analyse their potential for agricultural applications including crop identification. This paper describes results from the analysis of images taken over two German test sites. These data prove that differences of the backscattering behavior of crops are mainly related to the dielectric geometry of the plants. The paper will give examples. Furthermore, the data analysis undertaken on the base of SAR 580 data will be described. (9 refs.)

110375 Method for retrieving the true backscattering coefficient from measurements with a real antenna. F.T.Ulaby, C.T.Allen, A.K.Fung (Remote Sensing Lab., Univ. of Kansas Center for Res., Inc., Lawrence, KS, USA).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.308-13 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
Measurements made of the power backscattered by a surface at angles near normal incidence include contributions due to both coherent and incoherent scattering. Additionally, these contributions are weighted by the antenna pattern. Using a theoretical model to describe the backscattering from a rough soil surface, a procedure is developed for retrieving the true angular pattern of the backscattering coefficient σ^0 from measured estimates of σ^0, where the measured estimate is based on the usual assumption that σ^0 is approximately constant over the angular extent of the antenna beam for narrow-beam systems. The retrieved patterns of σ^0 were then used to evaluate the dependence of σ^0 on soil surface roughness at 1.5, 4.25, and 7.25 GHz. (10 refs.)

110376 Classification of agricultural crops in radar images. P.Hoogeboom (Phys. Lab. TNO, The Hague, Netherlands).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.329-36 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
For the past few years an accurate X-band SLAR system with digital recording has been available in The Netherlands. The images of this system are corrected to indicate radar backscatter coefficients (gamma) instead of arbitrary greytones. In 1980 a radar measurement campaign was organized in the Flevopolder area. Ground-based measurements were carried out and at certain prefixed times flights were made. The optimum flight times had been derived from a simulation study, based on previous measurements. The results of this campaign are now being analyzed. The one-dimensional case, consisting of one flight over the test area at a previously derived optimum flight time gives only 35-percent correct classification in 7 classes. Multidimensional cases with flights at different dates improve the classification result to over 85-percent. The small differences in backscatter between the various types of crops clearly demonstrate the need for an accurate radar system which does not show too much speckle. (8 refs.)

110377 Computer simulation of speckle in a synthetic aperture radar image pixel. K.Tomiyasu (General Electric Co., Valley Forge Space Center, Philadelphia, PA, USA).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.357-63 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
Images of a uniform scene produced with a synthetic aperture radar will frequently appear nonuniform. This phenomenon, called 'speckle', is attributed to the coherency of the radar signal and intrapixel interferometry. Speckle is generally regarded as image contrast or response variation between adjacent pixels of a uniform scene. The same type of variation can be observed by imaging just one such pixel when viewed from different azimuthal heading angles. A computer program described in this paper was written to simulate the radar return from a single pixel containing numerous scatterers. The phase and amplitude of the signal reflected from the pixel generally varies from pulse to pulse due to intrapixel interference. After integration, the pixel response usually differs with each 'azimuth look', and this speckle variation between azimuth looks may be as much as 20 dB or more. Speckle variation can be significantly reduced by averaging or median filtering multiple azimuth looks per pixel. (22 refs.)

110378 Application possibilities of passive remote-sensing systems in the millimeter-wave region. K.Gruner, W.Keydel, H.Suss (DFVLR, Inst. fur Hochfrequenztechnik, Oberpfaffenhofen, Germany).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.376-82 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
This presentation gives, after a discussion of advantages and disadvantages of microwave radiometry and a short reference to the state of the art, several application possibilities based on airborne DFVLR measurements at 32 and 90 GHz: Earth observation with respect to vegetation conditions, ground moisture, and snow cover; traffic control at land and sea and sensing of road conditions; and Earth observation during bad ground visibility. An outlook to expectable future developments will be given on the basis of present requirements. Main goals are the increase of data rates as well as geometrical and temperature resolution improvements by use of multireceiver systems in order to get operational microwave radiometry systems for remote sensing. (3 refs.)

110379 Radar backscattering properties of corn and soybeans at frequencies of 1.6, 4.75, and 13.3 GHz. J.F.Paris (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.392-400 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
An observational study was made of the radar-backscattering properties of corn and soybeans in commercial fields in a test site in Webster County, Iowa. Aircraft-based radar scatterometers measured the backscattering coefficient of the crops at three frequencies, 1.6 GHz (*L*-band), 4.75 GHz (*C*-band), and 13.3 GHz (*Ku*-band), at 10 sensor look-angles (5 to 50 degrees from the nadir in steps of 5 degrees), and with several polarization combinations. They produced 50 combinations of frequency, look-angle, and polarization for analysis for about 80 fields on two flight dates. Based on these data, the investigator reached conclusions concerning the influences of crop row direction, row-direction differences and soil moisture on the discrimination of these two crops by radar techniques. (21 refs.)

110380 Scattering from randomly oriented circular discs with application to vegetation. M.A.Karam, A.K.Fung (Remote Sensing Lab., Univ. of Kansas Center for Res., Inc., Lawrence, KS, USA).
Radio Sci. (USA), vol.18, no.4, p.557-65 (July-Aug. 1983).
A vegetation layer is modeled by a collection of randomly oriented circular discs over a half space. The backscattering coefficient from such a half space is computed using the radiative transfer theory. Comparisons are shown with measurements taken from milo, corn and wheat and good agreements are obtained for both polarized and cross-polarized returns. (15 refs.)

110381 Shadowing by non-Gaussian rough surfaces for which decorrelation implies statistical independence. E.Bahar, M.A.Fitzwater (Electrical Engng. Dept., Univ. of Nebraska, Lincoln, NE, USA).
Radio Sci. (USA), vol.18, no.4, p.566-72 (July-Aug. 1983).
Expressions for the shadow functions are derived for a broad class of non-Gaussian rough surfaces. The numerical results obtained for the backscatter shadow functions are compared with an exponential joint height probability density that does not become statistically independent as the surface heights decorrelate. (12 refs.)

110382 Model for atmospheric corrections to microwave brightness temperature data. K.S.Rao, Y.V.S.Murthy (Centre of Studies in Resources Engng., Indian Inst. of Technol., Bombay, India), A.K.S.Gopalan, R.Ramakrishnan, T.J.Majumdar.
Remote Sensing Environ. (USA), vol.13, no.3, p.209-32 (July 1983).
The effects of atmospheric liquid water (cloud) and water vapor on the brightness temperature data acquired by Bhaskara-Satellite Microwave Radiometer at 19.1 and 22.235 GHz near the nadir look angle have been discussed in detail. It has been observed that the net contribution to brightness temperature data due to the atmosphere is quite considerable over sea and wet land conditions. Two operational quasistatistical models have been developed for doing atmospheric corrections to brightness temperature data, one applicable under cloud-free conditions and the other under all weather conditions. The physical concept to arrive at these quasistatistical models have been discussed. The constants of the models are estimated by the method of least squares fit by simulating 200 sets of atmospheric and ground conditions. (20 refs.)

110383 Multiple microtektite horizons in Upper Eocene marine sediments: no evidence for mass extinctions. G.Keller (US Geological Survey, Menlo Park, CA, USA), S.D'Hondt, T.L.Vallier.
Science (USA), vol.221, no.4606, p.150-2 (8 July 1983).
Microtektites have been recovered from three horizons in eight Middle Eocene to Middle Oligocene marine sediment sequences. Five of these occurrences are coeval and of latest Eocene age (37.5 to 38.0 million years ago) ; three are coeval and of early Late Eocene age (38.5 to 39.5 million years ago) : and three are of middle Oligocene age (31 to 32 million years ago) . In addition, rare probable microtecktites have been found in sediments with ages of about 36.0 to 36.5 million years. The microtektite horizon at 37.5 to 38.0 million years can be correlated with the North American tektite-strewn field, which has a fission track age (minimum) of 34 to 35 million years and a paleomagnetic age of 37.5 to 38.0 million years. There is no evidence for mass faunal extinctions at any of the microtektite horizons. (20 refs.)

110384 Correction for low Sun elevation in Landsat imagery. M.Piacentini (Dipartimento di Elettronica, Politecnico di Milano, Milano, Italy).
Signal Process. (Netherlands), vol.5, no.4, p.311-18 (July 1983).
The use of Landsat images of mountainous areas to extract the texture of the terrain poses some unique problems, due to the Sun illumination. The author develops a simple but effective model which shows that the whole process is equivalent to a linear space invariant filtering, at least in its general effects. This equivalence, confirmed by experimental results, is utilized to develop an inverse filter. The author also reports, as an example, the effects of the illumination and of its correction on an algorithm which finds the local principal direction of the structure of the terrain, showing the interesting improvements in performances that can be obtained. The conclusions are not restricted to the Landsat images only, but can be extended to any aerial or satellite image of the mountainous areas. (2 refs.)

Application of Nuclear Techniques in Geothermal Investigations Consultants Meeting .... See Entry 105018

Proceedings of Symposium 5 of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 105087

On the periglacial regions of the oceans .... See Entry 110362

Surface water hydrology—runoff generation and basin structure .... See Entry 110501

Augmenting LANDSAT MSS data with topographic information for enhanced registration and classification .... See Entry 110702

The Thematic Mapper—an overview .... See Entry 110703

Variation of the microwave brightness temperature of sea surfaces covered with mineral and monomolecular oil films .... See Entry 110706

Improvement of moisture estimation accuracy of vegetation-covered soil by combined active/passive microwave remote sensing .... See Entry 110707

Amplitude and phase errors involved in retrieving depolarized radar cross section measurements .... See Entry 110708

Synthetic aperture radar imaging from an inclined geosynchronous orbit .... See Entry 110710

Remote sensing of soil moisture: recent advances .... See Entry 110711

The dielectric properties of wet materials .... See Entry 110714

Comparison of several techniques to obtain multiple-look SAR imagery .... See Entry 110715

Remote sensing of wetlands .... See Entry 110716

Tradeoffs among several synthetic aperture radar image quality parameters: results of a user survey study ....See Entry 110726

Spectral characterization of the Landsat-4 MSS sensors ....See Entry 110727

Effects of the atmosphere on image resolution in microwave radiometry ....See Entry 110734

92.00 HYDROSPHERIC AND ATMOSPHERIC GEOPHYSICS

(for marine geology and geophysics, see 91.50)

92.10 PHYSICS OF THE OCEANS

(see also 43.30 Underwater sound)

110385 Low frequency variability in the Mediterranean Outflow west of Gibraltar. B.R.Stanton (Inst. of Oceanographic Sci., Wormley, England).
Deep-Sea Res. Part A (GB), vol.30, no.7A, p.743-61 (July 1983).
Low frequency variability in the Mediterranean Outflow was studied using three current meter moorings set to the west of the Strait of Gibraltar in 1974 and 1976 to 1977. At low frequencies (period greater than 2 days) temperature and velocity were highly coherent in the transition layer above the outflow core and temperature fluctuations were carried with the outflow. While no significant series correlations are found between mooring data and meteorological data from Gibraltar, the largest fluctuations in the outflow were associated with extreme meteorological conditions. The forcing of the events is examined. Wind stress forcing gives results that contradict previous findings, while the barotropic response of the flow through the straits to rapid changes in barometric pressure is a likely mechanism in some instances. (18 refs.)

110386 Mesoscale rings in an ocean with vertical shear. M.Ikeda (Dept. of Oceanography. Univ. of British Columbia, Vancouver, BC, USA).
Deep-Sea Res. Part A (GB), vol.30, no.7A, p.783-99 (July 1983).
Movement and evolution of mesoscale rings in an ocean with vertical shear are studied using a two-layer quasi-geostrophic, inviscid model on a β plane. Initially an isolated ring is assumed to have motion only in the upper layer, which is otherwise quiet. The vertical shear is represented by a uniformal zonal flow in the lower layer. The results are applied to rings drifting in recirculating gyres associated with the Gulf Stream, where the upper layers are westward-flowing relative to the lower layers. Waves generated in the flows are discussed. (11 refs.)

110387 An investigation of summer sea surface temperature anomalies in the eastern North Pacific Ocean. J.R.Lanzante, R.P.Harnack (Dept. of Meteorology & Phys. Oceanography, State Univ. of New Jersey, New Brunswick, NJ, USA).
Tellus Ser. A (Sweden), vol.35a, no.4, p.256-68 (Aug. 1983).
A study of summer sea surface temperature anomalies in the eastern North Pacific Ocean is undertaken to examine some of the processes that could affect their evolution and which may be important for their prediction. An empirical approach is utilized. The factors considered include sea surface temperature (SST) persistence, oceanic thermal advection, and wind mixing. The primary variable studied is the summer SST anomaly for each of 25, 5° latitude by 10° longitude boxes in the region 140°W-170°E, 30-55°N. Thirty years of data is used (1947-76). Diagnostic analyses using data from four Ocean Weather Stations (C, D, P and V) are performed prior to the analyses described above in order to examine wind mixing more closely. The monthly mean SLP gradient is used as an estimate of average monthly wind speed over the 25 box domain where measured winds are not routinely available. In addition, winds derived from daily sea level pressure (SLP) analyses are averaged to form monthly means. The box-averaged data are employed to specify the summer SST from the components of the total horizontal thermal advection. (29 refs.)

110388 Ocean response to mesoscale atmospheric forcing. I.Orlanski, L.J.Polinsky (Geophys. Fluid Dynamics Lab./NOAA, Princeton Univ., Princeton, NJ, USA).
Tellus Ser. A (Sweden), vol.35a, no.4, p.296-323 (Aug. 1983).
Many processes have been proposed as possible forcing mechanisms for mesoscale oceanic variability. The authors show that atmospheric forcing can be an important source of mesoscale variability in the ocean and that the response is linearly proportional to the product of the time scale of the storm and its intensity. The authors clarify the point that for storms with scales considerably smaller than the barotropic Rossby radius of deformation, the oceanic stratification and the horizontal extent of the storm are the only factors determining the penetration depth of the response, implying that it is not the Rossby radius of deformation but rather the scale of penetration depth ($h=(f/N)L$) that characterizes the response. The role of the mixed layer is considered very important in the transfer of surface stresses down into the system. (19 refs.)

110389 On the existence of some periodicities in the long fluctuations of the sea level. S.Fais (Osservatorio Geofisico Sperimentale, Trieste, Italy), F.Mosetti.
Boll. Oceanol. Teor. & Appl. (Italy), vol.1, no.3, p.175-85 (July 1983).
Analyses the periodicities in three sea level series, relative to the Brest, Swinoujscie and Venice marigraphic stations. The spectral analysis of the sea level record carried out by Fast Fourier Transform and Maximum Entropy Method techniques shows various periodical components for the long period sea level fluctuations. Many of the components found are common to the three examined series and, as it results from previous studies, they are in accordance with some of the periodicities characterizing a lot of natural oscillating phenomena, particularly the climatic and geophysical ones. Therefore, it can be considered that both the natural oscillating phenomena and the long period sea level fluctuations in any locality are ruled by a mean common law, that influences their temporal evolution. The authors present the results of some spectral analyses with the relative periodicities component of the above-mentioned law. (17 refs.)

110390 Water continuity or salt continuity: an actual problem for the matter budget of the sea through the straits. F.Mosetti (Istituto di Geodesia e Geofisica, Univ. di Trieste, Trieste, Italy).
Boll. Oceanol. Teor. & Appl. (Italy), vol.1, no.3, p.225-9 (July 1983).
Discusses solving the dynamic method for computing the currents acting through a strait. For such a purpose some conditions on the continuity are considered. Only by means of such a condition can the relative values of velocity, given with the dynamic method, be transformed into absolute values. The discussion concerns the choice of the condition of continuity of the water or the one of the salt. Both the conditions are characteristic of the hydrological conditions considering the role of the evaporation. (no refs.)

110391 The vertical structure annual cycle of the mass field parameters in the Gulf of Trieste. F.Stravisi (Istituto Talassografico di Trieste, Trieste, Italy).
Boll. Oceanol. Teor. & Appl. (Italy), vol.1, no.3, p.239-50 (July 1983).
Vertical CT and velocity profiles have been measured in the Gulf of Trieste over a three year period. The temperature, salinity and density data every meter depth are analyzed by means of a cosine least squares fitting procedure, using two waves of annual and semi-annual period respectively. The smooth depth dependence of the computed mean values, wave amplitudes and phases proves the efficiency of the method even in the case of few data not equally distributed in time. The time depth t, S, ρ histories through the year are examined. The mean velocity field as a function of depth shows a surface layer with a strong shear and a bottom layer flowing in opposite directions. (9 refs.)

110392 Waves and circulation driven by oscillatory winds in an idealised ocean basin. D.B.Haidvogel, P.B.Rhines (Woods Hole Oceanographic Instn., Woods Hole, MA, USA).
Geophys. & Astrophys. Fluid Dyn. (GB), vol.25, no.1-2, p.1-63 (1983).
Examines via direct numerical integration, the transient and rectified response of a flat-bottomed barotropic ocean to a spatially localised oscillatory wind-stress pattern. The experiments exemplify in many respects the dynamics which drive the deep motion in recent eddy-resolving ocean circulation studies [e.g. Holland and Rhines (1980)], and may be contrasted with the results of Pedlosky (1965) and Veronis (1966) for spatially broad, time-dependent forcing. By considering doubly re-entrant (periodic) and closed basin geometries, the structure and magnitude of the induced circulation is shown to depend most critically on the form of the mean quasi-geostrophic contours. (23 refs.)

110393 Linear stability and stable modes of geostrophic fronts. N.Paldor (Dept. of Isotope Res., Wiezmann Inst. of Sci., Rehovot, Israel).
Geophys. & Astrophys. Fluid Dyn. (GB), vol.24, no.4, p.299-326 (1983).
A Rayleigh integral is used to prove that an unbounded geostrophic front of uniform potential vorticity is stable with respect to small perturbations of arbitrary wavelength. The ageostrophic theory developed in this study yields a stable, near-inertial, long trapped mode. Recent oceanic observations of the increase in the energy of the inertial peak in the vicinity of fronts support the existence of this inertial trapped mode. In addition the theory yields a geostrophic mode which is expected to become unstable when the potential vorticity is not uniform. (26 refs.)

110394 Long-wave instability of an isolated front. P.D.Killworth (Dept. of Appl. Math. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
Geophys. & Astrophys. Fluid Dyn. (GB), vol.25, no.4, p.235-58 (1983).
The stability of an isolated one-layer reduced gravity front is examined. It is shown that the system is unstable to long-wave disturbances provided merely that a simple condition on the depth profile is satisfied far from the front. The instability does not require the extremum of potential vorticity needed by quasi-geostrophic theory. The instability releases mean kinetic and mean potential energy from the system, but lacking a second layer cannot truly be termed baroclinic instability. (8 refs.)

110395 Benthic fronts and global excess radon distribution. C.Lambert (Lab. Mixte, CNRS-CEA, Gif-sur-Yvette, France), P.Linden, D.Lowenthal, M.Stern.
Geophys. & Astrophys. Fluid Dyn. (GB), vol.25, no.4, p.309-15 (1983).
GEOSECS measurements of excess radon 222 as a function of depth above the sediments in the Atlantic and Pacific are sufficient to resolve the median profile in each ocean, but not the mean profile. The transport process maintaining the oceanic means is highly intermittent, and is not consistent with mixing by small scale turbulence generated at the ocean bottom. The authors suggest that transport of radon above the benthic boundary layer is driven by isopycnal motions associated with baroclinic instabilities on benthic fronts. A method for generating benthic fronts together with the subsequent instabilities is demonstratted in the laboratory. (7 refs.)

110396 Gravity wave propagation at randomly inhomogeneous nonstationary currents. M.A.Raevskii.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.6, p.639-45 (June 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
Closed equations have been obtained for the average field and average intensity of gravity waves propagating at the current whose velocity is a random function of coordinates and time. Scattering of gravity waves by large scale near-surface turbulence and random internal waves is considered on the basis of these equations. In particular, it is shown that the average energy of gravity waves increases monotonously at the scattering. Estimates have been obtained for the characteristic time of the average field damping, the angular spectrum variation and the energy of the waves. (3 refs.)

110397 A model for transformation of nonlinear baroclinic vortex in open ocean. Yu.A.Ivanov, V.I.Kuzin.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.6, p.646-52 (June 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
The transformation of a model vortex in a constant-depth baroclinic ocean is studied. Initially, a baroclinic vortex is specified, then it is modified as a solution of a differential equation that is an equation of conservation of a planetary vortex to a geostrophic approximation. The problem is solved numerically by the finite element method. Comparison of the results is made, when nonlinearity is taken into account and when it is not. (3 refs.)

110398 On the character of the variability of the semi-diurnal velocity oscillations in the ocean. K.I.Chigrakov.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.7, p.716-23 (July 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
The temporal variability of the oceanic semi-diurnal velocity oscillations is considered. The algorithms of the comparatively narrow-band filter for extraction of these oscillations from vector time series are presented. Several examples of the strong difference of the semi-diurnal oscillations observed at close places and examples of the great variability of these oscillations during one or two periods are presented. (13 refs.)

110399 Thermal influence of submerged buoyant jet on sea ice cover. V.V.Bogorodskii, K.K.Sukhorukov.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.7, p.724-9 (July 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
Presents studies of free artificial thermal convection from a submerged axisymmetrical concentrated source. The thermal and kinematical structure of the rising jet is studied under conditions of a homogeneous and stably stratified environment with the ice cover on the surface. An analytical description

of mean temperature and vertical velocity fields is presented for the free jet in a homogeneous environment and the internal structure of turbulence near the axis is studied. The efficiency of the thermal influence of the free jet on the ice cover from below is discussed and formulae are suggested for the calculation of the heat flux in the melting zone with dependence on the power and depth of the source. (5 refs.)

110400 On calculation of vertical velocity in models of sea currents. A.S.Sarkisyan, Yu.L.Dyomin, D.I.Trukhchev.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.7, p.730-40 (July 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
Some methods for the calculation of the vertical velocity field in numerical models of sea currents are discussed. The results obtained with quasigeostrophic and nonlinear (primitive equation) models are compared. A few methods for the calculation of the vertical velocity field are used in both models. Some causes of errors arising in determining the vertical velocity are discussed. (12 refs.)

110401 On interactions of synoptic scale eddies in the open ocean. D.G.Seidov, I.G.Yushina.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.7, p.750-60 (July 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
The evolution of the barotropic mode for the motion of several idealized currents in the open ocean is studied using a numerical model. Interactions between the individual eddies, between eddies and jets, and instability of jets produced by turbulent fluctuations are simulated. It is shown that the joint effect of nonlinear interaction and differential rotation leads to complicated dynamics with some sinergism in the field of synoptic scale currents. (8 refs.)

110402 Comparative study of some heat balance parameters in the Bay of Bengal and the Arabian Sea. G.R.Lakshmana Rao, K.Sivanagi Reddy (Dept. of Meteorology & Oceanography, Andhra Univ., Waltair, India).
Indian J. Mar. Sci., vol.12, no.1, p.43-4 (March 1983). [received: Sept. 1983]
Annual variations of net radiation, total energy transfer, surplus energy and sea surface temperature of 2 stations (17°N, 61°E and 17°N, 69°E) in the Arabian Sea and 1 station (17°N, 87°E) in the Bay of Bengal are compared. Net radiation maximum is observed in April and minimum in December at all stations. At the station in the Bay of Bengal the total energy flux from the sea surface is more during winter than during SW monsoon period, whereas in the Arabian Sea stations it is reverse. During winter the Bay of Bengal station shows more energy deficit than the other 2 stations. The sea surface temperature follows the trend of the surplus energy, lagging behind by nearly a month. (6 refs.)

110403 Mesoscale oceanographic features associated with the central Bering Sea ice edge: February-March 1981. R.D.Muench (Sci. Applications Inc., Bellevue, WA, USA).
J. Geophys. Res. (USA), vol.88, no.C5, p.2715-22 (30 March 1983). [received: Sept. 1983]
Midwinter 1981 observations from the central Bering Sea shelf showed a hydrographic structure which was two layered in temperature, salinity, and density. This structure was confined to a 100-km-wide band which coincided approximately with the ice edge. The colder, lower-salinity upper layer was continuous in its *T-S* properties with homogeneous water to the north beneath the ice. The warmer, more saline lower layer was similarly continuous with water to the south near the shelf break. A northwestward baroclinic flow of the surface relative to 75 dbar was associated with the layered structure. The layered structure and associated flow appear to be regular winter features associated with the ice edge in this region. Input of low-salinity water from melting of ice along the edge is adequate to maintain the layered structure, and its associated baroclinic circulation, against the effects of tidal and wind mixing. (21 refs.)

110404 Effects of a shelf polynya on flow and water properties in the northern Bering Sea. J.D.Schumacher (Pacific Marine Environmental Lab./NOAA, Seattle, WA, USA), K.Aagaard, C.H.Pease, R.B.Tripp.
J. Geophys. Res. (USA), vol.88, no.C5, p.2723-32 (30 March 1983). [received: Sept. 1983]
Presents long-term ($\sim$230-day) measurements from three moorings in the vicinity of Saint Lawrence Island on the northern Bering Sea shelf. One mooring was deployed near the polynya which often exists south of the island. These data confirm the existence of strong ($\sim$0.15 m s^{-1}) flow toward Bering Strait northwest of the island (in Anadyr Strait) and suggest that regional circulation results in a moderate ($\sim$0.035 m s^{-1}) mean flow eastward along the southern coast of Saint Lawrence Island. Coherent variations in the regional circulation and variations in the geostrophic wind account for much of the low-frequency current fluctuation south of Saint Lawrence Island. However, there were 11 events when offshore (northerly) winds coincided with the temperature following the freezing point, increasing salinity, and reversal of the current. This suggests that ice formation and the ensuing brine rejection affect flow in the vicinity of the polynya. (25 refs.)

110405 Multiyear sea ice variability in the eastern Bering Sea: an update. H.J.Niebauer (Inst. of Marine Sci., Univ. of Alaska, Fairbanks, AL, USA).
J. Geophys. Res. (USA), vol.88, no.C5, p.2733-42 (30 March 1983). [received: Sept. 1983]
Time series of sea surface temperature (SST), percent ice cover degree day, and surface wind anomalies are updated from Niebauer [1980] for the period 1974-1982 from the eastern Bering Sea. These data are used to provide further documentation of the recent short-term ($\sim$1977-present) climatic warming trend in the region of the eastern Bering Sea. The data analysis indicates that the warming trend is statistically significant and that it ended in 1979. Details of the anomalies in SST, ice and surface, and 700-mbar winds are updated for the individual winters of 1979-82, are compared and contrasted to the recent multilayer warming trend and are discussed in relation to longer-term studies of air-ice-sea interactions in this region. (23 refs.)

110406 Nimbus 7 SMMR observations of the Bering Sea ice cover during March 1979. D.J.Cavalieri (Goddard Lab. for Atmospheric Sci., NASA Goddard Space Flight Center, Greenbelt, MD, USA), S.Martin, P.Gloersen.
J. Geophys. Res. (USA), vol.88, no.C5, p.2743-54 (30 March 1983). [received: Sept. 1983]
A method of deriving sea ice concentrations from the 0.81-cm wavelength radiances of the Nimbus 7 scanning multichannel microwave radiometer (SMMR) is described and used in a comparative study of the Bering Sea ice cover during March 1979. Case studies during 2 days in March demonstrate the utility of the SMMR for studying marginal ice zone processes. The first day provides an example of ice divergent conditions with winds from the northeast advecting the ice southwest toward the ice edge. Comparison of the SMMR-derived ice concentration maps with surface, aircraft, and Tiros-derived ice charts shows that the microwave data give the ice edge position to within 30 km, corresponding to the highest spatial resolution of SMMR. (17 refs.)

110407 Oceanographic conditions in the marginal ice zone north of Svalbard in early fall 1979 with an emphasis on mesoscale processes. O.M.Johannessen, J.A.Johannessen (Geophys. Inst., Univ. of Bergen, Bergen, Norway), J.Morison, B.A.Farrelly, E.A.S.Svendsen.
J. Geophys. Res. (USA), vol.88, no.C5, p.2755-69 (30 March 1983). [received: Sept. 1983]
During September-October 1979 the Norwegian Remote Sensing Experiment was carried out in the marginal ice zone north of Svalbard. Convergence of the ice cover is correlated with along-ice edge winds with the ice to the right, while divergence occurs during off-ice winds or calm conditions. A wind-driven ice edge jet, is observed. Wind-driven upwelling of the pycnocline of up to 7 m was present along the ice edge during a 10- to 15-m/s easterly wind event. The upwelling is due to Ekman divergence at the ice edge, caused by higher wind stress over ice than over open water. The ice edge meanders with a scale of 20-40 km and sheds eddies with a scale of 5 to 15 km into the open water. (43 refs.)

110408 An ice-water vortex at the edge of the East Greenland current. P.Wadhams, V.A.Squire (Scott Polar Res. Inst., Univ. of Cambridge, Cambridge, England).
J. Geophys. Res. (USA), vol.88, no.C5, p.2770-80 (30 March 1983). [received: Sept. 1983]
During the Ymer-80 cruise in August 1980 an ice feature of 60-km diameter was observed having the shape of a breaking wave. It lay at the edge of the East Greenland drift ice in Fram Strait with its center at 79°15′N, 00°38′E, and the wave was breaking upstream relative to the East Greenland Current. Two conductivity, temperature, and depth sections across the feature in N-S and E-W directions revealed warm (up to 4.3°C) water some 60 km inside the polar front, in lenses centered at 40-m depth but with an effect to beyond 600 m. The temperature anomalies were accompanied by salinity anomalies so that there was little net effect on the density profile. The form of the sections, together with the ice distribution (observed by vertical photography from a helicopter) and surface motion (observed by tracking four radar transponders) all suggest that the feature is a vortex produced by an instability in the polar front. (12 refs.)

110409 Norwegian remote sensing experiment: evaluation of the Nimbus 7 scanning multichannel microwave radiometer for Sea Ice research. E.Svendsen (Geophys. Inst., Univ. of Bergen, Bergen, Norway), K.Kloster, B.Farrelly, O.M.Johannessen, J.A.Johannessen, W.J.Campbell, P.Gloersen, D.Cavalieri, C.Matzler.
J. Geophys. Res. (USA), vol.88, no.C5, p.2781-91 (30 March 1983). [received: Sept. 1983]
An algorithm has been developed for estimating total and multilayer sea ice concentration from passive microwave and surface air temperature measurements. The algorithm was made for use with Nimbus 7 scanning multichannel microwave radiometer (SMMR) data. It is based on radiation physics and may thus easily be modified to suit other passive microwave instruments. A comparison between Nimbus 7 SMMR and aircraft microwave measurements indicates that estimates of total ice concentration are accurate to ±3% and those of multilayer ice concentration to ±10%. These accuracies are not valid during the melt season when the snow on the ice is wet. (12 refs.)

110410 On the seasonal sea ice cover of the Sea of Okhotsk. C.L.Parkinson (Goddard Lab. for Atmospheric Sci., NASA/Goddard Space Flight Center, Greenbelt, MD, USA).
J. Geophys. Res. (USA), vol.88, no.C5, p.2793-802 (30 March 1983). [received: Sept. 1983]
Free of ice 4 months of the year, the Sea of Okhotsk begins to freeze over in a few coastal locations in November, attains its maximum ice coverage usually in mid March, and by June retains ice in only a few coastal regions. This sequence is well recorded by satellite imagery from the Electrically Scanning Microwave Radiometer (ESMR) on board Nimbus 5. Four years of ESMR data reveal significant interannual variations in the maximum ice cover and in the smoothness of the growth and retreat periods. The years 1973-1976 were studied. The general features of the cycle of sea ice distribution are compared with basic oceanographic factors. (21 refs.)

110411 The movement and decay of ice edge bands in the winter Bering Sea. S.Martin, P.Kauffman (School of Oceanography, Univ. of Washington, Seattle, WA, USA), C.Parkinson.
J. Geophys. Res. (USA), vol.88, no.C5, p.2803-12 (30 March 1983). [received: Sept. 1983]
During periods of off-ice winds, the winter Bering Sea ice edge consists of ice bands that measure 1-10 km in length, 0.1-1 km in width, and are oriented at approximately right angles to the wind. The bands are composed of small floes 10-20 m in diameter and 1-5 m in thickness. In March 1981 working from the NOAA ship Surveyor, the authors mounted two radar transponders 4 km apart on ice floes within such a band and then tracked them for 46 h over an 80 km distance as the band moved into warmer water and melted. Comparison of the band position with that of a satellite-tracked ARGOS station deployed in the ice interior shows that the band moved 30% faster than the interior ice. Analysis of the observations strongly suggest that the cause of the speed increase is the wind-wave radiation stress on the upwind side of the band. (9 refs.)

110412 A mechanism for the formation of ice edge bands. P.Wadhams (Scott Polar Res. Inst., Univ. of Cambridge, Cambridge, England).
J. Geophys. Res. (USA), vol.88, no.C5, p.2813-18 (30 March 1983). [received: Sept. 1983]
A mechanism is proposed for the formation of multiple bands at an ice edge that is subjected to an off-ice wind. The wind moves the outermost floes seaward faster than the interior ice, dilating the marginal ice zone and opening up random polynyas. In the largest of the polynyas, the off-ice wind generates a significant fetch-limited wave spectrum, which produces a wave radiation pressure on floes at the downwind end of the polynya, increasing their velocity. They are herded against their downwind neighbors, creating a band of high ice concentration. The band is stabilized by an internal compacting stress due to the exponential decay of the wind-wave spectrum across the band and to a slower decay of swell incident from seaward. The band's growth terminates when it encounters a second downwind polynya of sufficiently large size. (23 refs.)

110413 On some possible interactions between internal waves and sea ice in the marginal ice zone. R.D.Muench (Sci. Applications Inc., Bellevue, WA, USA), P.H.LeBlond, L.E.Hachmeister.
J. Geophys. Res. (USA), vol.88, no.C5, p.2819-26 (30 March 1983). [received: Sept. 1983]
The ice edges of the world ocean are generally the site, at times when winds are blowing off the ice, of regularly spaced surface bands of ice floes. These bands have size scales of the order of 1-10 km, and their long axes are oriented approximately normal to the wind direction. Available oceanic temperature and salinity data from the Bering and Greenland Sea ice edge regions suggest that these ice bands are commonly underlain by a two-layered density structure which is maintained by net melting along the ice edges.

Linear internal wave theory is applied to these data to compute first-mode interfacial wave phase speeds. A simple analytical model is developed that demonstrates the feasibility of generation of such interfacial internal waves by the stress discontinuity due to off-ice winds blowing over either a stationary or a moving ice edge. Ice band phenomena are discussed. (20 refs.)

110414 Turbulent heat and momentum transfer in the oceanic boundary layer under melting pack ice. M.G.McPhee (Naval Postgraduate School, Monterey, CA, USA).
J. Geophys. Res. (USA), vol.88, no.C5, p.2827-35 (30 March 1983). [received: Sept. 1983]
A theory for momentum flux in the planetary boundary layer (PBL) stabilized by continuous surface buoyancy is extended to include turbulent flux of an arbitrary scalar contaminant and then used to estimate how wind-driven sea ice melts as it encounters temperatures in the oceanic boundary layer that are above the melting point. Given wind stress and temperature difference $\Delta\theta$ across the oceanic PBL, the theory predicts melt rate and ice drift velocity. Results indicate that the effect of buoyancy on PBL turbulence is significant even with small values of $\Delta\theta$ (<0.5K). Curves of melt rate and ice speed as functions of u_*, the interfacial friction velocity, show that melting is strongly dependent on stress at the interface and that the effective drag on the ice undersurface is significantly reduced at oceanic temperatures commonly observed in the marginal ice zone. (14 refs.)

110415 Sea ice melting in the marginal ice zone. E.G.Josberger (US Geological Survey, Univ. of Puget Sound, Tacoma, WA, USA).
J. Geophys. Res. (USA), vol.88, no.C5, p.2841-4 (30 March 1983). [received: Sept. 1983]
The heat and salt flux boundary conditions together with the freezing curve relationship are a necessary component of any ice-sea water thermodynamic model. A neutral two-layer oceanic planetary boundary layer model that incorporates these boundary conditions gives the following results: the interfacial salinity is within 10% of the far-field salinity for conditions commonly encountered in the MIZ and depends only on the turbulent Lewis number and the far-field temperature and salinity. The predicted melt rates agree with the limited field observations, of the order of 1 m day^{-1}. The Obukov lengths, determined from the predicted interface conditions and melt rates, are generally much greater than the Ekman layer thicknesses; hence, the surface buoyancy flux has little effect on the turbulence in the planetary boundary layer. (11 refs.)

110416 Wind drag coefficient over first-year sea ice in the Bering Sea. S.A.Macklin (Pacific Marine Environmental Lab./NOAA, Seattle, WA, USA).
J. Geophys. Res. (USA), vol.88, no.C5, p.2845-52 (30 March 1983). [received: Sept. 1983]
Profiles of relative wind speed and temperature were collected from four levels over rough sea ice in the marginal ice zone of the Bering Sea and used to compute surface wind drag coefficients. Based upon 138 profiles for near-constant ice conditions, northeast winds of 3-15 m s^{-1}, and near-neutral stability, the mean, near-neutral, 10-m drag coefficient was 0.00309 ± 0.00049. This is among the largest drag coefficients measured for neutral atmopheric conditions over sea ice. Sixty-five percent of the variance of this estimate is explained by orientation of the ice floe to the wind; an additional 5% of the variance is explained by wind-speed dependence. (21 refs.)

110417 Drag measurements for first-year sea ice over a shallow sea. C.H.Pease, S.A.Salo, J.E.Overland (Pacific Marine Environmental Lab., NOAA, Seattle, WA, USA).
J. Geophys. Res. (USA), vol.88, no.C5, p.2853-62 (30 March 1983). [received: Sept. 1983]
For a free-drift case a method is developed for simultaneously determining air (C_a) and water (C_w) drag coefficients by solving the vertically integrated stress balance equation for sea ice. The method allows the algebraic determination of C_a and C_w from measurements of relative wind and relative current at single reference levels, from estimates of the densities of all three fluids and ice thickness, and from estimates of the accelerations caused by the nonsurface stress terms derived from position measurements. The method treats the ice as a natural drag plate and therefore includes contributions from both skin and form drag. An experiment was conducted on a single floe in the eastern Bering Sea over the continental shelf during March 1981. The site was about 80 km from the ice edge and was occupied for approximately 3 days following the passage of a storm which had broken the pack into 10-20 m diameter floes. Both profile and slab inversion estimates of drag were made. (23 refs.)

110418 A coupled ice-ocean model of upwelling in the marginal ice zone. L.P.Roed (Inst. of Geophys., Univ. of Oslo, Oslo, Norway), J.J.O'Brien.
J. Geophys. Res. (USA), vol.88, no.C5, p.2863-72 (30 March 1983). [received: Sept. 1983]
A dynamical coupled ice-ocean numerical model for the marginal ice zone (MIZ) is suggested and used to study upwelling dynamics in the MIZ. The nonlinear sea ice model has a variable ice concentration and includes internal ice stress. The model is forced by stresses on the air/ocean and air/ice surfaces. The main coupling between the ice and the ocean is in the form of an interfacial stress on the ice/ocean interface. The ocean model is a linear reduced gravity model. The wind stress exerted by the atmosphere on the ocean is proportional to the fraction of open water, while the interfacial stress ice/ocean is proportional to the concentration of ice. A new mechanism for ice edge upwelling is suggested based on a geostrophic equilibrium for the sea ice medium. (33 refs.)

110419 Numerical simulation of the Weddell Sea pack ice. W.D.Hibler,III, S.F.Ackley (US Army Cold Regions Res. & Engng. Lab., Hanover, NH, USA).
J. Geophys. Res. (USA), vol.88, no.C5, p.2873-87 (30 March 1983). [received: Sept. 1983]
To investigate the role of ice dynamics on the seasonal cycle of Antarctic sea ice, a series of 2-year simulations of the Weddell sea pack ice are carried out. The simulations employ the dynamic thermodynamic model developed by Hibler (1979) and use 1-day time step on an 18×15 grid with a resolution of 222 km. Daily atmospheric data from 1979 are used to drive the simulations. With atmospheric temperature fields modified to reflect buoy observations, the simulations yield a seasonal cycle of ice with maximum and minimum extents close to that observed. Except for portions of the western Weddell, the advance of the ice is found to be primarily thermodynamic in nature, while the rapid decay depends critically on the presence of both leads and lateral ice advection. The average fraction of open water is substantial even in winter, and varies from a minimum of 10% in September to a maximum of 35% in March. (29 refs.)

110420 An investigation of a polynya in the Canadian Archipelago. I. Introduction and oceanography. D.R.Topham, R.G.Perkin (Inst. of Ocean Sci., Sidney, British Columbia, Canada), S.D.Smith, R.J.Anderson, G.Den Hartog.
J. Geophys. Res. (USA), vol.88, no.C5, p.2888-99 (30 March 1983). [received: Sept. 1983]
In certain parts of the Canadian Archipelago, small localized areas of water remain ice free throughout the winter, despite the extreme temperature differences between the atmosphere and the ocean surface. One such area, close to the Dundas Island, has been studied in detail, both from the point of view of the atmospheric/oceanic heat exchange over the open water and its local geographic and oceanographic context. This paper describes the oceanography of the area and local weather and tidal flow conditions. A significant feature of the oceanographic records is a strong modulation of near-surface ocean temperature at tidal frequencies involving temperature differences as great as 0.2°C within a single tidal cycle. For the most part, the surface waters are 0.1° to 0.2°C above freezing. The presence of this relatively warm surface water is thought to be due to upward mixing occasioned by fast tidal flows across the shallow sill conncting Dundas and Devon islands. (20 refs.)

110421 An investigation of a polynya in the Canadian Archipelago. II. Structure of turbulence and sensible heat flux. S.D.Smith, R.J.Anderson (Bedford Inst. of Oceanography, Dartmouth, Nova Scotia, Canada), G.Den Hartog, D.R.Topham, R.G.Perkin.
J. Geophys. Res. (USA), vol.88, no.C5, p.2900-10 (30 March 1983). [received: Sept. 1983]
For pt.I see ibid., vol.88, no.C5, p.2888-99 (1983). The Dundas Island polynya is a natural laboratory for the study of atmospheric turbulence and heat exchange between the Arctic Ocean and the atmosphere in extreme (20-34°C) sea-air temperature differences. Wind and temperature fluctuations were measured at a height of 4.4 m at the downwind edge, where turbulent heat flux was characteristic of the surface flux from the polynya. Profiles of wind, temperature, and temperature fluctuations were also measured. Temperature ramps associated with the passage of convective plumes give skewed temperature distributions. Formulas described turbulence structure in convective boundary layers in terms of 'similarity' theory are verified and compared with published results taken in less extreme temperature gradients. Heat flux can be estimated from either temperature variance or temperature spectra. (38 refs.)

110422 An investigation of a polynya in the Canadian Archipelago. III. Surface heat flux. G.Den Hartog (Atmospheric Environment Service, Downsview, Ontario, Canada), S.D.Smith, R.J.Anderson, D.R.Topham, R.G.Perkin.
J. Geophys. Res. (USA), vol.88, no.C5, p.2911-16 (30 March 1983). [received: Sept. 1983]
For pt.II see ibid. vol.88, no.C5, p.2900-10 (1983). The heat loss from the Dundas Island polynya is calculated for a 3 week period during March 1980. Bulk and free convection formulae based on sonic anemometer-thermometer measurements are used to calculate sensible and latent heat fluxes. These terms, along with simple models to calculate the albedo and the long-wave radiation exchanges, yield a surface heat budget for the polynya. The sensible heat flux for the period March 12, 1980, to April 1, 1980, averaged 204 W/m^2 and the mean total heat loss from the polynya was 329 W/m^2. (16 refs.)

110423 A model of grease ice growth in small leads. J.Bauer, S.Martin (School of Oceanography, Univ. of Washington, Seattle, WA, USA).
J. Geophys. Res. (USA), vol.88, no.C5, p.2917-25 (30 March 1983). [received: Sept. 1983]
When a strong, cold wind blows over open polar leads, ice grows in the form of small crystals which are herded downwind by both wind waves and a wind-driven surface current to pile up at the downwind edge of the lead. As this process continues, the piled-up ice, called 'grease ice', advances upwind until the entire lead is ice covered. In a numerical model of ice growth in a horizontally one-dimensional lead with a wind blowing along its length, the wave field and surface current, which are functions of wind speed and fetch, are used to calculate the ice pileup depth and the ice cover advance rate. (38 refs.)

110424 Initial model results for Arctic mixed layer circulation under a refreezing lead. T.L.Kozo (Polar Sci. Center, Univ. of Washington, Seattle, WA, USA).
J. Geophys. Res. (USA), vol.88, no.C5, p.2926-34 (30 March 1983). [received: Sept. 1983]
At the temperatures in the Arctic Ocean mixed layer during lead-induced surface water cooling, convection is primarily salinity controlled owing to continuous brine expulsion from newly forming ice. A nonlinear, time-dependent, convective model has been developed that simulates existing field data obtained on the circulation characteristics under and near a refreezing lead. The model uses typical Arctic Ocean ambient conditions as initial input and allows for imposition of varying geostrophic currents. The zero geostrophic current (free convective case) model output for typical lead surface salt input resulted in maximum horizontal current velocities of 0.05 m s^{-1} eddy viscosities on the order of 0.01 $m^2\ s^{-1}$, average salt fluxed beneath the lead of 3.3×10^{-5} kg $m^{-2}\ s^{-1}$, and a subsequent increase in the depth of the mixed layer. (29 refs.)

110425 Melting characteristics of horizontal ice surfaces in cold saline water. B.Gebhart, B.Sammakia (Dept. of Mech. Engng. & Appl. Mech., Univ. of Pennsylvania, Philadelphia, PA, USA), T.Audunson.
J. Geophys. Res. (USA), vol.88, no.C5, p.2935-42 (30 March 1983). [received: Sept. 1983]
The results of a laboratory experimental investigation of the buoyancy driven flow adjacent to and below a horizontal ice surface melting in cold water at near oceanic salinity are presented. This melting configuration is characteristic of circumstances encountered by sea ice. Several ambient water temperatures t_∞ are investigated, from $t_\infty = -1.75$°C to $t_\infty = 3$°C. Time exposure photographs of the flow field reveal that distinctively different flow regimes occur, across even that narrow range of ambient temperature. At all temperature levels, the flow immediately below the sea surface is found to be horizontally radially inward toward the center of the ice. Also, another outward moving horizontal layer appeared, parallel to and below the inward moving layer. The downward extent of penetration of this layer motion was studied. (19 refs.)

110426 Measurements of salinity and volume and brine excluded from growing sea ice. M.Wakatsuchi, N.Ono (Inst. of Low Temperatures Sci., Hokkaido Univ., Sapporo, Japan).
J. Geophys. Res. (USA), vol.88, no.C5, p.2943-81 (30 March 1983). [received: Sept. 1983]
The volume of brine excluded from growing sea ice and its salinity were measured using a brine sampler. The measurements were made, on both laboratory and field, under various growth conditions of the sea ice. The salinity of the brine becomes higher, and the volume flux decreases as the sea ice growth rate decreases. Consequently, the salt flux of the brine decreases

with decreasing growth rate. In the case of sea ice growth at a constant rate, as the sea ice becomes thicker, the salinity of the brine excluded increases while its volume flux decreases. However, the salt flux is nearly independent of the ice thickness increase, at least up to a thickness of 15 cm. (11 refs.)

110427 Numerical study of the water movement driven by brine rejection from nearshore arctic ice. Z.Kowalik, J.B.Matthews (Geophys. Inst., Univ. of Alaska, Fairbanks, AL, USA).
J. Geophys. Res. (USA), vol.88, no.C5, p.2953-8 (30 March 1983). [received: Sept. 1983]
A numerical model of brine-induced circulation is used to study circulation in the lagoons and shelf waters of the Beaufort Sea. The model solves the equations of motion, continuity, and salt transport. The salt flux is set as a function of the salinity difference between growing sea ice and seawater and the rate of ice growth. Several experimental runs show that under-ice haline circulation is controlled by salt flux and bottom configuration. An idealized model of a shallow arctic lagoon gives currents of 1 cm s^{-1} for brine-induced circulation under landfast ice. This agrees very well with observations. (21 refs.)

110428 New measurements of sulfate and chlorinity in natural sea ice. W.S.Reeburgh, M.Springer-Young (Inst. of Marine Sci., Univ. of Alaska, Fairbanks, AL, USA).
J. Geophys. Res. (USA), vol.88, no.C5, p.2959-66 (30 March 1983). [received: Sept. 1983]
Precise determinations of sulfate and chlorinity were made on SIPRE core samples of natural sea ice. One ice was a multiyear ice that had remained attached to T-3 (Fletcher's Ice Island) for over 20 years and the other was a shore-fast annual ice collected near Barrow, Alaska. The results show sulfate: chlorinity ratios different from the seawater ratio. A mixing model shows that on warming and aging, sulfate and chlorinity are lost in a constant ratio, indicating conservative behavior. Fractionation in sea ice appears to be determined in the freezing process and further enrichment does not take place with aging. The effects of sulfate fractionation in sea ice are too small and the residence times of both sea ice and Arctic Ocean surface water are too short to permit detectable modification of seawater composition by freezing. (53 refs.)

110429 Edge waves as a cause of ice rideup onshore. E.Mollo-Christensen (Dept. of Meteorology & Phys. Oceanography, MIT, Cambridge, MA, USA).
J. Geophys. Res. (USA), vol.88, no.C5, p.2967-70 (30 March 1983). [received: Sept. 1983]
Edge waves on ice-covered water, generated elsewhere by wind, current, or wave impingement at the ice edge, can reach large amplitudes where bottom slope and current combine to give low group velocity. The amplitude of water velocity normal to shore can become large, and the resulting acceleration of the ice cover onto shore may be sufficient to cause ice rideup. Edge waves on an ice-covered ocean with a mean current are analyzed to a linear approximation, and estimates are given of velocities and amplitudes. (6 refs.)

110430 Interactions between waves and mean drift in an ice pack. E.Mollo-Christensen (Dept. of Meteorology & Phys. Oceanography, MIT, Cambridge, MA, USA).
J. Geophys. Res. (USA), vol.88, no.C5, p.2971-2 (30 March 1983). [received: Sept. 1983]
In a drifting ice pack, the mean drag depends upon the amplitude of oscillations present, and it reaches a maximum when the amplitude of oscillations along the direction of mean drift equals the drift velocity. The damping of waves entering a pack increases with increasing drift velocity, so waves entering a drifting pack will vary in amplitude because of dissipation. The dispersion of surface gravity waves in an ice pack under compression shows that the group velocity of the waves decreases with increasing mean compressive stress, so there can also be dispersive mechanisms causing wave amplitude variations within the ice peak. The observations in the Norwegian Remote Sensing Experiment, namely that the drag in a drifting pack varied with distance from the pack edge, are in general concord with these results. (4 refs.)

110431 Azimuthal structure of a cyclonic Gulf Stream ring. R.P.Mied, G.J.Lindemann (Environmental Sci. Div., Naval Res. Lab., Washington, DC, USA), J.M.Bergin.
J. Geophys. Res. (USA), vol.88, no.C4, p.2530-46 (20 March 1983). [received: Sept. 1983]
During the period June 8-19, 1979, an intensive expendable bathythermograph survey of a Gulf Stream ring was made. After mapping the irregularly spaced data onto a regular grid, and azimuthally decomposing the temperature field at constant depth into Fourier constituents $e^{in\theta}$, the $n=2$ model was found to be the dominant one. The geostrophic stream function was calculated utilizing the hydrostatic equation and the measured temperature/salinity curves. (19 refs.)

110432 The temperature and salinity finestructure of the ocean under the Ross Ice Shelf. T.D.Foster (Univ. of California, Santa Cruz, CA, USA).
J. Geophys. Res. (USA), vol.88, no.C4, p.2556-64 (20 March 1983). [received: Sept. 1983]
A series of temperature and salinity profiles was made in the ocean under the Ross Ice Shelf at 82°22.5′S, 168°37.5′W where the ice was 420 and the underlying seawater 240 m thick. The water structure consisted of a fairly well-mixed, low salinity layer at the in situ freezing point of the ice-water interface about 30 m thick, a transition layer characterized by intrusions about 85 m thick, a strongly stratified layer with increasing temperature and salinity about 50 m thick, another transition layer characterized by intrusions about 45 m thick, and an isohaline bottom layer with a nearly abiabatic temperature gradient about 30 m thick. The temperature fluctuations in the two transition layers can be attributed mainly to intrusive activity even though internal wave activity was highest in these regions. (30 refs.)

110433 Phytoplankton and thermal structure in the upper ocean: consequences of nonuniformity in chlorophyll profile. M.R.Lewis, J.J.Cullen, T.Platt (Marine Ecology Lab., Bedford Inst. of Oceanography, Dartmouth, Nova Scotia, Canada).
J. Geophys. Res. (USA), vol.88, no.C4, p.2565-70 (20 March 1983). [received: Sept. 1983]
Nonuniformities in vertical chlorophyll (phytoplankton) distributions lead to nonuniformities in absorption and consequently to variations in local heating. Local heating rate tends to decrease monotonically with increasing depth, but certain vertical distributions of chlorophyll lead to a change of sign of the gradient. Data from an oligotrophic ocean station showed a subsurface maximum of chlorophyll intense enough to allow increased heating on the upper slope of the chlorophyll maximum, with a maximum gradient of 0.003°C d^{-1} m^{-1}. It is suggested that the importance of such subsurface heating for augmenting vertical mixing and influencing mixed layer deepening may be greatest in the optically clear, open ocean regions. (47 refs.)

110434 Island shadows in wave directional spectra. S.S.Pawka (Shore Processes Lab., Scripps Inst. of Oceanography, La Jolla, CA, USA).
J. Geophys. Res. (USA), vol.88, no.C4, p.2579-91 (20 March 1983). [received: Sept. 1983]
Shadows of individual islands are observed in directional spectra sampled with a high resolution linear array at Torrey Pines Beach, California. A detailed investigation of the spectra indicates that the Channel Islands restrict the wave energy density to certain narrow directional sensors. A deep spectral trough, associated with San Clemente Island, is a predominant feature in the well resolved spectra (wave frequencies ~0.06-0.15 Hz). Negligible values of energy density in the center of this directional 'gap' were consistently observed in the range 0.82-0.114 Hz. Measurable but low gap energy density values are seen in the high and low frequency regimes. Generation of high frequency waves ($f \geq 0.13$ Hz) by local winds generally smears the island windowing effects. (16 refs.)

110435 Bottom-water observations in the Vema fracture zone. S.L.Eittreim (US Geological Survey, Menlo Park, CA, USA).
J. Geophys. Res. (USA), vol.88, no.C4, p.2609-14 (20 March 1983). [received: Sept. 1983]
The Vema fracture zone trough, at 11°N between 41° and 45° W is open to the west at the 5000-m level but is silled at the 4650-m level on the east where it intersects the axis of the Mid-Atlantic Ridge. The trough is filled with Antarctic Bottom Water with a potential temperature of 1.32°C and salinity of 34.82 ppt. The bottom water is thermally well mixed in a nearly homogeneous layer about 700 m thick. The great thickness of this bottom layer may result from enhanced mixing induced by topographic construction at the west end of the fracture zone trough. The authors also studied the benthic thermocline, the currents and the turbidity of the deep ocean. (19 refs.)

110436 Coastal sea level response to frontal passages on the Louisiana-Texas shelf. Wen-Ssn Chuang, W.J.Wiseman,Jr. (Coastal Studies Inst., Louisiana State Univ., Baton Rouge, LA, USA).
J. Geophys. Res. (USA), vol.88, no.C4, p.2615-20 (20 March 1983). [received: Sept. 1983]
Sea level variations resulting from wind forcing along the Louisiana-Texas shelf are examined on 5-month winter records. Local weather patterns during the winter are dominated by cold-front passages. The associated surface wind field is well organized, predominantly in the cross-shell direction. Regional sea level response, however, shows considerable variability; it is mainly a response to alongshore wind at Galveston, but cross-shelf wind at Eugene Island. This spatially nonuniform response appears to be due to the different water depth over the inner shelf, which is shallower off Eugen Island and favors direct cross-shelf wind setup. A friction model is applied to each region. (24 refs.)

110437 SEASAT-derived ocean surface topography: comparison with coincident Kuroshio hydrographic data. H.M.Byrne, P.E.Pullen (NOAA, Pacific Marine Environmental Lab., Seattle, WA, USA).
J. Geophys. Res. (USA), vol.88, no.C4, p.2621-5 (20 March 1983). [received: Sept. 1983]
During the SEASAT repeat-orbit period, a CTD and deep XBT hydrographic experiment was conducted across the Kuroshio to obtain contemporaneous surface topography measurements for comparison with the altimeter-derived surface height measurements. The results showed that the altimeter could detect and measure the change in sea surface topography caused by movement of the Kuroshio and the cold rings that were found in the hydrographic data. The altimeter measured changes in the surface topography that matched those measured by the hydrographic sections. (12 refs.)

110438 Mean heat and momentum budgets during upwelling for the coastal waters off northwest Africa. J.Richman, A.Badan-Dangon (School of Oceanography, Oregon State Univ., Corvallis, OR, USA).
J. Geophys. Res. (USA), vol.88, no.C4, p.2626-32 (20 March 1983). [received: Sept. 1983]
Mean heat and momentum budgets for the upwelling region off northwest Africa during March and April 1974 are estimated at midshelf, 32 km from the coast, using current and temperature measurements at six depths in 73 m of water. In the heat budget, the mean cross-shelf circulation transports 1.14×10^{7} W m^{-1} offshore, while fluctuations in the cross-shelf circulation transport an additional 1.9×10^{6} W m^{-1} offshore. This offshore heat flux is compensated by the net radiative heat gain in the region and an alongshore heat flux due to the mean circulation. In the cross-shelf momentum budget, the alongshore flow is nearly geostrophic with the Coriolis force being approximately balanced by the steric sea level slope. For the alongshore momentum budget, the surface wind stress is balanced by the bottom stress, alongshore pressure gradient, and Coriolis force associated with the net onshore mass transport. (25 refs.)

110439 Some estimates of transport processes in Long Island Sound. D.Tolmazin (Dept. of Marine Sci., Univ. of Connecticut, Groton, CT, USA).
J. Geophys. Res. (USA), vol.88, no.C4, p.2633-41 (20 March 1983). [received: Sept. 1983]
A parametric description of lateral and vertical oscillatory transport in two segments of Long Island Sound is presented. The vertical eddy viscosity and diffusivity coefficients are estimated on the basis of a model for turbulent kinetic energy transfer. Characteristics of horizontal mixing are examined by means of dimensional analysis. The relative importance of the mechanisms controlling mass distribution in the estuary is evaluated by calculating longitudinal dispersion coefficients in a form introduced by Fisher (1972). It is shown that the mass transport in Long Island Sound is governed mainly by two processes: lateral turbulent disperion and net longitudinal transport caused by the density gradients. (42 refs.)

110440 Tidal phase of internal-wave generation. C.Sawyer (NOAA, ERL, Pacific Marine Environmental Lab., Seattle, WA, USA).
J. Geophys. Res. (USA), vol.88, no.C4, p.2642-8 (20 March 1983). [received: Sept. 1983]
The tidal phase at which ocean internal waves are generated is examined by using two sets of data. The first data set, consisting of 21 time series of internal-wave packets located with respect to the continental shelf edge on satellite images, clearly indicates generation near flood tide. In the second data set, observations of thermal oscillations shoreward of a sill can be modeled either as generated shortly after ebb tide on the seaward side of the sill or slightly before flood on the shoreward side. The absence in both sets of observations of evidence of internal waves over the sill or seaward of the sill points to flood generation at the sill as well as at the shelf. The shelf edge is found to be the most likely site of tidal generation of internal waves observed over the shelf. (15 refs.)

110441 Generation of internal waves in Massachusetts Bay. T.K.Chereskin (Dept. of Meteorology & Phys. Oceanography, MIT, Cambridge, MA, USA).

J. Geophys. Res. (USA), vol.88, no.C4, p.2649-61 (20 March 1983). [received: Sept. 1983]

Observations of stratified tidal flow over a submarine ridge indicate that the large amplitude and asymmetry of the topography are critical in determining the type of flow response. The observations consist of hydrographic, current meter, and echo-sounding data and are used as a basis for inferring the generation mechanism of previously observed trains of internal waves. The flow response on ebb and flood tide is categorized according to the Froude number classification of sill flows proposed by Farmer and Smith (1980*a*). The calculated Froude numbers, response length scale, and duration differ markedly between the two phases of the tide due to the symmetry of the bank. (12 refs.)

110442 On the stratification of turbulent mixed layers. L.Mahrt, J.-C.Andre (Atmospheric Sci. Dept., Oregon State Univ., Corvallis, OR, USA).

J. Geophys. Res. (USA), vol.88, no.C4, p.2662-6 (20 March 1983). [received: Sept. 1983]

The vertical distribution of density or temperature is studied in turbulent boundary layers stratified by either salt or temperature and driven in an annulus by a rotating screen. With rapidly growing boundary layers the buoyancy flux due to entrainment becomes sufficiently large that the boundary layer is no longer well mixed. Stratification in the boundary layer is largest near the entrainment interface, corresponding to extension of the density transition into the turbulent boundary layer. The stratification in the rest of the boundary layer is smaller and nearly independent of height. The mean boundary layer stratification and structure and integral properties of the density distribution are found to be strongly dependent on the ratio of the entrainment rate to the turbulent velocity scale. (15 refs.)

110443 Geochemical profiles in the central Arctic Ocean: their relation to freezing and shallow circulation. R.M.Moore, M.G.Lowings (Dept. of Oceanography, Dalhousie Univ., Halifax, Nova Scotia, Canada), F.C.Tan.

J. Geophys. Res. (USA), vol.88, no.C4, p.2667-74 (20 March 1983). [received: Sept. 1983]

Temperature, salinity, nutrient, tritium, and oxygen isotope data collected during the Lomonosov Ridge Experiment along a drift track between the Makarov and Fram Basins over the Lomonosov Ridge are presented. The relationship of these quantities to the processes that maintain the halocline, in particular to the production of more saline waters by addition of brines formed during the freezing of seawater, is described. The results support the idea that the wide continental shelves of the Arctic Ocean play an important role in maintaining the halocline. (17 refs.)

110444 A vertical section of eddy kinetic energy through the Gulf Stream system. P.L.Richardson (Woods Hole Oceanographic Instn., Woods Hole, MA, USA).

J. Geophys. Res. (USA), vol.88, no.C4, p.2705-9 (20 March 1983). [received: Sept. 1983]

Ocean current observations made by drifting buoys, SOFAR floats, and current meters are combined to produce the first section of eddy kinetic energy through the Gulf Stream and subtropical gyre along 55°W. Eddy kinetic energy peaks at 2000 $cm^2 s^{-2}$ in the surface Gulf Stream near 39°N and decreases latitudinally and vertically to a low of 0.5 $cm^2 s^{-2}$ in the abyssal gyre interior (4000 m, 28°N). Still further south, eddy energy increases slightly in the region of the North Equatorial Current. (20 refs.)

110445 Wave evolution over a gradual slope with turbulent friction. J.W.Miles (Inst. of Geophys. & Planetary Phys., Univ. of California, La Jolla, CA, USA).

J. Fluid Mech. (GB), vol.133, p.207-16 (Aug. 1983).

The evolution of a weakly nonlinear, weakly dispersive gravity wave in water of depth d over a bottom of gradual slope δ and Chezy friction coefficient C_f is studied. It is found that an initially sinusoidal wave evolves into a periodic sequence of solitary waves with relative amplitude $a/d=\alpha_1=15\delta/4C_f$ if $\alpha_1<\alpha_b$, where α_b is the relative amplitude above which breaking occurs. This prediction is supported by observations (Wells 1978) of the evolution of swell over mudflats. (16 refs.)

110446 Effects of rotation and shear on doubly diffusive instability. S.Worthem (Sea-Air Interaction Lab., NOAA, Miami, FL, USA), E.Mollo-Christensen, F.Ostapoff.

J. Fluid Mech. (GB), vol.133, p.297-319 (Aug. 1983).

A linear stability of a doubly diffusive system, with rotation and shear, shows that overstable oscillations can occur in stratifications typical of the equatorial ocean, that internal waves encountering an equatorial current can exchange energy with the current, and that the wave-induced fluxes of salt and heat can lead to a layer formation in the salinity, temperature and velocity fields. (39 refs.)

110447 A study of the variability of ocean currents in the northwestern Atlantic using satellite altimetry. A.R.Robinson (Centre for Earth & Planetary Phys., Harvard Univ., Cambridge, MA, USA), N.E.Huang, C.D.Leitao, C.G.Parra.

J. Phys. Oceanogr. (USA), vol.13, no.4, p.565-85 (April 1983).

Altimeter data obtained from GEOS-3 during the three-year period 1975-78 for a region of the western North Atlantic which includes a portion of the Gulf Stream system and part of the open ocean area of the subtropical gyre are analysed by a new technique which utilises all the points along the satellite tracks. The physical phenomenon studied are the time-variable but almost geostrophic currents, or mesoscale eddies, so that geoid errors contaminate the scientific signal minimally and the dynamical interpretation is direct. Results presented include the spatial distribution of geostrophic eddy kinetic energy and examples of a synoptic map of the eddy field (April 1977) and of a time series at a point. (48 refs.)

110448 An estimation of sea-level and surface-current anomalies during the 1972 El Nino and consequent thermal effects. A.E.Gill (Dept. of Appl. Math. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).

J. Phys. Oceanogr. (USA), vol.13, no.4, p.586-606 (April 1983).

First, it is shown that if the dynamics is simplified by assuming a one-mode, low-frequency (or long-wave) model, the whole field of anomalous motion in the tropical region can be deduced from the time series of sea-level anomaly at the eastern boundary. This is because the amplitudes of all the equatorial waves are proportional to sea level at this longitude, and the amplitudes at other longitudes can be deduced by integrating along characteristics using the method of Gill and Clarke (1974). The integration proceeds forward in time for the planetary waves and backward in time for the Kelvin wave. The calculation requires a knowledge of wind stress anomalies, although the wind effect only becomes significant after integration to large distances from the eastern boundary. The western boundary is irrelevant to the calculations. The technique is applied to estimate zonal surface current anomalies in the equatorial Pacific for the period 1971-73 spanning a major El Nino. The second part of the paper uses the reconstructed anomaly field of the first part to examine anomalies in the heat balance of the surface layer of the equatorial Pacific. (26 refs.)

110449 Low-frequency current regimes over the Bering Sea shelf. J.D.Schumacher (Environmental Res. Labs., NOAA, Seattle, WA, USA), T.H.Kinder.

J. Phys. Oceanogr. (USA), vol.13, no.4, p.607-23 (April 1983).

Using direct current measurements made during the period 1975-81, the general circulation over the southeastern Bering Sea is described. It is differentiated by regimes related to depth and forcing mechanisms. Three regimes are present, delineated by water depth (z): the coastal ($z\leq50$ m), the middle shelf ($50<z<100$ m), and the outer shelf ($z\geq100$ m). Statistically significant mean flow (~1 to 10 $cm\ s^{-1}$) exists over the outer shelf, generally directed toward the northwest, but with a cross-isobath component. Flow of similar magnitude occurs in the coastal regime, paralleling the 50 m isobath in a counterclockwise sense around the shelf. Mean flow in the middle shelf is insignificant. Kinetic energy at frequencies <0.5 cycle per day is greater over the outer shelf than in the other two regimes, suggesting that oceanic forcing is important there, but does not affect the remainder of the shelf. Kinetic energy in the band from 0.5 to 0.1 cpd follows a similar spatial pattern, reflecting the greater number of storms over the outer shelf. (39 refs.)

110450 The baroclinic stability of the Atlantic North Equatorial Current. T.Keffer (Dept. of Phys. Oceanography, Woods Hole Oceanographic Instn., Woods Hole, MA, USA).

J. Phys. Oceanogr. (USA), vol.13, no.4, p.624-31 (April 1983).

POLYMODE Array III, Cluster C, was a collection of four current meter moorings that were placed in the Atlantic North Equatorial Current for one year in May 1978. They were designed to look for indications of baroclinic instability such as downgradient eddy heat fluxes and upward phase propagation. However, Fu, Keffer and other investigators find that the eddy heat fluxes tended to be more across-gradient and sometimes even upgradient. They also find only slight indications of upward phase propagation. In this study, the linear stability model of Gill et al. is applied to determine the expected heat fluxes, and the modal shapes and scales due to linear amplification. It appears that the expected fluxes should be detectable. Modal shapes are similar to the observed shapes but the fastest growing mode is only about half the size of the observed correlation scale. (17 refs.)

110451 Fine and microstructure observations on a hydrographic section from the Azores to the Flemish Cap. D.T.Georgi (Exxon Production Res. Co., Houston, TX, USA), R.W.Schmitt.

J. Phys. Oceanogr. (USA), vol.13, no.4, p.632-47 (April 1983).

Continuous conductivity-temperature-depth-dissolved-oxygen (CTD) data are used to investigate the spatial distribution of fine and microstructure between the Azores and Flemish Cap. The CTD data are used to calculate a conductivity-microstructure Cox number. This indicator summarises microstructure variance from the 0.08-2 m vertical wavelength range. The CTD data are also used to calculate the finestructure-temperature Cox number. Finally, the fine and microstructure data are combined to calculate lateral flux and flux divergence for the waters east of the North Atlantic Current. The distribution of the conductivity Cox number indicates that vertical mixing is more intense above the base of the main thermocline (5°C isotherm) than below it, and that mixing is more prominent near the North Atlantic Current than farther east. Stations near the front indicate elevated conductivity Cox numbers associated with intrusive features. (34 refs.)

110452 Mid-latitude mesoscale temperature variability in six multiship XBT surveys. D.E.Harrison (Dept. of Meteorology & Phys. Oceanography, Cambridge, MIT, MA, USA), W.J.Emery, J.P.Dugan, Bo-Cheng Li.

J. Phys. Oceanogr. (USA), vol.13, no.4, p.648-62 (April 1983).

Discusses the spatial character of mesoscale temperature variability as observed in six midlatitude multiship expendable bathythermograph (XBT) surveys, two from the North Pacific and four from the North Atlantic. These surveys sample mid-ocean regions as well as regions adjacent to the western boundary currents of both subtropical gyres. Mesoscale characteristics exhibit substantial changes between surveys, between ship tracks within each survey and between different portions of individual ship tracks. These results suggest that a single XBT section across a region is unlikely to represent the range of variability within that region satisfactorily. Fluctuations below the mixed layer are strongly vertically correlated, but surface temperatures are not well correlated with those below the mixed layer. (21 refs.)

110453 Stability of free surface Ekman layers. G.F.Spooner (Ocean Dynamics Branch, Naval Res. Lab., Washington, DC, USA).

J. Phys. Oceanogr. (USA), vol.13, no.4, p.663-77 (April 1983).

The stability of free surface, laminar Ekman layers is examined for both the homogeneous and the two-layer case. The eigenvalues of the homogeneous case depend upon the wavenumbers α and γ and the Reynolds number Re. Those of the two-layer case depend upon α, γ, Re, the depth of the top layer, and the parameter $Fr^*=g\delta(\rho^*-\rho)/(U_s{}^2\rho)$, where g is the acceleration of gravity, δ is the Ekman scaling depth, ρ and ρ^* are the densities of the top and bottom layers, respectively, and U_s is the mean speed at the surface. The behaviour of the inflection point mode and the parallel mode of instability is examined as a function of the independent parameters in both cases. (16 refs.)

110454 A numerical study of the effects of coastline geometry on wind-induced upwelling in the Gulf of Lions. Bach-lien Hua (Museum Nat. d'Histoire Naturelle, Paris, France), F.Thomasset.

J. Phys. Oceanogr. (USA), vol.13, no.4, p.678-94 (April 1983).

An attempt is made to explain the fixed locations of coastal upwelling centres in the Gulf of Lions as a function of the coastline geometry alone. The semi-implicit numerical model, based on two-layer shallow water equations, uses a spatial discretisation with triangular finite elements. Vertical mixing is shown to play an important role in determining the final shape of the upwelling centres. It is conjectured that an observed upwelling filament results from the straining and stretching of a coastal upwelling centre by the observed anticyclonic circulation further offshore. (18 refs.)

110455 Hydraulic control and flow separation in a multi-layered fluid with applications to the Vema Channel. N.G.Hogg (Woods Hole Oceanographic Instn., Woods Hole, MA, USA).

J. Phys. Oceanogr. (USA), vol.13, no.4, p.695-708 (April 1983).

Observations from a recent field experiment in the Vema Channel are briefly described. These show a remarkable change in the configuration of isopycnal surfaces within the channel and the development of thick, nearly homogeneous regions near the bottom which are capped by sharp vertical gradients. Contrary to previous speculation that these 'bottom boundary layers' result from enhanced vertical mixing, a dynamical mechanism is explored. This involves the hydraulic adjustment of an inertial, semi-geostrophic flow to the channel geometry. First, an active two-layer flow in a rectangular geometry is studied to show that internal flow separation can occur when the flow is accelerated sufficiently by a narrowing channel. Almost always this separation accompanies hydraulic control: the slowest upstream moving Kelvin wave is stopped and upstream and downstream states are not symmetric with respect to the channel width. An active three-layer flow with a variable bottom profile is then presented as a more accurate model of the Vema Channel. (12 refs.)

110456 Lagrangian current measurements within the eastern margin of a warm-core Gulf Stream ring. J.J.Bisagni (US Naval Underwater Systems Centre, Newport, RI, USA).

J. Phys. Oceanogr. (USA), vol.13, no.4, p.709-15 (April 1983).

Two satellite-tracked buoys drogued at 10 m depth were deployed within shelf water, close to the shelf/slope front in late summer 1980. Position and sea-surface temperature data from the two buoys were combined with surface-water mass analysis based on high resolution infrared satellite imagery. Buoy trajectories and surface-water mass analysis suggest that both buoys traversed a region of shelf water while moving to the southwest at less than 25 cm s^{-1}. Stronger currents up to 54 cm s^{-1} from warm-core ring 80-A were encountered near 38°N latitude. These currents caused the buoys to move anticyclonically along the ring's eastern margin within a well defined shelf-water entrainment. Buoy sea-surface temperatures and positions showed good correlation with frontal boundaries based on satellite imagery. Volume transport of the ring entrainment was estimated to be 1.5×10^5 m^3 s^{-1} (4700 km^3 $year^{-1}$). (23 refs.)

110457 Topographic rectification of tidal currents. W.R.Young (Univ. of California, San Diego, CA, USA).

J. Phys. Oceanogr. (USA), vol.13, no.4, p.716-21 (April 1983).

The rectification of oscillatory tidal currents on the sloping sides of a low submarine bank is discussed using the moment method. In the present problem the moment method is applied to the barotropic potential vorticity equation linearised about an oscillatory, spatially uniform tidal velocity. To apply the method it is necessary to assume that the topography produces only a small change in depth. The method economically provides the most important qualitative properties (e.g., transport, location and width) of the time averaged current. It is shown that harmonic truncation correctly predicts the transport and location of the rectified current when the bank is low. However if the width of the bank is much less than a tidal excursion distance, harmonic truncation may give a very mistaken impression of the width of the rectified current. (12 refs.)

110458 Mass, heat, salt and nutrient fluxes in the South Pacific Ocean. C.Wunsch (Dept. of Appl. Maths. & Theoretical Phys., Univ. of Cambridge, Cambridge, England), D.Hu, B.Grant.

J. Phys. Oceanogr. (USA), vol.13, no.5, p.725-53 (May 1983).

An inverse method is applied to the Scorpio sections spanning the subtropical gyre of the South Pacific. In addition to constraints upon geostrophic fluxes of mass and salt, constraints are written for silica, oxygen and 'PO', and the Ekman fluxes and divergence are accounted for explicitly. Nutrient constraints contribute significantly to the system information with oxygen containing information independent of 'PO'. Attention is focused on zonally integrated quantities that are insensitive to differences in modeling assumptions. Overall interior flows are dominated by an equatorward flux of bottom water, a poleward return flow at mid-depths, equatorward flow of circumpolar intermediate water and a convergence of surface waters. The zonal average vertical velocity appears to be everywhere downward with the bottom water entraining fluid from above. The net meridional fluxes of silica, phosphate, oxygen and fresh water are indistinguishable from zero. (48 refs.)

110459 Development of a simple upper-ocean and sea-ice model. D.Pollard, M.L.Batteen, Young-June Han (Climatic Res. Inst., Oregon State Univ., Corvallis, OR, USA).

J. Phys. Oceanogr. (USA), vol.13, no.5, p.754-68 (May 1983).

Results are described for three simple numerical models of the upper ocean and sea ice with prescribed atmospheric forcing. The ability of each model version to simulate the observed sea surface temperature is assessed as a basis of comparison for future coupled experiments with atmospheric GCMs. The upper-ocean model versions range from a slab of fixed thickness to a variable-depth mixed layer above a variable exponential temperature gradient representing the seasonal thermocline. Sea-ice thickness is determined thermodynamically by local melting or accretion, and the effects of ice transport and leads are neglected. Each version is tested by integrating to equilibrium with horizontal advection neglected, using monthly climatological atmospheric data for a selected north-south section in the mid-Pacific Ocean and the results for different model versions are compared with each other and with available observations. (55 refs.)

110460 Self-advection of density perturbations on a sloping continental shelf. Ping-Tung Shaw, G.T.Csanady (Woods Hole Oceanographic Instn., Woods Hole, MA, USA).

J. Phys. Oceanogr. (USA), vol.13, no.5, p.769-82 (May 1983).

Bottom water movement on the continental shelf is modeled by the nonlinear interaction between long-shore bottom geostrophic flow and the density field. Bottom geostrophic velocity, subject to linear steady momentum equations with linear bottom friction, can be generated by along-isobath density variations over a sloping bottom. At the same time, the density field is slowly advected by the velocity field. Away from boundary layers, the interplay is governed by Burgers' equation, which shows the formation and self-propulsion of strong density gradients along an isobath. The problem is further investigated by solving the governing equations numerically. Under forcing by localized surface cooling, the flow in the mid-shelf region shows the characteristics of the solution of Burgers' equation. The theory sheds light on bottom water movements in the Adriatic Sea, over the Antarctic continental shelf, and in the Middle Atlantic Bight. It also describes the dispersion of river water and dense water outflow on the shelf. (29 refs.)

110461 Pressure fluctuations on the open-ocean floor off the Gulf of California: tides, earthquakes, tsunami. J.H.Filloux (Scripps Instn. of Oceanography, Univ. of California, San Diego, La Jolla, CA, USA).

J. Phys. Oceanogr. (USA), vol.13, no.5, p.783-96 (May 1983).

The paper supplements Filloux (1980) on sea-floor pressure observations conducted with a sensitive though not 'perfectly' stable transducer. A variety of examples are used to demonstrate that a wide range of research subjects in the fields of physical oceanography and submarine geophysics can be studied with measurements from Bourdon-tube pressure sensors combined with inherently linear and friction-free electrooptical feedback. Results from a three-month experiment in the Pacific Ocean, off the entrance of the Gulf of California, are presented. The tidal behavior at the experimental site is representative of the open ocean conditions that control the co-oscillation of the Gulf of California. At supra-tidal frequencies the pressure signature of local surface waves is significant. The occurrence during the experiment of the Petatlan earthquake (14 March 1979) provided the opportunity to record a tsunami traveling in deep water. The seismic disturbance from the earthquake was also recorded. At the highest frequencies the author examines instrumental noise, the deep pressure signature of surface waves and swells, and the possibility of monitoring microseism activity. (41 refs.)

110462 Determination of the pressure along a closed hydrographic section. I. The ideal case. P.Welander (School of Oceanography, Univ. of Washington, Seattle, WA, USA).

J. Phys. Oceanogr. (USA), vol.13, no.5, p.797-803 (May 1983).

The pressure along a closed hydrographic section can be correctly calculated from density data, in the ideal case of perfectly steady, geostrophic, density-conserving flow; and from dense, error-free data, excluding certain degenerate cases. A corresponding practical method, aimed at an estimate of the pressure from real hydrographic data, is designed. The calculation is made by a minimization of the volume enclosed by the surface $B=F(\rho, P)$ in the P-ρ-B space, where ρ is the density, $P=f\rho_z$ the potential vorticity, and $B=B^*+p_0$ the Bernoulli function, split in a known baroclinic part B^* and an unknown pressure p_0, defined at a chosen depth z_0. The minimization is made under free variation of $p_0(s)$, as a function of the tangential coordinate s; the minimum volume is zero under the ideal conditions. Practically, one minimizes a moment rather than the volume, with identical results in the ideal case. (5 refs.)

110463 Doppler sonar observations of internal waves: wave-field structure. R.Pinkel (Scripps Instn. of Oceanography, Univ. of California, San Diego, La Jolla, CA, USA).

J. Phys. Oceanogr. (USA), vol.13, no.5, p.804-15 (May 1983).

During May of 1980 an internal-wave-measurement experiment was conducted from the Research Platform FLIP off the California coast. The author discusses an 18-day sequence of velocity profiles obtained during the experiment using a pair of Doppler sonars. The sonars profile to a depth of 700 m, with approximately 20 m depth resolution. Plots of the velocity and shear field indicate the dominance of near-inertial motions. Much of the near-inertial variance can be ascribed to a few identifiable wave groups. The progress of these groups can be tracked for many days. The shear at the base of the mixed layer is often dominated by near-inertial motions propagating vertically through the thermocline rather than wind-forced motions in the mixed layer itself. The wisdom in modeling the low-frequency wave field as an 'equivalent continuum' is questioned. (15 refs.)

110464 On the theory of the equilibrium range in the spectrum of wind-generated gravity waves. S.A.Kitaigorodskii (Dept. of Earth & Planetary Sci., Johns Hopkins Univ., Baltimore, MD, USA).

J. Phys. Oceanogr. (USA), vol.13, no.5, p.816-27 (May 1983).

It is shown that an exact analog of Kolmogoroff's spectrum in a random field of weakly nonlinear surface gravity waves gives a spectral form for frequency spectra $S(\omega)\sim\omega^{-4}$ in close agreement with the results of recent observational studies. The proposed theory also indicates the existence of a 'transitional' range of wavenumbers (frequencies) where the deviation from Kolmogoroff's equilibrium is due to gravitational instability (wave breaking). Because of this it is suggested that the equilibrium form for the spectrum of wind-generated waves has two asymptotic regimes: Kolmogoroff's and Phillips' (1958) type of equilibrium with a relatively rapid transition from the first to the second. (18 refs.)

110465 Four views of a portion of the North Atlantic subtropical gyre. L.Armi (Scripps Instn. of Oceanography, La Jolla, CA, USA), H.Stommel.

J. Phys. Oceanogr. (USA), vol.13, no.5, p.828-57 (May 1983).

Data from four cruises to the 'β-triangle' centered at 27°N, 32°30′W are smoothed by fitting second-degree polynomials at each of about 30 different density surfaces. The density intervals are $\Delta\sigma_p=0.3$ per mille, corresponding to about 50 db intervals in pressure. From the polynomials, a determination is made of central values, horizontal derivatives and Laplacians of the fields of pressure, salt, oxygen and dynamic height. In addition, maps of the fits and deviations of each station from the smoothed fits are produced. From the steady advective diffusive equation and the smoothed fits to the salt, oxygen and dynamic height fields, the lateral isopycnal diffusivity is estimated. The mixing length of the horizontal turbulence is found. (32 refs.)

110466 Upper ocean thermal variability in the Sargasso Sea July 1977-July 1978: the POLYMODE XBT program. D.E.Harrison (Dept. of Meteorology & Phys. Oceanography, MIT, Cambridge, MA, USA), R.H.Heinmiller.

J. Phys. Oceanogr. (USA), vol.13, no.5, p.859-72 (May 1983).

Discusses the upper ocean mesoscale temperature variability field as sampled by XBTs in the joint US-USSR POLYMODE Synoptic Experiment during July 1977 to July 1978. There is a 'background' persistent, relatively weak and rather large-scale pattern of variability, of alternating warm and cold areas which propagate nearly westward. For the background, very little point correlation between surface temperatures and temperatures beneath the mixed layer is found, but sub-mixed-layer temperatures above and below the '18°C water' show negative correlation. The authors find a number of smaller scale, apparently discrete, features which are somewhat more intense than the background. They exhibit little consistency in direction of propagation, and pattern propagation, rather than pattern evolution, as generally observed. The time-average depth field of the 15°C isotherm exhibits spatial variations comparable in magnitude to its pointwise standard deviation values. (14 refs.)

110467 Interannual variation in net heating at the surface of the tropical Pacific Ocean. B.C.Weare (Dept. of Land, Air & Water Resources, Univ. of California, Davis, CA, USA).

J. Phys. Oceanogr. (USA), vol.13, no.5, p.873-85 (May 1983).

Interannual variations of net surface heating of the tropical Pacific Ocean are analyzed for the period 1957-76. Special emphasis is given to exploring the relationship between these variations and those in sea temperature associated with El Nino/Southern Oscillation. The analyses include eigenvector analysis, composites of the net heating for various phases of El Nino, and time series analysis of various measures of the variability. The results indicate large scale patterns of variability dominated by time scales greater than one year. A link between the large-scale variations of sea temperature and net surface heating is evident from each set of analyses. It is hypothesized that net surface heating contributes to the development of the early stages of an El Nino warm period. (24 refs.)

110468 Modeling the mean barotropic circulation in the Bay of Fundy and Gulf of Maine. D.A.Greenberg (Atlantic Oceanographic Lab., Bedford Inst. of Oceanography, Dartmouth, Nova Scotia, Canada).

J. Phys. Oceanogr. (USA), vol.13, no.5, p.886-904 (May 1983).

Two two-dimensional, nonlinear numerical models are used to study the residual barotropic circulation generated by tides and steady winds in the Bay of Fundy and Gulf of Maine. The first, a multi-grid model, is used to examine the Bay of Fundy with a coarse look at the Gulf of Maine. The circulation in the upper Bay of Fundy is predominantly tidally driven. Steady wind stresses have some effect on the strength of these currents but little effect on the pattern. The counterclockwise gyre, observed in the body of the Bay of Fundy, is not reproduced in the model. The second model covers the lower Bay of Fundy and the Gulf of Maine with a single fine grid and is used to look at details in the Gulf of Maine. A clockwise circulation around Georges Bank and Nantucket Shoals is clearly indicated from tidal forcing alone, as is a gyre over the shallow part of Browns Bank. Different steady wind-stress fields give rise to variations in current strength and current patterns. (29 refs.)

110469 An observation of frontal wave development on a shelf-slope/warm core ring front near the shelf break south of New England. S.R.Ramp (Nat. Marine Fisheries Service, Northeast Fisheries Center, Woods Hole, MA, USA), R.C.Beardsley, R.Legeckis.
J. Phys. Oceanogr. (USA), vol.13, no.5, p.907-12 (May 1983).
Small-scale waves have been observed near 40°N, 68°30′W in specially enhanced satellite imagery of a strong temperature front formed in May 1979, between the shelf/slope-water front and warm core ring 79-B. These frontal waves had a wavelength of 23 ± 4 km, an eastward propagation speed of 32 ± 4 km day^{-1}, and a growth rate (*e*-folding time) of 17.5 h (12-19 h). These satellite data plus current-velocity and hydrographical data gathered from the Nantucket Shoals Flux Experiment (NSFE79) allow comparison of the observed growth rate with theoretical predictions based on the assumption of a Margules front and the instability model of Orlanski (1968). This comparison suggests that the observed frontal waves were due primarily to horizontal-shear instability and derived their energy from the mean flow structure across the front in the presence of ring 79-B. (8 refs.)

110470 Sea ice thickness distribution in Fram Strait. P.Wadhams (Scott Polar Res. Inst., Univ. of Cambridge, Cambridge, England).
Nature (GB), vol.305, no.5930, p.108-11 (8 Sept. 1983).
HM nuclear submarine Sovereign has obtained the first synoptic measurements of the ice thickness distribution in Fram Strait, the main outflow from the Arctic Ocean. The ice nearest the ice edge is of quite different character from ice in the interior of the Strait, with a greater proportion of first-year ice and less pressure ridging. An estimate of the ice flux through Fram Strait can be made from the distribution of mean ice drafts. (26 refs.)

110471 Reflection and refraction of topographic Rossby waves. V.M.Volosov (Shirshov Inst. of Oceanology, Acad. of Sci., Moscow, USSR).
Oceanology (USA), vol.22, no.2, p.117-20 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.2 (1982). [received: Aug. 1983]
The linear approximation of the theory by Volosov (1976, 1980) and Rhines et al. (1973) is modified to investigate the reflection and refraction of barotropic topographic Rossby waves in a homogeneous ocean with a moderate-depth gradient and small-scale anisotropic bottom relief. The amplitudes of the reflected and refracted waves and the particle velocities are found, and the transmission and reflection coefficients are calculated. Special cases of propagation without reflection, total internal reflection and the generation of exponentially damped waves are considered. A physical interpretation of the results is given and some generalizations are indicated. (9 refs.)

110472 The effect of synoptic eddies on the heat content distribution in the Sargasso Sea. N.P.Bulgakov, A.B.Polonskiy (Marine Hydrophys. Inst., Acad. of Sci., Sevastopol, Ukrainian SSR).
Oceanology (USA), vol.22, no.2, p.121-3 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.2 (1982). [received: Aug. 1983]
The data collected on expeditions of the Marine Hydrophysical Institute teams under the POLYMODE program are used to analyze the horizontal distribution of heat content of the active and baroclinic layers of the ocean on synoptic scales. (8 refs.)

110473 Structure of the equatorial currents in the central and western Pacific. V.A.Bubnov (Shirshov Inst. of Oceanology, Acad. of Sci., Kalingrad, USSR), V.D.Yegorikhin, A.S.Osadchiy.
Oceanology (USA), vol.22, no.2, p.124-6 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.2 (1982). [received: Aug. 1983]
The vertical structure of currents at the equator is analyzed from measurements made in February-April 1980 at two stations in the central Pacific and three stations in the western Pacific. A typical dynamic structure of three zonal flows was observed in the upper 700 m layer: the south equatorial current, the Cromwell current and the westward intermediate equatorial current. In the western Pacific a well-defined double-core structure of the subsurface equatorial countercurrents was recorded. Its formation is due to the variable wind regime. (13 refs.)

110474 Effect of compressibility of seawater in current calculations. V.V.Guretskiy (Arctic & Antarctic Res. Inst., Leningrad, USSR).
Oceanology (USA), vol.22, no.2, p.127-9 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.2 (1982). [received: Aug. 1983]
The effect of seawater compressibility on current calculations is analyzed. The fields of total integral circulation in the Southern Ocean obtained from a diagnostic model with and without correction for the seawater compressibility are presented. The analysis shows that when a horizontal temperature inhomogeneity is present at depth, correction for the pressure in the seawater density calculation increases the calculated horizontal density gradients and current velocities. (8 refs.)

110475 Model of the climatic spectrum of internal waves in the ocean. A.S.Samodurov (Marine Hydrophys. Inst., Acad. of Sci., Sevastopol, Ukrainian SSR).
Oceanology (USA), vol.22, no.2, p.130-2 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.2 (1982). [received: Aug. 1983]
Expressions for the space-time energy spectra of internal waves in the ocean are obtained by the analysis of the spectral wave equation in the ray approximation. (7 refs.)

110476 Concerning the mechanisms of generation of fine structure of the current velocity field in the ocean. V.M.Zhurbas (Shirshov Inst. of Oceanology, Acad. of Sci., Moscow, USSR).
Oceanology (USA), vol.22, no.2, p.133-6 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.2 (1982). [received: Aug. 1983]
Observational data on the fine structure of the velocity field of currents in the surface layer of the ocean over the vertical scale range of 16 to 24 m, obtained with acoustic velocity profilers during the 22nd cruise of R/V Dmitriy Mendeleyev (Station 1798) are presented. The measurements were performed by repeated soundings in the 20 to 700 m layer. It was found that the spectral density of the fine structure of the velocity field can be described by the relationship $S_v(m) \sim m^{-3}$, where m is the vertical wave number, the RMS deviations of current velocity σ_v vary with depths as $\sigma_v \sim N(z)$ at $N(z) \gtrsim 10^{-2}$ rad/sec (layer with high density gradients, $N(z)$ is the mean Vaisala-Brunt frequency profile) and $\sigma_v \sim N^{1/2}(z)$ at $N(z) < 10^{-2}$ (main pycnocline). It is shown that these properties of the fine structure of the current velocity field in the layer with high velocity gradients can be attributed to mechanisms of internal waves and geostrophic turbulence, whereas the comparison of experimental data in the main pycnocline with analytic expression is made difficult by the significant error of velocity measurements. (12 refs.)

110477 Effect of surfactants on wind-driven waves. A.V.Arkharov, S.A.Petrichenko, V.D.Pudov (Inst. of Experimental Meteorology, Obninsk Kiev State Univ., Kiev, Ukrainian SSR).
Oceanology (USA), vol.22, no.2, p.137-9 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.2 (1982). [received: Aug. 1983]
The results of an experimental study of the effect of surfactants on the development of wind-driven waves are presented. It is shown that with a surfactant film on the surface, no waves are generated at velocities of up to 3 to 5 m/sec. At wind speeds of 12 m/sec the waves are accelerated more rapidly on a surfactant-coated surface, but the intensity of waves is lower than on an uncoated one. (4 refs.)

110478 Measurement of volume scattering of sound in the ocean with a deep-water acoustic instrument. Yu.Yu.Zhitkovskiy, V.A.Mozgovoy, V.V.Savel'yev (Shirshov Inst. of Oceanology, Acad. of Sci., Moscow, USSR).
Oceanology (USA), vol.22, no.2, p.150-1 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.2 (1982). [received: Aug. 1983]
A study of volume scattering of sound in the central Atlantic by means of a deep-water acoustic instrument system showed that the sound scattering layer observed at depths of 500 to 600 m consists of individual 'targets', apparently fish shoals. The coefficients of volume scattering of sound inside a given 'target' can exceed by two orders of magnitude its means value for a given layer. (1 ref.)

110479 An experimental study of the mean velocity distributions of translational flows in the coastal zone of the sea. S.A.Yefremov (Shirshov Inst. of Oceanology, Acad. of Sci., Moscow, USSR).
Oceanology (USA), vol.22, no.2, p.197-8 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.2 (1982). [received: Aug. 1983]
The possibility of the existence of velocity extrema within a flow is verified experimentally. A theory of these extrema is presented. Numerical estimates show that such a velocity distribution in translational flows may occur in the presence of mutually opposing gradient and wind-driven currents. (1 ref.)

110480 Ocean acoustic tomography: rays and modes. W.Munk, C.Wunsch (Dept. of Appl. Math. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
Rev. Geophys. & Space Phys. (USA), vol.21, no.4, p.777-93 (May 1983).
The authors have measured perturbation of the sound speed (temperature) field within an ocean volume by repeated acoustic transmissions through the volume along may different ray paths. The data set consisted of ray travel time perturbations, and the sound field was obtained by inverse theory. The method is extended to cases (e.g. the 'axial' ocean near a sound speed minimum) where ray theory is not applicable or not convenient. This is done by including in the data set the frequency perturbation of lower modes. The procedures are illustrated for bilinear and quadratic sound channels, and for a cosh z profile. (30 refs.)

110481 Mean latitudinal water and temperature values for the World Ocean. L.A.Strokina (State Hydrologic Inst., USSR).
Sov. Meteorol. & Hydrol. (USA), no.4, p.40-3 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.4, p.50-5 (1982).
Presents mean long-term zonally averaged values of the water and air temperature at the surface of the World Ocean for each month of the year. The relationships of these temperatures for various latitudinal zones are examined. (19 refs.)

Atmosphere-ocean dynamics .... See Entry 105050

Parametric excitation of internal waves and convective instability in the fluid layer heated from above .... See Entry 107173

Dispersion and sedimentation of industrial waste of bauxite, blendes, fluorites and phosphorites dumped in the Gulf of Venice, Italy .... See Entry 109926

Fly-ash particles intercepted in the deep Sargasso Sea .... See Entry 109928

Induction of currents in long submarine cables by natural phenomena .... See Entry 110296

The reflection of obliquely incident tsunami .... See Entry 110322

Regional sea level, Southern Oscillation and beach change, New South Wales, Australia .... See Entry 110361

Oil slick drift trajectories for hypothetical spills in the Arabian Sea .... See Entry 110482

Studies for dispersion of radioactive effluents from an atomic power plant in coastal waters at Kalpakkam .... See Entry 110483

Property distributions and deep chemical measurements within the western Gulf of Mexico .... See Entry 110485

Delineation of seasonal changes of chlorophyll frontal boundaries in Mediterranean coastal waters with Nimbus-7 Coastal Zone Color Scanner data .... See Entry 110489

Ice-age simulations with a calving ice-sheet model .... See Entry 110498

Research on snow and ice .... See Entry 110506

The cooling of the layer between 500 and 1000 mb .... See Entry 110517

A model of the atmospheric boundary layer over the marginal ice zone .... See Entry 110568

140000-yr isotope climatic record from raised coral reefs in New Guinea .... See Entry 110644

Airborne measurements of laser backscatter from the ocean surface .... See Entry 110672

Determination of sea surface temperatures and atmospheric correction values for infrared images on the base of data of the metrological satellite NOAA 5 .... See Entry 110682

The IT method for the harmonic tidal prediction .... See Entry 110684

The Ocean Color Experiment (OCE) on the second orbital flight test of the Space Shuttle (OSTA-1) .... See Entry 110713

The effect of oceanic whitecaps and foams on pulse-limited radar altimeters .... See Entry 110720

High-resolution spectral estimation of synthetic aperture radar ocean wave imagery .... See Entry 110721

GPS aiding of ocean current detemination .... See Entry 110722

Oscillations of moored current meters and their effect on the measurement of current variables .... See Entry 110724

92.20 INTERDISCIPLINARY ASPECTS OF OCEANOGRAPHY

110482 Oil slick drift trajectories for hypothetical spills in the Arabian Sea. P.G.Kurup (Dept. of Marine Sci., Univ. of Cochin, Cochin, India).
Indian J. Mar. Sci., vol.12, no.1, p.1-10 (March 1983). [received: Sept. 1983]
The location of oil slick deposition on the shore and the duration available for weathering have been predicted using monthly wind and current data. Of the 732 spills studied, 135 spills may pollute the Indian coast with varying intensity. The period May-September provides more chances of severe oil deposition on the west coast of India. Slicks from the farthermost spills considered (370 km offshore) takes only 14 d to reach the Indian shore during July. A series of 12 monthly charts have been produced, which enables forecast of the slick movement and allows some qualitative inferences on the severity of damage these spills can cause on the shores. (13 refs.)

110483 Studies for dispersion of radioactive effluents from an atomic power plant in coastal waters at Kalpakkam. K.V.K.Nair, M.A.R.Iyengar, S.Ganapathy, V.Kannan, M.P.Rajan, P.R.Kamath (Environmental Survey Lab., Bhabha Res. Centre, Kalpakkam, India).
Indian J. Mar. Sci., vol.12, no.1, p.11-16 (March 1983). [received: Sept. 1983]
Drift bottle and dye discharge studies from a jetty at a point 180 m (A) away from the shore showed that the discharges moved shoreward and breaking waves appeared to be the dominant factor affecting water movement. Similar studies at 270 (B) and 320 m (C) from the shore showed that wind and wind driven currents were the factors affecting water movement. Detailed observations at B showed it to be the most suitable location for the discharge of radioactive effluents. Studies on vertical distribution of density showed density stratification during the rainy season; density stratification is likely to be strengthened with warm water discharges. (6 refs.)

110484 Revised parameters for modeling the transport of PCB components across an air water interface. R.F.Bopp (Lamont-Doherty Geological Obs., Columbia Univ., Palisades, NY, USA).
J. Geophys. Res. (USA), vol.88, no.C4, p.2521-9 (20 March 1983). [received: Sept. 1983]
A number of revisions of the data base and conceptualizations utilized in air-water transport models for PCB components are suggested. The most significant of these involves the assignment of physical chemical properties on the basis of degree of chlorination. The effect of temperature on the rate of transport is also discussed. The revised model is tested on a number of natural situations and compared with available data. (48 refs.)

110485 Property distributions and deep chemical measurements within the western Gulf of Mexico. J.M.Morrison, W.J.Merrell,Jr. (Dept. of Oceanography, Texas A&M Univ., College State, TX, USA), R.M.Key, T.C.Key.
J. Geophys. Res. (USA), vol.88, no.C4, p.2601-8 (20 March 1983). [received: Sept. 1983]
Distribution of salinity, dissolved oxygen, nitrate, phosphate, and silicate are presented for the western Gulf of Mexico in 1978. Plots of chemical concentration versus potential density are used to identify the presence of gulf water, tropical Atlantic central water, Antarctic intermediate water, Caribbean midwater, and upper North Atlantic deep water within the upper 1600 m of the western Gulf of Mexico. Property distributions are closely related to the current regime described by Merrell and Morrison (1981). Tritium, carbon 14, radium 226, and ranon 222 values that were taken at a deep station located at 23°02′N and 92°28′W are also presented. (15 refs.)

110486 Palladium and nickel in north-east Pacific waters. .Dong Soo Lee (Scripps Instn. of Oceanography, Univ. of California, San Diego, La Jolla, CA, USA).
Nature (GB), vol.305, no.5929, p.47-8 (1 Sept. 1983).
Reports the first palladium profiles in marine water and sediment columns. Palladium concentration in the water column of the north-east Pacific increases from 0.18 pmol kg^{-1} at the surface to 0.66 pmol kg^{-1} in deep waters. There is a strong co-variance between palladium and nickel, which implies similar biogeochemical sediments from the Palace Moat, Tokyo, Japan, is observed and is perhaps a consequence of palladium usage in automobiles. (17 refs.)

110487 Rare earth elements in seawater near hydrothermal vents. G.Klinkhammer, H.Elderfield (Dept. of Earth Sci., Univ. of Leeds, Leeds, England), A.Hudson.
Nature (GB), vol.305, no.5931, p.185-8 (15 Sept. 1983).
Rare earth element (REE) patterns in the deep Pacific are strongly depleted in the lighter elements and have a large negative cerium anomaly. These REE patterns and associated concentration-depth profiles are maintained by regeneration in deep waters modified by preferential scavenging of the lighter elements. Scavenging by iron- and manganese-rich hydrothermal plumes might explain why vast areas of sediments far removed from spreading centres contain a metalliferous component. (22 refs.)

110488 Study of the temperature dependence of the rate of oxygen exchange across an air-water interface. N.A.Mel'nichenko (Far Eastern State Univ., Vladivostok, USSR), V.I.Chizhik.
Oceanology (USA), vol.22, no.2, p.157-61 (1982). Translation of: *Okeanologiya (USSR)*, vol.22, no.2 (1982). [received: Aug. 1983]
The pulse nuclear magnetic resonance method (relaxation technique) was used for measurement of rates of diffusive oxygen exchange across air-water (both distilled and sea) interfaces in the temperature range of 0 to 35°C. This rate proved virtually independent of water salinity and direction of diffusion (air to water, or vice versa). Its temperature dependence obey Arrhenius' law. (13 refs.)

110489 Delineation of seasonal changes of chlorophyll frontal boundaries in Mediterranean coastal waters with Nimbus-7 Coastal Zone Color Scanner data. D.Caraux, R.W.Austin (Visibility Lab., Scripps Instn. of Oceanography, La Jolla, CA, USA).
Remote Sensing Environ. (USA), vol.13, no.3, p.239-49 (July 1983).
The seasonal changes in chlorophyll-like pigment distribution in the North-western Mediterranean Sea (Gulf of Lions) were monitored during the year 1979. Data were collected from the Coastal Zone Color Scanner (CZCS), carried on the Nimbus-7 satellite. A series of cloud-free images covering the whole year was selected and processed to evaluate chlorophyll-like pigment concentrations. The upwelling subsurface radiance of the ocean (L_{ss}) was extracted from the apparent upwelling signal reaching the satellite sensor using an algorithm removing atmospheric effects. Chlorophyll-like pigment concentration was then derived from L_{ss} in different wavelengths. Characteristic boundaries between water masses with different phytoplankton content were obtained. The results demonstrate that phytoplankton distribution is a good indicator of seasonal variations of oceanic fronts. Features such as coastal upwellings, cyclonic eddies, or plume of the Rhone river could be monitored. (21 refs.)

110490 Space-time variability of petroleum hydrocarbons in waters of the north Atlantic. E.A.Sobchenko, I.G.Orlova, V.A.Mikhailov, R.I.Lisovskii (State Oceanographic Inst., Odessa, USSR).
Sov. Meteorol. & Hydrol. (USA), no.4, p.44-51 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.4, p.56-65 (1982).
Results of observations of oil pollution of surface waters of the North Atlantic carried out within the framework of the IOC-WMO pilot project during a three-year period (1977-1979) are presented. An assessment of the current level of oil pollution of the investigated region and background level of the dissolved-emulsified fraction of petroleum hydrocarbons is given. The temporal (interannual) variability of various forms of oil pollution is examined. (14 refs.)

Morphological, sedimentological and chemical aspects of the sediments in the Gulf of Cagliari (Sardinia) ....See Entry 109925

Anthropogenic tritium in South Atlantic bottom water ....See Entry 109927

Fly-ash particles intercepted in the deep Sargasso Sea .... See Entry 109928

Determination of copper, cadmium and lead in seawater by atomic absorption spectrometry with electrothermal atomization ....See Entry 109945

Benthic fronts and global excess radon distribution ....See Entry 110395

New measurements of sulfate and chlorinity in natural sea ice ....
....See Entry 110428

Phytoplankton and thermal structure in the upper ocean: consequences of nonuniformity in chlorophyll profile ....See Entry 110433

Geochemical profiles in the central Arctic Ocean: their relation to freezing and shallow circulation .... See Entry 110443

Atmospheric chloroform ($CHCl_3$): ocean-air exchange and global mass balance
....See Entry 110535

Variation of the microwave brightness temperature of sea surfaces covered with mineral and monomolecular oil films ....See Entry 110706

The Ocean Color Experiment (OCE) on the second orbital flight test of the Space Shuttle (OSTA-1) ....See Entry 110713

92.40 HYDROLOGY AND GLACIOLOGY

110491 Thermal response of unconfined ice shelves to climatic conditions. F.M.Williams, K.Hutter.
Acta Mech. (Austria), vol.48, no.3-4, p.131-46 (1983).
An analysis of the thermomechanical behavior of an ice shelf is presented. The mathematics is simplified by simulating the transverse temperature distribution by a realistic shape function thereby replacing the local energy equation by a time-dependent, total energy balance condition which accurately models the ocean-ice and ice-atmosphere heat exchange processes. The emerging steady state theory correlates a dimensionless combination of accumulation rate, horizontal strain rate and thickness with heat flux and surface temperature and shows fair agreement with published data. A time-dependent small perturbation analysis further shows that the criterion of stability of the solutions is expressible in terms of this dimensionless parameter. (14 refs.)

110492 On the area/depths relation of selected rainfall events. D.Schumann (Meteorologischer Dienst, Berlin, Germany).
Z. Meteorol. (Germany), vol.33, no.3, p.179-83 (1983). In German.
For 80 rainfall events, the decrease of the maximum point rainfall with increasing area is investigated for rainfall durations from 1 to 36 hours. The results show that both the range of the areal rainfall/point rainfall ratio between rainfalls of the same duration and the mean areal rainfall/point rainfall ratio for rainfalls of different duration are a distinct function of the rainfall duration. The relation between the area-depth ratio and the weather conditions is discussed. The author highlights the means for an operational use of the present results particularly for real-time purposes of meteorology and water management. (6 refs.)

110493 Ground-water microtemperature measurements, coseismic signals and atmospheric pressure effects. H.Shimamura (Lab. for Ocean Bottom Seismology, Geophysical Inst., Hokkaido Univ., Sapporo, Japan).
Ann. Geophys. (France), vol.1, no.3, p.235-8 (May-June 1983).
Very accurate temperature measurements of ground-water, with an accuracy better than 1/1000°C, have been made in about forty wells in Japan. Many coseismic signals, with amplitudes of 1-170 m°C, have been observed. They are generally consistent with magnitudes and distances of earthquakes. The observed microtemperature also shows a clear effect of the atmospheric pressure changes, where the observed temperature increases when the pressure decreases. The pressure coefficients varies for more than 100 times from well to well. Some possible precursors of earthquakes have also been recorded. The authors believe they are tracing the movements of ground-water through the microtemperature measurements, although the mechanism has not yet been exactly clarified. (2 refs.)

110494 The occurrence of lead in Antarctic recent snow, firn deposited over the last two centuries and prehistoric ice. C.F.Boutron (Lab. de Glaciologie et Geophys. de l'Environnement, CNRS, Grenoble, France), C.C.Patterson.
Geochim. & Cosmochim. Acta (GB), vol.47, no.8, p.1355-68 (Aug. 1983).
Concentrations of lead have been measured by ultraclean Isotope Dilution Mass Spectrometry in snow cores covering the last two centuries collected at an inland site in East Antarctica using an ultraclean all plastic hand operated auger and in a prehistoric blue ice block collected at an Antarctic coastal site. Lead contamination of 16 to 200 pg Pb/g existed on the outside of the snow cores, but the measured concentrations decreased more or less abruptly along a radius from the outside to the centers of the snow cores, establishing interior values in the 1 to 5 Pb/g range. The interior of the blue ice block appears not to have been significantly contaminated, and contains about 1.7 pg Pb/g. These new data show that most previously published data on lead in Antarctic snow and ice were in high positive error because of contamination during field sampling, laboratory analysis or both. The remote polar areas of the Southern Hemisphere are still affected by industrial lead pollution. Prehistoric Antarctic ice is shown to contain about 1 pg Pb/g natural excess lead above silicate dust lead. (40 refs.)

110495 Flow in alluvial-river curves. M.F.Ascanio (Inst. de Mecanica de Fluidos, Univ. Central de Venezuela, Caracas, Venezuela), J.F.Kennedy.
J. Fluid Mech. (GB), vol.133, p.1-16 (Aug. 1983).
Uniform flow in curved, wide, erodible-bed channels is formulated on the basis of the conservation of flux of moment-of-momentum, to obtain relations for the vertical distributions of radial-plane velocity and radial shear stress. The expression for the radial stress exerted on the bed is utilized in a force-equilibrium analysis of the moving bed layer to obtain relations for the average transverse slope of the bed and for the radial bed profile. The reduction of primary bed shear stress due to the net radial transport of streamwise momentum toward the outer (concave) bank is then calculated, by introduc-

ing the derived expressions for the velocity components into the momentum equation for the primary-flow direction. (15 refs.)

110496 Peculiarities of the nonequilibrium distribution of moisture in the freezing and thawing of disperse soils. Yu.S.Danielyan, P.A.Yanitskii (V.I. Muravlenko State Res. & Project Inst. of Petroleum & Gas Industry, Tyumen, USSR).
J. Eng. Phys. (USA), vol.44, no.1, p.76-82 (Jan. 1983). Translation of: *Inzh.-Fiz. Zh. (USSR)*, vol.44, no.1, p.91-8 (Jan. 1983). [received: Sept. 1983]
Presents the results of numerical simulation of the process of moisture migration in disperse soils with different regimes of freezing and with a view to the nonequilibrium effects accompanying the phase transformations of water. The results of simulation are compared with data of experimental investigations from the literature. (9 refs.)

110497 The bathymetry of Lakes King and Victoria. D.R.Blackman, J.B.Hinwood (Dept. of Mech. Engng., Monash Univ., Clayton, Victoria, Australia).
Proc. R. Soc. Victoria (Australia), vol.95, no.1-2, p.53-8 (30 June 1983).
The authors describe a recent bathymetric survey of part of the Gippsland Lakes. Charts giving the results are included. (4 refs.)

110498 Ice-age simulations with a calving ice-sheet model. D.Pollard (Climatic Res. Inst., Oregon State Univ., Corvallis, OR, USA).
Quaternary Res. (USA), vol.20, no.1, p.30-48 (July 1983).
Variations of ice-sheet volume during the Quaternary ice ages are simulated using a simple ice-sheet model for the Northern Hemisphere. The basic model predicts ice thickness and bedrock deformation in a north-south cross section, with a prescribed snow-budget distribution shifted uniformly in space to represent the orbital perturbations. An ice calving parameterization crudely representing proglacial lakes or marine incursions can attack the ice whenever the tip drops below sea level. The model produces a large ~100000-yr response in fair agreement with the $\delta^{18}O$ deep-sea core records. (43 refs.)

110499 Flood frequency analysis: a review of 1979-1982. N.P.Greis (Bell Labs., Holmdel, NJ, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.699-706 (April 1983).
Discusses the areas of (1) distributional analysis and (2) robust parameter estimation, and what might be called developments of potential in the area of (3) regionalized and geomorphologic approaches to the flood frequency problem. While the primary focus is on American work, the author includes some mention of non-American work when the contributions of American hydrologists can be seen more distinctly against a backdrop of global activity. (130 refs.)

110500 Surface water hydrology: on-line estimation. S.Sorooshian (Dept. of Hydrology & Water Resources, Univ. of Arizona, Tucson, AZ, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.706-21 (April 1983).
Discusses conceptual rainfall-runoff models, and systems-theoretic models. An attempt is made to highlight those problem areas that were addressed during the past four years (1979-1982) and those issues which are yet to be adequately resolved. (113 refs.)

110501 Surface water hydrology—runoff generation and basin structure. K.Beven (Dept. of Environmental Sci., Univ. of Virginia, Charlottesville, VA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.721-30 (April 1983).
Addresses the problem of developing a theory of the relationship between runoff generation and basin structure. It is suggested that the current generation of physically based models of basin hydrology cannot predict runoff generation in the field with any adequacy because they are not good descriptors of runoff processes, except under some special circumstances. Some of the complex factors contributing to runoff generation that lead to this conclusion are discussed. Special emphasis is placed on the problems posed by the spatial variability of soil characteristics to the application of physically based models. The way in which basin structure changes with spatial scale is then considered. (165 refs.)

110502 Urban hydrology. J.W.Delleur (School of Civil Engng., Purdue Univ., West Lafayette, IN, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.730-40 (April 1983).
Discusses hydrologic processes in urban areas, hydraulic conveyances, detention basins, combined sewer overflows, rainfall runoff models, data acquisition and the Nationwide Urban Runoff Program. (575 refs.)

110503 Progress in hydrodynamic modeling. Review of US contributions, 1979-1982. D.R.Lynch (Thayer School of Engng., Dartmouth Coll., Hanover, NH, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.741-54 (April 1983).
Discusses one and two dimensional modelling for vertically homogeneous hydrodynamics and in partially stratified hydrodynamics and stratified hydrodynamics. (183 refs.)

110504 Unsaturated soil water flow. R.E.Smith (Agricultural Res. Service, US Dept. of Agriculture, Fort Collins, CO, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.755-60 (April 1983).
Discusses research by United State's scientists published in journals during the nominal period 1979 to 1982, inclusive. Much excellent work published in the same journals by scientists from other countries has been passed over. The last half year 1982 could not be covered due to publication deadlines. For the same reason, research published in late 1978 has been included which was not discussed in the previous quadrennial report. The summary and bibliography are not exhaustive insofar as local institutional reports and journals not ordinarily dealing with the subject have not been searched through. (105 refs.)

110505 Ground water: a review. J.D.Bredehoeft (US Geological Survey, Menlo Park, CA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.760-5 (April 1983).
Groundwater hydrology is discussed including transport with chemical reactions, and the restorability of an aquifer which has been contaminated. (111 refs.)

110506 Research on snow and ice. R.G.Barry (Dept. of Geography, Univ. of Colorado, Boulder, CO, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.765-76 (April 1983).
Snow and ice distribution and remote sensing, sea ice dynamics, icebergs, glaciers, ice sheets, cryosphere-climate interactions and CO_2 effects in the atmosphere are discussed. (371 refs.)

110507 Chemical study of the Tama River. V. N.Kokubu, K.Suzuki, K.Motozima, A.Fujitsuka (Univ. of Electro-Communications, Tokyo, Japan).
Rep. Univ. Electro-Commun. (Japan), vol.33, no.2, p.239-45 (Feb. 1983).
For pt.IV see ibid., vol.33, no.1, p.43-8 (1982). The results of the determinations made in 1976 on Tama River water are reported. Ten sampling stations were the same as the preceding report in 1975. The water samples were collected from April 1976 to February 1977. The water temperature, pH value, redox potential, Na, K, Ca, Mg, F, Cl, SO_4, PO_4 and SiO_2 are determined. The variations of chemical composition of the river water and mutual relations of chemical constituents are discussed. Secular change of the river water quality from 1972 to 1973 is also described. (6 refs.)

110508 Turbulent structure of a natural density current in the region of its formation. Yu.G.Pyrkin, B.I.Samolyubov, A.A.Kuznetsov (Moscow State Univ., Moscow, USSR).
Sov. Meteorol. & Hydrol. (USA), no.4, p.52-8 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.4, p.66-74 (1982).
The turbulent structure of a stratified bottom flow in the zone of its formation under natural conditions is analyzed. The regularities of the spectral density of the turbulence of the flow (vertically and along the axis of the flow) are examined jointly with the profiles of the velocity, suspension concentration, temperature, and intensity of velocity fluctuations. (9 refs.)

110509 Investigation of the trend in the change in the volume of river discharge when estimating the normal annual runoff. E.A.Leonov, V.E.Leonov (State Hydrological Inst., USSR).
Sov. Meteorol. & Hydrol. (USA), no.4, p.59-66 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.4, p.75-84 (1982).
An analysis of the variations in the runoff of large rivers in the USSR shows that long-term trends in the volume of discharge are observed in runoff over many years. The change in runoff for phases of an increase and decrease of the volume of discharge is described well by the equation of a complex exponential function from values of the moving averages of the fixed normal annual runoff. The average duration of the increase and decrease of the discharge volume for an averaging period of T=50 years is 60-70 years. (18 refs.)

Institute of Statisticians International Conference on Practical Bayesian Statistics .... See Entry 105021

Proceedings 1983 International Symposium on Urban Hydrology, Hydraulics and Sediment Control .... See Entry 105035

Influence of surface type on the brightness temperature of snow-covered terrain .... See Entry 105359

Neptunium and americium speciation in selected basalt, granite, shale, and tuff ground waters .... See Entry 109930

Source parameter inversion of a reservoir-induced seismic sequence: Lake Kariba, Africa (1963 September) .... See Entry 110319

Geothermal measurements in the upper Euphrates Valley—W Iraq .... See Entry 110325

Speleothems, travertines, and paleoclimates .... See Entry 110343

Pore structure of hydrothermally altered rocks in the Otake geothermal area .... See Entry 110365

Multispectral remote sensing of saline seeps .... See Entry 110372

Patterns of India monsoon rainfall anomalies .... See Entry 110532

The Group Agromet Monitoring Project (GAMP): application of Meteosat data for rainfall, evaporation, soil-moisture and plant-growth monitoring in Africa .... See Entry 110551

A study of meteorological patterns associated with a lake confined by mountains—the Dead Sea case .... See Entry 110584

Climatic information over the last century deduced from a detailed isotopic record in the south pole snow .... See Entry 110643

The geologic record of climatic change .... See Entry 110646

Evaporation derived from optical and radio-wave scintillation .... See Entry 110667

Augmenting LANDSAT MSS data with topographic information for enhanced registration and classification .... See Entry 110702

Improvement of moisture estimation accuracy of vegetation-covered soil by combined active/passive microwave remote sensing .... See Entry 110707

Remote sensing of soil moisture: recent advances .... See Entry 110711

The dielectric properties of wet materials .... See Entry 110714

Remote sensing of wetlands .... See Entry 110716

92.60 METEOROLOGY

(see also 43.28 Aeroacoustics and atmospheric sound)

110510 Observations of plume trajectories in the initial momentum influenced phase and parameterization of entrainment. K.T.Spillane (Div. of Atmospheric Phys., CSIRO, Mordialloc, Victoria, Australia).
Atmos. Environ. (GB), vol.17, no.7, p.1207-14 (1983).
Observations of plume trajectories from a 500 MW power station are reported for that phase of the rise influenced by the initial momentum flux. The mass-radius (a) growth law: $da/ds=0.16|(U_p-U_e\sin\phi)/U_p|+0.4(U_e\cos\phi)/U_p$, combined with Briggs' (1975) concept of an effective transverse momentum radius of 1.5a are shown to be suitable empirical concepts for modelling the entrainment of mass and momentum into the integral conservation equations of a wet-plume. Cross-wind pressure effects are shown to be small and related to R_0 but further trials at $R_0>5$ are required to confirm their dependence on R_0. Bifurcating plumes are as well described as conventional plumes with no evidence of stack wake effects at $R_0=1.8$. (S is the distance along the plume centre line which is at an angle ϕ to the vertical, U_p is the integral plume speed, U_e the wind speed and $R_0=U_p/U_e$ at the outlet). (29 refs.)

110511 A mesoscale atmospheric dispersion model for predicting ambient air concentration and deposition patterns for single and multiple sources. I.M.Ritchie, J.D.Bowman, G.B.Burnett (Minnesota State Planning Agency, St. Paul, MN, USA).
Atmos. Environ. (GB), vol.17, no.7, p.1215-23 (1983).
A mesoscale modified Gaussian model (MGM) that incorporates chemical oxidation of sulfur dioxide, dry deposition and precipitation scavenging for single and multiple sources is described. The model was verified in the range 5-250 km using 1.5-y monthly deposition data, 1-y of 24-h ambient air SO_2 data, and by comparison to two dispersion models. The calculated deposition rates which were compared to data collected around the Sudbury, Ontario, smelter complex were found to be within a factor of two to three of measured values depending on the averaging time. The comparison with two existing dispersion models gave results to within a factor of two. Sensitivity testing on the input parameters is also discussed. (22 refs.)

110512 Evaluation of an episodic regional transport model for a multi-day sulfate episode. D.A.Stewart, R.E.Morris, Mei-Kao Liu (Systems Applications Inc., San Rafael, CA, USA), D.Henderson.
Atmos. Environ. (GB), vol.17, no.7, p.1225-52 (1983).
An episodic regional transport model (RTM-II) is applied to a sulfate episode that occurred over the eastern third of the United States and southeastern Canada during the latter part of July 1978. An evaluation of the model performance is presented. Measurements for regional SO_2 and sulfate concen-

trations obtained from up to 54 monitoring stations geographically distributed throughout the modeling region are used. Simulation results are presented in a semi-quantitative manner through region-wide isopleth diagrams and time histories at individual stations. An analysis of the residuals over all measurements, the highest 50 per cent, and highest 10 per cent of the measurements is also included. (28 refs.)

110513 Atmospheric pollution studies at Kanpur—suspended particulate matter. V.P.Sharma, H.C.Arora, R.K.Gupta (Kanpur Zonal Lab., Nat. Environmental Engng. Res. Inst., Kanpur, India).

Atmos. Environ. (GB), vol.17, no.7, p.1307-13 (1983).

Kanpur is the largest industrial metropolis in the State of Uttar Pradesh, India. The atmosphere over the city is considerably polluted. An air quality evaluation study during 1973-1975 has yielded interesting results. This communication deals specifically with suspended particulate matter and its constituents collected from three sampling stations: Gwaltoli, Beconganj and Raipurwa. The study revealed that the 3-y average of the annual arithmetic means recorded for the three stations were 224, 256 and 298 $\mu g\ m^{-3}$, respectively. The constituents of the suspended particulate matter evaluated are benzene extractable matter, heavy metals namely iron, lead, copper, zinc and chromium and acid radicals namely sulphate and nitrate. Interesting observations have been recorded on the relationship of suspended particulate matter and benzene extractable matter. (7 refs.)

110514 Modeling of multiphase atmospheric aerosols. P.Saxena, C.Seigneur (Systems Applications Inc., San Rafael, CA, USA), T.W.Peterson.

Atmos. Environ. (GB), vol.17, no.7, p.1315-29 (1983).

Presents a mathematical model that describes the chemical composition and growth rate of atmospheric aerosols containing sulfate and nitrate, and that is applicable over the entire range of relative humidities. The model describes aerosols as consisting of an insoluble core, a soluble solid shell and an aqueous film. The chemical composition of the solid and aqueous aerosol phases in this model is governed by the following processes: (1) the chemical equilibria between the ambient gas and the aerosol liquid phases and between the aerosol liquid and the soluble solid phases; (2) the diffusion-limited condensation of H_2SO_4 and (3) the liquid-phase chemical reaction of SO_2. At low humidities the liquid phase may not be thermodynamically viable, in which case the model then treats the solid-phase/gas-phase equilibrium. (47 refs.)

110515 Some environmental effects of forest fires in interior Alaska. F.Eaton, G.Wendler (Geophys. Inst., Univ. of Alaska, Fairbanks, AK, USA).

Atmos. Environ. (GB), vol.17, no.7, p.1331-7 (1983).

The high variability of burning conditions and fuels, found in Alaskan forest fires, produces an associated complex emission of particulate matter. Histological evidence of some large particles has been found in the forest fire plumes as well as aerosols resulting apparently from gas-to-particle conversion. Particles analyzed with a scanning electron microscope and X-ray energy dispersive techniques show large variability in both physical and chemical characteristics. Optical measurements show forest fire smoke affects atmospheric turbidity regionally. Turbidity values presented which were measured in the plume from a forest fire 400 km from Fairbanks show values in excess of those found for heavily polluted urban regions. The particulate matter analysis showing irregular shapes and highly varied chemical composition displays the difficulty in radiative transfer calculations due to the assumptions of Mie theory. The nature of the aerosol size concentrations found in forest fire plumes also violates the assumption necessary for application of Angstrom's classic method of defining the turbidity coefficient and wavelength exponent. (27 refs.)

110516 Rotary spectral analysis for horizontal flow over central Europe. P.C.Werner (Meteorologischer Dienst, Potsdam, Germany).

Z. Meteorol. (Germany), vol.33, no.3, p.144-7 (1983). In German.

The vector of the large-scale geostrophic current over central Europe at the 500 and 1000 mb level is treated by an analysis of rotary spectra. The orientation of the major axis depends on the frequency of variation and shifts from a N-to-S direction with low frequencies to a NE-to-SW direction with higher frequencies, which is particularly distinct at the 1000 mb level. This shift is not monotonous at 500 mb nor very distinct, which affects the direction of rotation of the orientation of the major axis with increasing height. The inclination of the major axis at the horizontal level affects the meridional flux of momentum. (5 refs.)

110517 The cooling of the layer between 500 and 1000 mb. P.C.Werner (Meteorologischer Dienst, Potsdam, Germany).

Z. Meteorol. (Germany), vol.33, no.3, p.162-6 (1983). In German.

In the period 1957-1980, for which special values of the relative topography 500/1000 mb over central Europe are available, the author recognizes a cooling in the lower and middle troposphere for annual averages and for several months. This temperature decrease is compared with changes of the general circulation of the atmosphere, of the sea-surface temperature in the North Atlantic, of the global radiation, and of the temperature in Potsdam. Obviously, the circulation and with it the thermal advection are the predominant cause of the temperature decrease. (14 refs.)

110518 Analysis of the periodic variations of atmospheric pressure over Greece. T.J.Makrogiannis, B.E.Angouridakis, A.N.Bartzokas (Meteorological Inst., Aristotelian Univ. of Thessaloniki, Thessaloniki, Greece).

Z. Meteorol. (Germany), vol.33, no.3, p.167-75 (1983).

The yearly variation of atmospheric pressure over Greece shows a double fluctuation with a primary maximum in October-November and a primary minimum in July. The diurnal variation presents a double fluctuation, too, with a primary maximum around 10.00, a primary minimum around 16.00, a secondary maximum around 22.00 and a secondary minimum around 05.00 hours. All the three harmonic terms contribute positively to the formation of the final curve, and their contributions cover 87% of the total variance. Most important, and almost identical to the final curve, is the 2nd harmonic term. (10 refs.)

110519 Forecasting of radiation fog at Thessaloniki, Greece. V.E.Angouridakis, A.A.Flocas (Inst. of Meteorology & Climatology, Univ. of Thessaloniki, Thessaloniki, Greece).

Z. Meteorol. (Germany), vol.33, no.3, p.176-8 (1983).

The likelihood of the occurrence of radiation fog at Thessaloniki is examined. The fog point (T_f) for all recorded cases of radiation fog for the period 1950-1979 is estimated using Saunders' method. A stepwise multiple regression analysis of the T_f values and nine other parameters was carried out. The validity of the assumption of a linear relationship between T_f and the other parameters are examined and an equation derived. When T_f by Saunders' method differs by 1C° or less from the value calculated by the derived equation, there is a 98% probability that radiation fog will occur at Thessaloniki. (7 refs.)

110520 On puff models of turbulence diffusion at various scales of atmospheric movements. E.D.Syrakov (Faculty of Phys., Sofia Univ., Sofia, Bulgaria).

C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.5, p.631-4 (1983). (10 refs.)

110521 Modelling of mesometeorological transfer of pollution in SL while recording the interaction effect of admixture with underlying surface. C.D.Djolov (Faculty of Phys., Sofia Univ., Sofia, Bulgaria), D.E.Sirakov, D.L.Yordanov.

C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.5, p.639-42 (1983).

A modern method for the study of atmospheric diffusion is based on a statistical trajectory model, in which every continuously-acting source is approximated with a series of Lagrange puffs. These are summed up at certain time intervals and a concentration field is obtained. (3 refs.)

110522 CTR notes: simple method for estimating atmospheric absorption at 1 to 15 GHz. D.V.Rogers (Propagation Studies Dept., COMSAT Labs., Clarksburg, MD, USA).

COMSAT Tech. Rev. (USA), vol.13, no.1, p.157-63 (Spring 1983).

To obtain estimates of propagation impairments for system studies, it is often desirable to use simple, fast computational methods that require minimal site-specific meteorological data. Such a procedure has been developed for estimating atmospheric gaseous absorption at frequencies of 1 to 15 GHz and slant path elevation angles of 0° to 90°, using only frequency and elevation angle as input parameters. Analytic expressions are derived by curve fitting absorption data from the CCIR, assuming fixed values of surface water vapor concentration, ρ_s, and surface temperature, T_s. To illustrate the method, equations are obtained for values of ρ_s and T_s corresponding to two different standard atmospheric conditions. (2 refs.)

110523 Satellite observation of the Earth radiation budget. R.Kandel (Service d'Aeronomie CNRS, Verrieres-le-Buisson, France).

Contrib. Atmos. Phys. (Germany), vol.56, no.3, p.322-40 (1983).

The role of earth radiation budget studies in climate research is discussed with a number of examples in which detailed knowledge of the radiation budget is needed to improve understanding of climate dynamics. Since the advent of artificial satellites, global monitoring has become possible, but accuracy is limited by a number of problems: (i) spectral response and radiometric calibration; (ii) spatial resolution and angular sampling of the anisotropic radiation field; (iii) temporal sampling of diurnal and synoptic variations. Accomplishments since 1957 are reviewed. Current attempts, notably the Earth Radiation Budget Experiment, to improve the situation are described. (91 refs.)

110524 On the intensity of atmospheric convection. J.Oerlemans (Inst. of Meteorology & Oceanography, Univ. of Utrecht, Utrecht, Netherlands).

Contrib. Atmos. Phys. (Germany), vol.56, no.3, p.341-53 (1983).

Several runs with a numerical cloud model are discussed in order to quantify the effect of latent heat release on the development of convective activity. A scheme of the numerical results is constructed by means of a simple gradient system, with surface heat flux and moisture content as control parameters. For some range of these control parameters, two stable steady states occur. Internal forcing due to latent heat release creates the bifurcation. It is shown that for moist conditions convective activity tends to have a bimodal probability distribution. The practical consequence is that the short-range predictability of the weather is substantially reduced. (16 refs.)

110525 Determination of H_2O and CH_4 profiles from data of a nadir to limb scanning balloon-borne radiometer. H.Fischer, F.Fergg, D.Rabus, W.Volker (Meteorologisches Inst. Munchen, Munchen, Germany), H.J.Bolle.

Contrib. Atmos. Phys. (Germany), vol.56, no.3, p.354-74 (1983).

Nadir to limb radiance profiles were measured with a balloon-borne radiometer of special design and inverted to give vertical concentration profiles of water vapor and methane. (35 refs.)

110526 Supra-annual variations of geopotential heights in the subtropical stratosphere. A.H.Gordon (Flinders Inst. of Atmospheric & Marine Sci., Flinders Univ. of South Australia, Bedford Park, Australia).

Contrib. Atmos. Phys. (Germany), vol.56, no.3, p.375-81 (1983).

Mean monthly geopotential height data at 50 mb, 30 mb and 10 mb for latitudes 10°, 20°N and 30°N for the period 1957-78 were examined with a view to ascertaining whether they exhibited similar periodic behaviour to that documented by equatorial stratospheric wind observations. Results indicated that the geopotential heights possessed a variable periodicity, but a peak of about 3 years appeared highly significant at 50 mb and 10°N at all longitudes, matching the statistical significance of the quasibiennial oscillation itself. (10 refs.)

110527 Synoptic forcing of the planetary boundary layer: a case study from the PUKK experiment. E.Schaller (Meteorologisches Inst., Bonn Univ., Bonn, Germany).

Contrib. Atmos. Phys. (Germany), vol.56, no.3, p.382-98 (1983).

A case study of the nocturnal boundary layer is presented on the basis of PUKK data covering a period from September, 29th, 16^h to September, 30th, 1981, 8^h. Due to the intensification of a weak high pressure cell the wind was turning during that clear night from NW to SW and was thus changing its origin from sea to inland. This situation allows a study of the effects resulting from a synoptic forcing on the planetary boundary layer. It is demonstrated that on a time scale of one hour relatively large turbulent fluxes can be observed due to an increased horizontal advection. (11 refs.)

110528 Propagation characteristics at 35 and 78 GHz for spaceborn altimeters. D.Tarducci (CSELT, Torino, Italy).

CSELT Rapp. Tec. (Italy), vol.11, no.4, p.255-64 (Aug. 1983).

Frequency bands around 35 and 78 GHz have been recently suggested for satellite radar altimeters. As for any Earth-to-satellite radio link these frequencies are affected by atmospheric phenomena. As a first step, 'clean air' effects due to oxygen and water vapour contributions to the refractive index of the medium are examined. Atmospheric particle effects are considered: 'coherent' effects on the statistically averaged field (attenuation, phase rotation and 'in-band distortions' of the radar pulse); 'radar reflectivity' contributions to the received field; scintillation effects due to the particles 'random' motion. For each of these phenomena computations have been carried out for some ice and water cloud particles concentrations and for rains at different rates. Range errors are also computed: they seem to decrease with increasing frequency from 35 to 78 GHz. Finally, Doppler effects are found to be negligible. From the authors results it seems possible to conclude that, at least as far as the propagation is concerned, the 78 GHz band appears to be particularly suitable for spaceborn radar altimeter applications. (16 refs.)

110529 Seasonal distributions of diabatic heating during the First GARP Global Experiment. M.-Y.Wei (Space Sci. & Engng. Center, Univ. of Wisconsin, Madison, WI, USA), D.R.Johnson, R.D.Townsend.

Tellus Ser. A (Sweden), vol.35a, no.4, p.241-55 (Aug. 1983).

The seasonal and annual global distributions of diabatic heating during the First GARP Global Experiment (FGGE) are estimated using the isentropic mass continuity equation. The data used are from the FGGE Level IIIa analyses generated by the United States National Meteorological Center. Spatially and temporally coherent diabatic heating distributions are obtained from the isentropic planetary scale mass circulation that is forced by large-scale heat sources and sinks. (32 refs.)

110530 Effects of orography on Mediterranean lee cyclogenesis and its relationship to European blocking. S.Tibaldi (European Centre for Medium Range Weather Forecasts, Reading, England), A.Buzzi.
Tellus Ser. A (Sweden), vol.35a, no.4, p.269-86 (Aug. 1983).
The role of orographically-induced cyclogenesis in the lee of the Alps in favouring the onset of Euro-Atlantic blocking is investigated by means of numerical simulations of a real case. The model used is the ECMWF global grid-point model as operational in August 1980. While the essential part that the local orography (the Alps) plays in triggering the development of cyclonic disturbances is confirmed for the first time using a global model, the relationship between Alpine cyclogenesis and European blocking remains less clear. The importance of global orography in generating and maintaining the blocking pattern is subsequently investigated and its crucial role evidenced and discussed. (34 refs.)

110531 African wave disturbances in a general circulation model. M.A.Estoque, J.Shukla, J.G.Jiing (Rosentiel School of Marine & Atmospheric Sci., Univ. of Miami, Miami, FL, USA).
Tellus Ser. A (Sweden), vol.35a, no.4, p.287-95 (Aug. 1983).
Evidence is presented to show that African wave disturbances are reproduced in a general circulation simulation. The model used is the general circulation model developed by the Goddard Laboratory for Atmospheric Sciences of the National Aeronautics and Space Agency. The model is integrated in order to simulate the summer of 1974. A synoptic analysis of the simulated data over Africa for the month of July is performed. The results of the analysis show that wave disturbances are generated by the model; the behavior and the structure of the simulated disturbances are similar to those observed over tropical Africa during the northern summer. (15 refs.)

110532 Patterns of India monsoon rainfall anomalies. S.Hastenrath, A.Rosen (Dept. of Meteorology, Univ. of Wisconsin, Madison, WI, USA).
Tellus Ser. A (Sweden), vol.35a, no.4, p.324-31 (Aug. 1983).
Pattern characteristics of annual rainfall anomalies over India during 1900-72 are studied from precipitation records of 31 regional subdivisions and series of annual cyclone frequency and number of break monsoon days. Methods include spatial correlation, pattern stratification, and principal component and spectral analyses. (26 refs.)

110533 Elemental carbon in the atmosphere: cycle and lifetime. J.A.Ogren, R.J.Charlson (Dept. of Civil Engng., Univ. of Washington, Seattle, WA, USA).
Tellus Ser. B (Sweden), vol.35B, no.4, p.241-54 (Sept. 1983).
Particulate elemental carbon is found in the atmosphere in both urban and remote regions and is often responsible for much of the absorption of solar radiation by atmospheric aerosols. Its atmospheric lifetime is controlled by four factors: the initial size distribution, the concentration of ambient particles, the frequency and duration of precipitation, and the efficiencies of removal mechanisms. A model of the atmospheric cycle of particulate elemental carbon which includes these factors is used to estimate the range of atmospheric lifetimes expected under various conditions. (32 refs.)

110534 SO_2 and $SO_4^=$ in the arctic: interpretation of observations at three Norwegian arctic-subarctic stations. J.Heintzenberg (Dept. of Meteorology, Univ. of Stockholm, Stockholm, Sweden), S.Larssen.
Tellus Ser. B (Sweden), vol.35B, no.4, p.255-65 (Sept. 1983).
Three years of SO_2 and $SO_4^=$ measurements (1978-81) at three Norwegian arctic-subarctic stations (70, 74, and 79°N) are related to air mass trajectories. The average decrease in non-marine $SO_4^=$-concentrations with increasing latitude is found to agree well with the latitude distribution of direct- or short-path return-flow frequency of trajectories from the Eurasian source area. As expected from its reactive, short-lived character, average SO_2-concentrations decrease much more rapidly than the frequency of source trajectories when moving into the Arctic. The seasonal variations in sulphur concentrations and source trajectories are less well correlated, best at the southernmost station. From the study of all individual pollution episodes (defined by ≥ 2 times average sulphur concentrations) the authors deduce that an increasing fraction of high sulphur levels can be explained by long-path return flow, when moving deeper into the Arctic. (17 refs.)

110535 Atmospheric chloroform ($CHCl_3$): ocean-air exchange and global mass balance. M.A.K.Khalil, R.A.Rasmussen, S.D.Hoyt (Dept. of Environmental Sci., Oregon Graduate Center, Beaverton, OR, USA).
Tellus Ser. B (Sweden), vol.35B, no.4, p.266-74 (Sept. 1983).
Based on the observed global concentrations of chloroform ($CHCl_3$) in the air and seawater the authors demonstrate that the tropical oceans are a source of chloroform to the atmosphere. Even though the total yearly emissions of $CHCl_3$ from the oceans are still uncertain, the authors estimate the flux to be 0.35 Tg yr^{-1}. Anthropogenic sources are estimated. This result suggests that atmospheric $CHCl_3$ may be mostly natural in origin and not entirely man-made as previously thought. The global burden of $CHCl_3$ in the atmosphere is estimated. Removal mechanisms are suggested. (28 refs.)

110536 Parameterization of ice nucleation on insoluble particles. M.J.Manton (Div. of Cloud Phys., CSIRO, Epping, NSW, Australia).
Tellus Ser. B (Sweden), vol.35B, no.4, p.275-83 (Sept. 1983).
Ice nucleation on an insoluble particle is controlled by one of three limiting processes: sublimation, condensation and freezing (contact and immersion). The limiting process is determined by the supersaturation S and supercooling ΔT of the environment, and so nucleation occurs in three distinct regions of $(\Delta T, S)$ space. Within each region, the nucleation of large particles takes place at specified threshold values of ΔT and S. The threshold conditions depend upon three surface parameters, which are related to the contact angle between the nucleus substrate and the phases of water. As ΔT and S are raised above the threshold conditions, small particles are gradually nucleated. Thus the heterogeneous nucleation of ice can be specified in terms of the environmental conditions, ΔT and S, and the surface properties of the nuclei. (13 refs.)

110537 Predicting daily insolation with hourly cloud height and coverage. T.P.Meyers, R.F.Dale (Dept. of Agronomy, Purdue Univ., West Lafayette, IN, USA).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.4, p.537-45 (April 1983).
A semi-physical model based on standard meteorological data is developed to estimate solar radiation received at the Earth's surface. The radiation model includes the effects of Rayleigh scattering, absorption by water vapor and permanent gases, and absorption and scattering by aerosols and clouds. Cloud attenuation is accounted for by assigning transmission coefficients based on cloud height and amount. The cloud transmission coefficients for various heights and coverages were derived empirically from hourly observations of solar radiation in conjunction with corresponding cloud observations at West Lafayette, Indiana. The model was tested with independent data from twelve North American sites. (19 refs.)

110538 An intercomparison between radiation budget estimates from METEOSAT 1, Nimbus 7 and TIROS-N satellites. R.W.Saunders (Dept. of Phys. & Astron., Univ. Coll. London, London, England), L.L.Stowe, G.E.Hunt, C.F.England.
J. Clim. & Appl. Meteorol. (USA), vol.22, no.4, p.546-59 (April 1983).
Daily averaged and instantaneous values of the Earth's radiation budget have been computed from the satellite measurements of reflected solar and emitted terrestrial radiation with METEOSAT 1, Nimbus 7 ERB and TIROS-N scanning radiometers. The estimates have been compared for 12 selected 2.5°×2.5° latitude-longitude regions for 14 October 1979. The comparisons between the three independent data sets is discussed and an assessment is made of the relative importance of diurnal variations and anisotropic scattering models. (29 refs.)

110539 An analysis of the ground temperature and reflectivity pattern about St. Louis, Missouri, using HCMM satellite data. F.M.Vukovich (Research Triangle Inst., Research Triangle Park, NC, USA).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.4, p.560-71 (April 1983).
Analyses demonstrate marked seasonal and day/night differences. The temperature contrast between the urban and rural region averages about 4.3C°. Difference in reflectivity between the centre of St. Louis and the surrounding suburban and rural regions ranges from 2 to 4 percentage points. (30 refs.)

110540 A model for the Priestley-Taylor parameter α. H.A.R.de Bruin (Royal Netherlands Meteorological Inst., De Bilt, Netherlands).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.4, p.572-8 (April 1983).
The behaviour of the Priestley-Taylor parameter α is investigated using a simplified atmospheric boundary-layer model coupled to the Penman-Monteith equation. It is found that under conditions typical for a sunny summer day in the mid-latitudes, α is primarily determined by the surface resistance r_s ($\alpha \approx 1.3$ when $r_s = 0$, $\alpha \approx 1$ when $r_s \approx 60$ s m^{-1}, and $\alpha \approx 0.6$ when $r_s \approx 250$ s m^{-1}). This is in good agreement with experimental values reported in literature. The model is an extension of the models by McNaughton (1976) and Perrier (1980). (17 refs.)

110541 Thunderstorm top structure observed by aircraft overflights with an infrared radiometer. R.F.Adler, M.J.Markus (Goddard Lab. for Atmospheric Sci., NASA/Goddard Space Flight Centre, Greenbelt, MD, USA), D.D.Fenn, G.Szejwzch, W.E.Shenk.
J. Clim. & Appl. Meteorol. (USA), vol.22, no.4, p.579-93 (April 1983).
Thunderstorm top structure is examined with high spatial resolution radiometric data (visible and infrared) from aircraft overflights together with other storm views, including geosynchronous satellite observations. The growth period of a relatively weak cumulonimbus cluster is also examined with aircraft and satellite data. (25 refs.)

110542 Experimental studies of the turbulence structure parameters of the convective boundary layer. A.Druilhet, J.P.Frangi, D.Guedalia, J.Fontan (Lab. de Phys. des Aerosols et Echanges Atmospheriques, Toulouse, France).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.4, p.594-608 (April 1983).
Presents a collection of experimental data obtained by means of instrumented aircraft during numerous experiments carried out above five flight areas from 1973 to 1978. Only dry convective conditions with weak dynamic instability are considered. The computed quantities are vertical turbulent fluxes of sensible and latent heat, second- and third-order moments of vertical wind component, potential temperature and humidity, dissipative and spectral characteristics and length scales. All these quantities are normalised using the convective similarity hypothesis of Deardorff. (60 refs.)

110543 Severe storm observations using the microwave sounding unit. N.C.Grody (NOAA/NESDIS, Washington, DC, USA).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.4, p.609-25 (April 1983).
The microwave sounding unit (MSU) aboard the NOAA polar orbiting satellites contains four channels in the oxygen band, at 50.30, 53.74, 54.96 and 57.95 GHz, which receive thermal radiation originating primarily from four regions ranging from surface to the lower stratosphere. This study focuses on the measurements obtained for a convective storm over the central United States beginning 12 April 1979. Temperature and precipitation effects are examined by comparing the MSU measurements with 'clear column' brightness temperatures computed from radiosonde data. (18 refs.)

110544 On using historical comparisons in evaluating cloud seeding operations. K.R.Gabriel, D.Petrondas (Dept. of Statistics, Univ. of Rochester, Rochester, NY, USA).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.4, p.626-31 (April 1983).
Cloud seeding operations are often evaluated by comparing precipitation during operations with records of previous 'historical' precipitation. Extensive worldwide precipitation records are used to examine whether the usual statistical techniques may be validly applied to comparisons of precipitation in successive years. (8 refs.)

110545 Simulation of transport and removal processes of the Saharan dust. In-Young Lee (Radiological & Environmental Res. Div., Argonne Nat. Lab., Argonne, IL, USA).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.4, p.632-9 (April 1983).
A planetary boundary layer model has been modified to include a Saharan air layer containing the bulk of Saharan dust. The Saharan air layer is recognised as a deep mixed layer which extends up to 4-6 km during hot summer months and is characterised by high potential temperature and high dust concentration. Microphysical processes of particle coagulation and sedimentation have been coupled with dynamic processes to simulate the evolution of dust particles. (17 refs.)

110546 Mt. St. Helens' aerosols: some tropospheric and stratospheric effects. J.J.Michalsky, G.M.Stokes (Pacific Northwest Lab., Richland, WA, USA).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.4, p.640-8 (April 1983).
Aerosol optical depth measurements based on the attenuation of direct solar radiation before and after the six major explosive eruptions of Mt. St. Helens during 1980 are presented. These automated measurements are from a site 200 km mostly east and slightly north of the volcano. In several cases the conversion of sulphur gases to sulphates proceeded much more rapidly (hours) than is usually found for tropospheric conditions. The second major result was that there was no evidence of a residual aerosol burden. (12 refs.)

110547 The use of high horizontal resolution satellite temperature and moisture profiles to initialise a mesoscale numerical weather prediction model—a severe weather event case study. G.A.Mills (Australian Numerical Meteorological Res. Centre, Melbourne, Australia), C.M.Hayden.
J. Clim. & Appl. Meteorol. (USA), vol.22, no.4, p.649-63 (April 1983).
Describes the assimilation of sub-synoptic resolution satellite-derived temperature and moisture profiles into a mesoscale numerical weather prediction model, intended for forecasting the environment of organised convective storm complexes in the midwest of the United States. It is demonstrated that the use of high resolution satellite data to initialise the system results in a good

level of forecast accuracy for the case study chosen, with very encouraging accuracy in the forecast moisture and vertical motion fields. (33 refs.)

110548 Comparison of tetroon and computed trajectories. L.M.Reisinger, S.F.Mueller (Tennessee Valley Authority, Muscle Shoals, AL, USA).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.4, p.664-72 (April 1983).
Forty-five tetroon flights made during the summer of 1980 for the PEPE/NEROS regional pollution studies, sponsored by the US Environmental Protection Agency, were compared to computed trajectories based on National Weather Service rawinsonde wind fields. Most tetroon data were obtained for travel times of less than 10 h and travel distances of less than 150 km. Two trajectory computation algorithms were used. No significant differences were found between the two comparisons. (17 refs.)

110549 Integral scales for the nocturnal boundary layer. I. Empirical depth relationships. R.B.Stull (Dept. of Meteorology, Univ. of Wisconsin, Madison, WI, USA).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.4, p.673-86 (April 1983).
The stable-layer thickness and near-surface potential temperature strength of the nocturnal boundary layer (NBL) are shown to have a 'background' square-root of time dependence. Superimposed upon this background are other time variations caused by changes in bulk turbulence parameter B and average surface heat flux. As an intentionally different approach to the NBL problem B is modelled in terms of forcings external to the NBL rather than in terms of internal variables. Nocturnal boundary layer observations from the Wangara and Koorin field experiments in Australia are used to yield B in terms of the geostrophic wind vector, the Coriolis parameter, the acceleration due to gravity, and a site and wind-direction-dependent empirical parameter. The resulting model is shown to be adaptable to frost-warning and air-quality applications. (28 refs.)

110550 Interannual variations of mean monthly sea-level pressure in January. H.van Loon, R.A.Madden (Nat. Centre for Atmospheric Res., Boulder, CO, USA).
J. Clim. & Appl. Meteorol. (USA), vol.22, no.4, p.687-92 (April 1983).
The standard deviations of mean sea-level pressure in January are compared for five discrete 16-year periods between 1901 and 1980. The changes from one period to another are large and larger in the North Atlantic than in the North Pacific Ocean. The differences between the periods are associated with variations in the position and central pressure of the Aleutian and Icelandic lows. There is no consistent link between the two lows as their central pressure varied in parallel till the late 1930s and oppositely thereafter. (9 refs.)

110551 The Group Agromet Monitoring Project (GAMP): application of Meteosat data for rainfall, evaporation, soil-moisture and plant-growth monitoring in Africa. C.E.England (Lab. for Planetary Atmospheres, London, England), R.Gombeer, E.Hechinger, R.W.Herschy, A.Rosema, L.Stroosnijder.
ESA J. (Netherlands), vol.7, no.2, p.169-88 (1983).
Summarises the results of the Group Agromet Monitoring Project which is intended to map and monitor key agro-meteorological parameters in the Sahel of Africa. The physiography and agro-environment of the test area in Mali are described, together with ground-truth and satellite data collection, as well as the geometric and atmospheric correction of the latter. Mapping of rainfall, surface radiation, evaporation and thermal inertia are discussed. A tentative germination-mapping approach is proposed. The results of rainfall, evaporation and germination mapping over the 18d test period are presented and discussed. It is concluded that Meteosat has the ability to provide unique surface climatological data. (4 refs.)

110552 Relationships between macrocirculation atmospheric processes at levels from 10 up to 100 km over middle Asia. K.A.Karimov.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.6, p.563-9 (June 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
Presents variations of daily averaged values of the zonal wind with synoptic periods for the levels from 10 up to 100 km. Using results of radiometeor observations at Frunze during 1970-1980 the author shows a connection of macrocirculation characteristics of the lower thermosphere with similar processes in the meso-and stratosphere. Phase changes of zonal wind temporal variations at tropospheric levels are in the opposite phase with stratospheric processes and in phase with mesospheric processes plus 2π. Using many years of radiometeor wind observations with simultaneous satellite thermal soundings, results of rocket and aerological observations the author proposes and discusses an empirical three-layer model of the atmosphere describing the connection of macrocirculation processes with synoptic periods at altitudes from 10 to 100 km. (11 refs.)

110553 Radar investigation of wind field divergence in convective clouds. A.A.Ivanov, Yu.V.Mel'nichuk, A.K.Morgoev.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.6, p.576-85 (June 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
The experimental results of dual doppler radar investigations of wind field divergence in cumulonimbus clouds are presented. The average relationship between divergence components measured in the horizontal plane is found. The vertical flow speed increments computed from the data of one- and two-dimensional measurements are compared and conclusions are presented on a possibility of using the single doppler radar for wind structure observations in cumulonimbus clouds. (6 refs.)

110554 Electrooptical studies of the humidification processes of different aerosols. V.N.Kapustin, Yu.S.Lyubovtseva, S.P.Stoylov, I.Petkanchin.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.7, p.696-702 (July 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
Results of electrooptical studies of NaCl, KCl and MgO aerosols are presented. It is shown that the particle's degree of orientation depends on the induced and permanent dipole moments associated with the particle. At low relative humidity (RH) the main influence on the orientation of the particle is the permanent dipole moment. With the growth of RH the influence of the induced dipole moment shows a strong increase. The observed changes in the electrical parameters of the particles reflect the physical changes on the particle/air interface that result from adsorption of water vapour. (8 refs.)

110555 The dependence of the *Q*-branch contour of Raman spectra of water vapour on temperature. Yu.S.Georgievskii, A.N.Denisov, V.M.Kopeikin.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.7, p.709-15 (July 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
Theoretical and experimental investigations of the Q-branch contour of Raman spectra dependence on temperature are discussed for water vapour. An analysis is carried out for changes with temperature of the contour for gaussian and triangle aperture functions with widths from 1 to 2 cm^{-1} in the temperature range 0-600°C. A formula is proposed for determination of the water vapour temperature from the ratio of intensities of two peaks of the Q-branch. Temperature ranges are determined in which one can control the water vapour concentration independently of temperature by the intensity of one of the peaks. An analysis of factors influencing the accuracy of temperature determinations is carried out and the corresponding errors are estimated. (18 refs.)

110556 Microwave attenuation statistics due to rain along Earth-space path. R.Chadha, G.S.Uppal, M.K.Raina (Radio Sci. Div., Nat. Phys. Lab., New Delhi, India).
Indian J. Radio & Space Phys., vol.12, no.2, p.37-9 (April 1983).
The rain attenuation statistics at 11 and 18 GHz derived from measurements by using microwave radiometers at 11 and 18 GHz over New Delhi are described. The worst month is determined from the cumulative distribution to be Aug. 1978. Rainfall and attenuation during the period Sept.-Nov. 1977 is compared to the winter period Dec. 1977-Mar. 1978. Comparison has also been made between the measured attenuation statistics and attenuation statistics obtained using radiometric techniques and direct satellite measurements at different places around the world. (5 refs.)

110557 Barotropic wave propagation and instability, and atmospheric teleconnection patterns. A.J.Simmons (European Centre for Medium Range Weather Forecasts, Reading, England), J.M.Wallace, G.W.Branstator.
J. Atmos. Sci. (USA), vol.40, no.6, p.1363-92 (June 1983).
A global barotropic model, linearized about the 300 mb climatological mean January flow, is perturbed by applying a series of localized forcings distributed throughout the tropics and subtropics. Structures which resemble the observed 'Pacific/North American' and 'East Atlantic' teleconnection patterns noted by Wallace and Gutzler (1981) tend to recur in the responses. Similar patterns are found to result from the dispersion of isolated initial perturbations placed at a variety of locations in the tropics and midlatitudes. It is shown that these structures are related to the most rapidly growing mode associated with barotropic instability of the zonally-varying climatological basic state. In the absence of damping, this mode has an e-folding time of about a week and a period close to 50 days. (51 refs.)

110558 The Charney baroclinic stability problem: approximate solutions and modal structures. L.E.Branscome (Rosenstiel School of Marine & Atmospheric Sci., Univ. of Miami, Miami, FL, USA).
J. Atmos. Sci. (USA), vol.40, no.6, p.1393-409 (June 1983).
The classic Charney baroclinic stability problem is examined through perturbation techniques in the shortwave limit, near the first neutral curve separating Charney and Green modes, and near the second neutral curve separating long and short Green modes. This method provides simple analytical expressions for the vertical structure of the growing waves and the dependence of phase speeds and growth rates on mean flow parameters. The rapidly growing Charney modes have horizontal and vertical scales which crucially depend on the β-parameter. Structures and heat and potential vorticity fluxes are also represented by approximate solutions and their dependence on wavenumber is examined. (25 refs.)

110559 The dynamical structure of the planetary boundary layer over the Arabian Sea, as deduced from constant-level balloon trajectories. G.Reverdin, G.Sommeria (Lab. de Meteorologie Dynamique, Paris, France).
J. Atmos. Sci. (USA), vol.40, no.6, p.1435-52 (June 1983).
During Summer 1979, 88 super-pressure constant-level balloons were launched at the nominal flight level of 900 mb from the Seychelles Islands and from the northern tip of the Malagasy Republic as part of the French participation in the MONEX experiment. Balloons tracked by the Argos system onboard TIROS-N and NOAA-6 satellites provide good estimates of the wind velocity and of the Lagrangian acceleration of air masses within the planetary boundary layer. With additional wind and pressure data, a study of the balance of forces and of the vertical wind structure in the planetary boundary layer has been performed, including the computation of the vertical transport of horizontal momentum by turbulent mixing. (19 refs.)

110560 Boundary layer evolution in the region between shore and cloud edge during cold-air outbreaks. S.A.Stage (Dept. of Meteorology, Florida State Univ., Tallahassee, FL, USA).
J. Atmos. Sci. (USA), vol.40, no.6, p.1453-71 (June 1983).
Equations for the evolution of the atmospheric boundary layer during cold air outbreaks are examined and analytic solutions are obtained which apply to the region prior to cloud formation whenever the soundings of potential temperature and water vapor mixing ratio at the shore may be treated as linear. The solutions have non-dimensionalized boundary layer depth as the independent parameter. Layer depth, potential temperature, mixing ratio, dewpoint, lifting condensation level, distance from shore (fetch), net sensible heat input, and net latent heat input are found as explicit functions of a nondimensional mixed-layer height. A perturbation method is used to derive solutions when divergence is significant and is shown to be a good approximation for realistically strong divergences. (9 refs.)

110561 The adequacy of the hydrostatic assumption in sea breeze modeling over flat terrain. C.L.Martin (Simpson Weather Associates, Charlottesville, VA, USA), R.A.Pielke.
J. Atmos. Sci. (USA), vol.40, no.6, p.1472-81 (June 1983).
Using a linear analytic model and a nonlinear numerical model, the adequacy of the hydrostatic model is investigated for use in the simulation of sea and land breezes over flat terrain. Among the results it is found that for a given horizontal scale of heating, the hydrostatic assumption becomes less valid as the intensity of surface heating increases, and as the synoptic temperature lapse rate becomes less stable. The spatial scale at which the hydrostatic assumption fails is substantially smaller than suggested by Orlanski (1981). For sufficiently stable large-scale thermodynamic stratifications, for instance, aspect ratios of order unity can still produce nearly identical solutions, regardless of whether or not the hydrostatic assumption is used. (9 refs.)

110562 Case study of a hailstorm in Colorado. IV. Graupel and hail growth mechanisms deduced through particle trajectory calculations. A.J.Heymsfield (Nat. Center for Atmospheric Res., Boulder, CO, USA).
J. Atmos. Sci. (USA), vol.40, no.6, p.1482-509 (June 1983).
For pt.III see ibid., vol.40, no.3, p.686-707 (1983). The processes of development of graupel and hail which fell to the ground from a storm in northeastern Colorado on 22 July 1976 are investigated over a one-hour period. The growth and trajectories of 130000 particles of different types and sizes are calculated in the measured three-dimensional wind fields. The growth conditions that these graupel and hail (spherical ice particles smaller than and larger than 1 cm, respectively) experience are presented and their trajectories are described. Particles which become hail are those whose terminal velocities are nearly equal to the vertical velocities of the air parcels in which they develop. (18 refs.)

110563 Measurement and interpretation of hailstone density and terminal velocity. N.C.Knight, A.J.Heymsfield (Nat. Center for Atmospheric Res., Boulder, CO, USA).
J. Atmos. Sci. (USA), vol.40, no.6, p.1510-16 (June 1983).
The mass, density, fall velocity and internal structure have been determined for low-density hailstones from an early spring storm in Boulder, Colorado, and drag coefficients were calculated. The density of the permeable hail is determined from a new method of volume measurement. The results are compared to those of particles grown in a one-dimensional parcel model using the appropriate sounding. The implications of the results are discussed with reference to hail growth in convective storms. (15 refs.)

110564 The role of cloud top entrainment in cumulus clouds. J.F.Boatman, A.H.Auer (Dept. of Atmospheric Sci., Univ. of Wyoming, Laramie, WY, USA).
J. Atmos. Sci. (USA), vol.40, no.6, p.1517-34 (June 1983).
This research was undertaken to discover the role which cloud top plays in the entrainment process and to determine whether observed downdraft magnitudes could be explained on the basis of evaporative cooling. An instrumented King Air research aircraft was used to acquire thermodynamic, microphysical and dynamical data within and near cumulus clouds of the high plains and midwestern United States. Temperature and liquid water content measurements made within the clouds were used to discover the source for any entrained air via a thermodynamic treatment initially pursued by Dufour (1956), and later expanded by Paluch (1979) and Betts (1982). The entrainment source regions found were either at or above the aircraft sampling level in 78 of the 87 cases examined. It was concluded that evaporative cooling could adequately explain the magnitude of the observed downdrafts in the 51 cases where a comparison between the predicted and observed downdraft magnitude was possible. (27 refs.)

110565 Numerical studies of major and minor stratospheric warmings caused by orographic forcing. J.P.Koermer, A.Kasahara, S.K.Kao (Dept. of Meteorology, Univ. of Utah, Salt Lake City, UT, USA).
J. Atmos. Sci. (USA), vol.40, no.6, p.1552-70 (June 1983).
A primitive equation spectral model using spherical harmonics is formulated to study dynamic interactions between the troposphere and stratosphere in association with sudden stratospheric warmings. Using sigma coordinates for five tropospheric layers and log-pressure coordinates for 26 stratospheric and mesospheric layers, separate model equations for each system are combined to form single matrix governing equations. The gradual introduction of large scale topography to balanced initial states representative of observed mean winter conditions in the Northern Hemisphere is used for the generation of planetary waves during 40-day time integrations. (50 refs.)

110566 Transformed Eliassen balanced vortex model. W.H.Schubert (Dept. of Atmospheric Sci., Colorado State Univ., Fort Collins, CO, USA), J.J.Hack.
J. Atmos. Sci. (USA), vol.40, no.6, p.1571-83 (June 1983).
Considers the axisymmetric balanced flow occurring in a thermally forced vortex in which the frictional inflow is confined to a thin boundary layer. Above the boundary layer the absolute angular momentum ${}^{1}/_{2}fR^{2}=rv+{}^{1}/_{2}fr^{2}$ is conserved. R is referred to as the potential radius, i.e. the radius to which a particle must be moved (conserving absolute angular momentum) in order to change its tangential component v to zero. Using R as one of the dependent variables the equations of the Eliassen balanced vortex model are then reviewed. The roles of the actual radius r and the potential radius R are then reversed i.e. R is treated as an independent variable and r as a dependent variable. Introducing transformed components (u^{*}, w^{*}) of the transverse circulation the transformed Eliassen balanced vortex equations are then obtained. These differ from the original equations in several respects. (26 refs.)

110567 The latitude-height structure of 40-50 day variations in atmospheric angular momentum. J.R.Anderson (Dept. of Meteorology & Phys. Oceanography, MIT, Cambridge, MA, USA), R.D.Rosen.
J. Atmos. Sci. (USA), vol.40, no.6, p.1584-91 (June 1983).
Quasiperiodic variations in the relative angular momentum of the atmosphere on time scales of around 40-50 days have been observed by Langley et al. (1981). A description of the two-dimensional (latitude-height) structure of the winds responsible for these changes is constructed in this article from five years of NMC twice-daily global analyses. Using cross-spectral and amplitude-phase eigenvector techniques, the authors find these variations are associated with wavelike motions in the tropical upper troposphere that propagate poleward and downward in phase within the tropics. A coherently connected midlatitude Northern Hemisphere component is also present whose phase is essentially independent of height. The tropical component is believed to be the zonally averaged part of the motions described by Madden and Julian (1971, 1972). (22 refs.)

110568 A model of the atmospheric boundary layer over the marginal ice zone. J.E.Overland, R.M.Reynolds, C.H.Pease (Pacific Marine Environmental Lab./NOAA, Seattle, WA, USA).
J. Geophys. Res. (USA), vol.88, no.C5, p.2836-40 (30 March 1983). [received: Sept. 1983]
A one-layer, primitive equation model is presented for the atmospheric boundary layer over the marginal ice zone (MIZ). The model simulates the slow rate of inversion growth and rate of warming of the boundary layer seaward of an ice edge for off-ice winds observed on two cruises in the Bering Sea by the NOAA R/V Surveyor. The horizontal temperature gradient in the boundary layer, caused by the oceanic heat flux seaward of an ice edge, induced an increase in wind speed with a maximum increase of 8% at 50 km seaward of the edge. At 100 km off ice, a momentum balance is established between accelerative terms and decelerative terms. Wind velocity in the boundary layer over the MIZ during off-ice winds is sensitive to changes in surface roughness. (22 refs.)

110569 Electron energy deposition in the middle atmosphere. A.L.Vampola, D.J.Gorney (Space Sci. Lab., Aerospace Corp., Los Angeles, CA, USA).
J. Geophys. Res. (USA), vol.88, no.A8, p.6267-74 (1 Aug. 1983).
Spectra of locally precipitating 36- to 317-keV electrons obtained by instrumentation on the S3-2 satellite are used to calculate energy deposition profiles as a function of latitude, longitude and altitude. In the 70- to 90-km altitude, mid-latitude ionization due to these precipitating energetic electrons can be comparable to that due to direct solar H Lyman α. At night, the electrons produce ionization more than an order of magnitude greater than that expected from scattered H Lyman α. Maximum precipitation rates in the region of the South Atlantic Anomaly are of the order of 10^{-2} erg/cm^{2} s with a spectrum of the form $j(E)=1.34\times10^{5}\ E^{-2.27}$ (keV). (39 refs.)

110570 A comparison between computed and measured oceanic winds near the British Columbia coast. R.E.Thomson (Inst. of Ocean Sci., Sidney, BC, Canada).
J. Geophys. Res. (USA), vol.88, no.C4, p.2675-83 (20 March 1983). [received: Sept. 1983]
Winds measured over the continental shelf off Vancouver Island during the summers of 1979 and 1980 are compared with winds computed by the National Marine Fisheries Service (Monterey, California), using synoptic surface atmospheric pressures. Although there is considerable qualitative similarity between the two sets of data, the computer 6-hourly winds fail accurately to resolve short-period fluctuations associated with transient wind systems and tend to underestimate the percentages of time of low and high wind speeds. In the frequency domain, the computed winds are representative to the oceanic winds for periods exceeding roughly 2 days but only marginally representative for periods of $1^{1}/_{2}$-2 days. At periods less than about $1^{1}/_{2}$ days, computed winds are not reliable indicators of oceanic wind variability. Moreover, the computed winds possess a large-amplitude sea breeze (diurnal) component that is present in the inner shelf wind data but not in the outer shelf wind data. (11 refs.)

110571 The influence of the Antarctic Peninsula on the wind field over the western Weddell Sea. T.R.Parish (Dept. of Atmospheric Sci., Univ. of Wyoming, Laramie, WY, USA).
J. Geophys. Res. (USA), vol.88, no.C4, p.2684-92 (20 March 1983). [received: Sept. 1983]
The Antarctic Peninsula is a formidable barrier to the easterly flow of stable air over the Weddell Sea. The damming up of cold stable air against the peninsula mountains creates a pressure field which provides the necessary dynamic support for strong, mountain-parallel winds often observed along the east side. Numerical experiments, using a two-dimensional (x,z) primitive equation model incorporating a cross section of the terrain of the Antarctic Peninsula, are carried out in attempt to simulate the principle features of these barrier winds. Implications of the wind field are discussed. (16 refs.)

110572 Eclipse-related measurements of middle-atmosphere electrical parameters. J.D.Mitchell, L.C.Hale, C.L.Croskey (Electrical Engng. Dept., Pennsylvania State Univ., University Park, PA, USA), R.O.Olsen.
J. Atmos. & Terr. Phys. (GB), vol.45, no.7, p.515-25 (July 1983). (Meeting of the American Geophysical Union on the Total Solar Eclipse of 26 February 1979, Toronto, Ont., Canada, May 1980).
Measurements of electrical conductivity and its constituent parameters, charge density and ion mobility, are presented for the solar eclipse rocket campaign conducted at Red Lake, Ontario, Canada. Three parachute-borne probes (two Gerdien condensers and a blunt probe) were flown during the eclipse which occurred on 26 February 1979. Addtitional payloads launched at other times provided important supplemental background measurements. The entire launch series occurred during aurorally active conditions. Specifically, positive conductivity enhancements above 45 km demonstrate the dominance of auroral ionization as a source for positive ions in the region. Such effects evidenced during the eclipse make it difficult to determine the extent to which the decrease in positive conductivity above 60 km is eclipse-related. (27 refs.)

110573 Recent measurements of electrical conductivity and ion pair production rate, and the ion-ion recombination coefficient derived from them in the lower stratosphere. Y.Morita (Res. Inst. of Atmospherics, Nagoya Univ., Toyokawa, Japan).
J. Geomagn. & Geoelectr. (Japan), vol.35, no.2, p.29-38 (1983).
The results of balloon measurements of electrical conductivity and ion pair production rate obtained from the Atmospheric Electrical Measurements Workshop at the University of Wyoming in the summer of 1978 are presented. Reasonable agreement is obtained from comparing the flights for electrical conductivity measurements. A small difference in the compared measurements of ion pair production rate is found at stratospheric heights. The profiles of ion pair production rate measured during the period of different sunspot numbers show a marked dependence of ion pair production rate on solar activity. (26 refs.)

110574 Atmospheric-pollution monitoring through conductivity measurements.. M.Carlevaro (Istituto di Elettrotechnica, Facolta di Ingegneria, Univ. di L'Aquila, L'Aquila, Italy), D.Paloetti.
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.15, p.539-43 (13 Aug. 1983).
The possibility to correlate the density of gaseous pollutants in the atmosphere (SO_2, NO_x) and the state of air ionization, defined by the volumetric density of ions of different sizes and mobilities has been experimentally investigated. A description is given of a possible method of measurement of atmospheric pollution, based on such a correlation. Preliminary experiments are reported. (3 refs.)

110575 Meteorology and crop-spraying. N.Thompson (Meteorological Office, Bracknell, England).
Meteorol. Mag. (GB), vol.112, no.1333, p.249-60 (Aug. 1983).
Adverse weather can seriously degrade the effectiveness and safety of crop-spraying and, in particular, may lead to damaging spray drift. The author provides a brief review of meteorological factors of importance in crop-spraying, and gives quantitative descriptions of spray drift and the related off-target uptake and deposition of pesticides in both vapour and drop forms. (24 refs.)

110576 Concorde forecasts and the new 15-level model. N.J.Atkins (Meteorological Office, Bracknell, England).
Meteorol. Mag. (GB), vol.112, no.1333, p.261-5 (Aug. 1983).
A global 15-level numerical model recently replaced the 10-level model at Bracknell and its behaviour in relation to the preparation of 100 mb flight forecast charts for Concorde aircraft has been monitored. Results so far are favourable, although a few dynamical problems have emerged. (2 refs.)

110577 Constructing a flow model with accurate satisfaction of the boundary conditions at a cylindrical profile. V.N.Kozhevnikov, A.S.Losev (Dept. of Atmospheric Phys., Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.5, p.48-55 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.5, p.43-50 (1982).
The question of accurately taking account of the real extended relief into account in the two-dimensional flow problem (in a vertical plane) is considered. The algorithm constructed may also be used in other theoretical models. It is shown, in several examples of calculations for real mountains, that in the flow problem sufficient accuracy is necessary both in taking account of the lower boundary condition and in calculating the trajectories of motion. Calculations show that the perturbations are intense immediately above the mountains, and are almost degenerate in the leeward direction. (12 refs.)

110578 Dispersion limitations of oxidation in power plant plumes during long-range transport. A.T.Cocks, A.S.Kallend, A.R.W.Marsh (Central Electricity Res. Labs., CEGB, Leatherhead, England).
Nature (GB), vol.305, no.5930, p.122-3 (8 Sept. 1983).
During the atmospheric transport of combustion-generated emissions of SO_2 and NO from point sources, the kinetics of oxidation processes are of particular importance in determining the pattern of subsequent wet and dry deposition because oxidation products such as sulphate aerosol and nitric acid may have deposition characteristics totally different from those of primary emissions. The authors report results of measurements made by an instrumented aircraft of the chemistry within a labelled plume on a trajectory over the North Sea which indicate that oxidation of plume material may be limited by dispersion at distances of at least 650 km. (10 refs.)

110579 Upper stratospheric circulations in the two hemispheres observed by satellites. I.Hirota, T.Hirooka, M.Shiotani (Geophys. Inst., Kyoto Univ., Kyoto, Japan).
Q. J. R. Meteorol. Soc. (GB), vol.109, no.461, p.443-54 (July 1983).
A global analysis is made of upper stratospheric circulations with the aid of Nimbus 5 and Tiros N satellite observations in order to make a comparison of characteristics between the northern hemisphere (NH) and the southern hemisphere (SH). It is shown that the reversal of north-south gradient of the zonal mean temperature at the stratopause level is always observed in the higher latitudes of the SH winter, while the temperature gradient of the NH winter is variable because of the occurrence of sudden warmings. Consequently, due to the thermal wind relation, the polar night westerlies of the SH stratosphere are generally stronger than those of the NH stratosphere. In association with this difference, the activity of transient planetary waves of wavenumber 2 is striking in the SH, in contrast to the predominance of steady waves in the NH. (22 refs.)

110580 The steady, linear response of the stratosphere to tropospheric forcing. D.J.Karoly, B.J.Hoskins (Dept. of Meteorology, Univ. of Reading, Reading, England).
Q. J. R. Meteorol. Soc. (GB), vol.109, no.461, p.455-78 (July 1983).
A linearized, steady-state, 15-level numerical model is used to study the stationary planetary wave response of the stratosphere to thermal and orographic forcing in the troposphere. Zonally symmetric basic states representative of northern hemisphere winter and summer conditions are used. Solutions for each zonal wavenumber are considered separately. Eliassen-Palm cross-sections are used as a diagnostic of wave propagation. First, several simple thermal and orographic forcing distributions are used in the winter basic state. The response in the stratosphere is sensitive to changes in the zonal wind but its structure is insensitive to the forcing mechanism and to the dissipation used in the model. For representative northern hemisphere thermal and orographic forcing, solutions in winter agree well with observations except for wavenumber one, which has too small an amplitude and an incorrect structure. (32 refs.)

110581 A spectral model of the zonally averaged circulation in the middle atmosphere. H.Volland (Radioastronomical Inst., Univ. of Bonn, Bonn, Germany).
Q. J. R. Meteorol. Soc. (GB), vol.109, no.461, p.479-99 (July 1983).
Most papers dealing with numerical simulation of the zonally averaged atmospheric circulation start with the solar heat input as an external source that drives the circulation. In this paper, the reverse way will be followed. First, the meridional structure of the wave modes with zonal wavenumber $m=0$ within the atmospheric waveguide is determined from tidal theory. Then the height structure of these modes is calculated numerically applying heat source configuration per mode by trial and error such that the observed global zonal wind and temperature fields between 0 and 100 km can be reproduced reasonably well. (25 refs.)

110582 Simulation of the atmospheric response to soil moisture anomalies over Europe. P.R.Rowntree, J.A.Bolton (Meteorological Office, Bracknell, England).
Q. J. R. Meteorol. Soc. (GB), vol.109, no.461, p.501-26 (July 1983).
Positive and negative anomalies in the initial soil moisture over central Europe were introduced in turn into integrations of a global model of the July atmosphere. The results show that by modifying the partitioning of the turbulent fluxes such anomalies can have major effects on the modelled rainfall, humidity and temperature during the following 50 days over the anomaly area and that the anomalies can propagate into adjacent land areas. Similar results were obtained with a lower-resolution version of the model. The effects of rainfall were already important on day 3 of the integration over the anomaly area and on day 6 over parts of Scandinavia outside the anomaly area. The experiment was repeated with a version of the model in which the prevailing flow over Europe was less weak with increased moist westerly flow from the Atlantic. (16 refs.)

110583 Nonlinear mountain waves in two and three spatial dimensions. W.R.Peltier (Dept. of Phys., Univ. of Toronto, Toronto, Ontario, Canada), T.L.Clark.
Q. J. R. Meteorol. Soc. (GB), vol.109, no.461, p.527-48 (July 1983).
A three-dimensional, time-dependent, anelastic model is employed to simulate the evolution of nonlinear internal waves which are forced by stratified flow over isolated topography. Both two-dimensional and three-dimensional flows are considered. In the former case the discussion focuses upon the development of the wave field induced by a uniform mean flow with constant stability. The full three-dimensional model is employed to study the nonlinear development of atmospheric 'ship-waves' which have recently been observed in satellite photographs to the lee of oceanic islands in the Norwegian and Barents seas. The model is able to reproduce the characteristics of the observed wave patterns rather nicely when it is initialized with vertical profiles of wind and stability obtained through upper air ascents from stations located on the islands themselves. (17 refs.)

110584 A study of meteorological patterns associated with a lake confined by mountains—the Dead Sea case. M.Segal, Y.Mahrer, R.A.Pielke (Dept. of Atmospheric Sci., Colorado State Univ., Fort Collins, CO, USA).
Q. J. R. Meteorol. Soc. (GB), vol.109, no.461, p.549-64 (July 1983).
A planned project to generate hydroelectric power by carrying Mediterranean water into the Dead Sea has stimulated a preliminary numerical model study of the regional meteorological patterns and the evaluation of some possible local climatic modifications. Predicted mesoscale meteorological patterns associated with two frequent synoptic conditions over the region are presented. Emphasis has been focused on illustrating and studying two general aspects of the thermal circulations generated by a lake which is confined between mountains (LMC): the effect of external flows on the LMC structure and the effects of lake water temperature on the LMC intensity. (33 refs.)

110585 Solutions to a model of a front forced by deformation. M.J.P.Cullen (Meteorological Office, Bracknell, England).
Q. J. R. Meteorol. Soc. (GB), vol.109, no.461, p.565-73 (July 1983).
A semi-geostrophic deformation model of a front studied by B.J. Hoskins (1982) and F.P. Bretherton (1972) is studied further. It is shown that a unique solution of the Lagrangian conservation laws governing the motion can still be constructed after the front has formed. This solution shows that separate upper and lower fronts propagate into the fluid, and are separated by a region where only smooth variations occur. Finite difference solutions of the primitive equations are also given which converge to a front with the correct mean slope and maximum long-front velocity but without the correct variation in slope through the depth of the fluid. (5 refs.)

110586 A model of the feeder-seeder mechanism of orographic rain including stratification and wind-drift effects. D.J.Carruthers, T.W.Choularton (Phys. Dept., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
Q. J. R. Meteorol. Soc. (GB), vol.109, no.461, p.575-88 (July 1983).
Orographic enhancement of rain via the 'feeder-seeder' mechanism has been calculated using a stratified airflow model. The effect of wind drift on precipitation has been included. Comparisons have been made using potential flow models both in two and in three dimensions and in the model of M.J. Bader and W.T. Roach (1977). For high windspeeds ($\gtrsim 15$ m s^{-1}), when large enhancements occur, the potential flow treatment is sufficient. Inclusion of stratification does not significantly affect the total washout, although in the case of long hills (half-length ≥ 10 km) the precipitation maximum is moved upwind. For long hills the results are also in close agreement with the model of Bader and Roach. Over shorter hills both wind drift and non-hydrostatic effects are important. Wind drift decreases both maximum and total enhancements. (16 refs.)

110587 Laboratory studies of the charging of soft-hail during ice crystal interactions. E.R.Jayaratne, C.P.R.Saunders, J.Hallett (Phys. Dept., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
Q. J. R. Meteorol. Soc. (GB), vol.109, no.461, p.609-30 (July 1983).
A laboratory investigation of electric charge transfer during the impact of vapour-grown ice crystals and supercooled water droplets upon a simulated soft-hailstone target has shown that the magnitude of the charge transferred to the riming surface when crystals separate from it is a function of temperature, crystal dimension, relative velocity, liquid water content, and impurity content of the water droplets and hence the impurity content of the riming target. The sign of the charge transfer depends on temperature, liquid water content and droplet and rime impurity content. It is suggested that there are two distinct charge transfer processes during crystal interactions with an ice target, the dominant one requiring the presence of supercooled water droplets. Careful control and knowledge of the microphysical properties of the clouds used in these experimental simulations has permitted an examination of charge transfer under many of the conditions used in previous studies. (32 refs.)

110588 The scavenging of particles by electrified drops: radar echo intensification following lightning. E.Barker, J.A.Bicknell, R.F.Griffiths, J.Latham, T.S.Verma (Phys. Dept., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
Q. J. R. Meteorol. Soc. (GB), vol.109, no.461, p.631-44 (July 1983).
A series of laboratory experiments were performed in an effort to improve the understanding of the physics of the echo-intensification phenomenon, in which the radar reflectivity of a region of a thundercloud increases rapidly immediately following the occurrence of lightning within it. Measurements were made of the charges, q, deposited on falling water drops when they engage in direct interactions with positive corona streamers in a uniform electric field, E, just above the limit for propagation, E_0. As the drop radius increased from 12 to 950 μm, q increased from about 10^{-13} to about 10^{-10}C; and C increased as E was raised above E_0. The collection efficiencies of drops in the radius range 40 to 120 μm was determined. A simple analysis indicates that reported echo-intensification observations cannot be explained in terms of these enhanced collection efficiencies, but could possibly be a consequence of the greatly enhanced velocities (and hence growth rates) of drops of radius ~ 100 μm highly charged by direct interaction with corona streamers in the intense electric fields of a thundercloud. (27 refs.)

110589 Turbulent dispersion from an elevated line source: Markov chain simulations of concentration and flux profiles. B.J.Legg (CSIRO Div. of Environmental Mech., Canberra, Australia).
Q. J. R. Meteorol. Soc. (GB), vol.109, no.461, p.645-60 (July 1983).
A Markov chain model that simulates the trajectories of fluid particles in turbulent flow is described. It incorporates fluctuations in vertical and streamwise velocity, and can be used with velocities that have a skewed probability distribution. The model is used to estimate the distribution of heat downwind from an elevated line source in the boundary layer above a rough surface, and the results are compared with those from a wind tunnel experiment. The simplest model, with fluctuations in vertical velocity only, underestimates the plume depth by 4% to 22% at various distances downwind, and underestimates the rise in the mean height of the plume by 1.5 mm in 25.5 mm. The inclusion of streamwise velocity fluctuations increases the vertical plume width by 6% and also improves the prediction of the mean height of the plume. (31 refs.)

110590 A laboratory experiment on momentum and heat transfer in the stratified surface layer. K.Fukui, M.Nakajima (Dept. of Chem. Engng., Himeji Inst. of Technol., Himeji, Japan), H.Ueda.
Q. J. R. Meteorol. Soc. (GB), vol.109, no.461, p.661-76 (July 1983).
Stratification effects on transport processes in the atmospheric surface layer or in the wall region are investigated by a laboratory experiment. A fully developed stratified condition was attained in turbulent flow between horizontal parallel plates kept at different temperatures. The experiment was performed both for stable and unstable conditions and provided conclusive data on stratification effects. A local gradient model is proposed, based on the concept that stratification effects may be evaluated at the same non-dimensional distance from the wall $z^{+}(\equiv z u_{w}^{*}/\nu_{w}$; u_{w}^{*}, ν_{w}, being friction velocity and kinematic viscosity, respectively, at the wall), the effects depending only on $\zeta(\equiv z/L$; L being the Monin-Obukhov length). A comparison of the shear functions with previous field and laboratory experiments shows excellent agreement. By use of this concept, the measured intensities of velocity and temperature fluctuations near the wall are also well correlated with ζ. (35 refs.)

110591 Measurement of the solar spectral irradiance at Tanashi, Tokyo. III. M.Habu, M.Suzuki, T.Nagasaka (Electrotech. Lab., Ibaraki, Japan).
Res. Electrotech. Lab. (Japan), no.830, p.1-175 (Jan. 1983). In Japanese.
For pt.II see ibid., no.812, p.1-152 (1981). Deals with the measurement of spectral irradiance on the horizontal plane produced by global solar radiation, that is, the combination of direct solar radiation and sky radiation. The instrument covers the spectral region of 295.1 nm to 1083.7 nm and measurements are made at 54 wavelengths which are more densely distributed in the shorter wavelength range than i the longer one, by comparing global solar radiation with radiation from a standard lamp of spectral irradiance calibrated at the ETL. The period of measurements is from December 1978 to February 1980, and measured data of 318 sets in total have been obtained. The data are classified according to four seasons, four grades of atmospheric

turbidity, and four groups of total cloud amount. The following relationships have been examined: relationship between correlated color temperature of solar radiation and solar altitude; relationship between chromaticity coordinates of solar radiation and the Planckian locus; and relationship between illuminance produced by global solar radiation and solar altitude. (14 refs.)

110592 The scintillations for weak atmospheric turbulence using a partially coherent source. Y.Baykal, M.A.Plonus, S.J.Wang (Dept. of Electrical Engng. & Computer Sci., Northwestern Univ., Evanston, IL, USA).
Radio Sci. (USA), vol.18, no.4, p.551-6 (July-Aug. 1983).
The scintillation index for weak atmospheric turbulence is formulated for a partially coherent source (in space and time). Results for two cases when the detector has a slow and a fast response time are obtained. The solutions correctly reduce to the known scintillation index in the limit of coherent and incoherent sources. Transmitter aperture averaging and frequency averaging effects are shown as special cases. The limitations of the source model used and the solution obtained for a fast detector are discussed. (16 refs.)

110593 Rays and modes in a nonuniform troposphere. A.V.Kukushkin, V.G.Sinitsin (Inst. of Radiophys. & Electronics, Acad. of Sci., Kharkov, Ukrainian SSR).
Radio Sci. (USA), vol.18, no.4, p.573-81 (July-Aug. 1983).
A version of the hybrid (ray mode) representation of wave fields has been suggested which is convenient with refractive index profiles corresponding to simultaneously existing surface and elevated ducts. The field at the reception point is represented as a sum of normal modes peculiar to an isolated surface duct and an assembly of rays reflected from the elevated layer. (14 refs.)

110594 Statistical properties of centimeter and millimeter wave fields above the sea surface. M.G.Balan, S.B.Bespechnyi, N.V.Gorbach, Yu.A.Pedenko, V.B.Razskazovskii (Inst. of Radiophys. & Electronics, Acad. of Sci., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.11, p.899-906 (Nov. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.11, p.1260-8 (Nov. 1982). [received: Sept. 1983]
Discusses the results of experimental studies of the statistical properties of a direct signal (in the 3.2-cm, 8-, 4-, and 2-mm bands) propagating over a rough sea surface at small grazing angles. The authors show that the distribution law for signal amplitude fluctuations over a short path (0.75 km) is neither a Rice nor Rayleigh distribution, which are more characteristic of long path lengths (16 km). They compare the experimental and calculated values of the diffuse scattering coefficient for various values of the Rayleigh parameter, and analyze data on the mutual spatial correlation of amplitude fluctuations, making it possible to recognize a significant anisotropy in the horizontal and vertical planes. (16 refs.)

110595 Planetary lightning: Earth, Jupiter, and Venus. M.A.Williams, E.P.Krider (Inst. of Atmospheric Phys., Univ. of Arizona, Tucson, AZ, USA), D.M.Hunten.
Rev. Geophys. & Space Phys. (USA), vol.21, no.4, p.892-902 (May 1983).
Terrestrial lightning is usually produced by convective clouds that contain supercooled water, ice, and precipitation. The available evidence suggests that interaction between riming ice particles and supercooled water, followed by a gravitational separation of charged precipitation elements, is the dominant mechanism for cloud electrification on Earth. These mechanisms probably operate on Jupiter in the H_2O cloud, and optical images of lightning and whistlers have been detected by Voyager 1. Optical searches for lightning on Venus have been inconclusive, but have set an upper limit to the planetary flashing rate of about 30 km^{-2} yr^{-1}. (108 refs.)

110596 Organic films on atmospheric aerosol particles, fog droplets, cloud droplets, raindrops, and snowflakes. P.S.Gill, T.E.Graedel (Bell Labs., Murray Hill, NJ, USA), C.J.Weschler.
Rev. Geophys. & Space Phys. (USA), vol.21, no.4, p.903-20 (May 1983).
Surface-active organic molecules are common constituents of atmospheric aerosol particles, raindrops, and snowflakes. The authors review the literature pertaining to organic films on aqueous surfaces, and the surface-active organic compounds in atmospheric water. New measurements of surface tension of aqueous solutions of common atmospheric organic compounds (β-pinene, *n*-hexanol, eugenol and anethole) are reported, and it is demonstrated that the compounds produce films with properties similar to those of the more well known surfactants. It is concluded that organic films are probably common on atmospheric aerosol particles and that they may occur under certain circumstances on fog droplets, cloud droplets, and snowflakes. (155 refs.)

110597 Organic material in the global troposphere. R.A.Duce (Center for Atmospheric Chem. Studies, Graduate School of Oceanography, Univ. of Rhode Island, Kingston, RI, USA), V.A.Mohnen, P.R.Zimmerman, D.Grosjean, W.Cautreels, R.Chatfield, R.Jaenicke, J.A.Ogren, E.D.Pellizzari, G.T.Wallace.
Rev. Geophys. & Space Phys. (USA), vol.21, no.4, p.921-52 (May 1983).
Reviews the information presently available on concentration distribution, sources, sinks, and atmospheric transformation reactions of organic matter in the global troposphere. The data base for tropospheric organic compounds is very small. However, it is apparent that while anthropogenic sources often dominate the atmospheric chemistry of organic material in urban and near-urban air, a key to understanding the global cycling of tropospheric organic substances is a clear understanding of the interaction of the atmosphere with the terrestrial and marine biosphere. (215 refs.)

110598 Chemical composition of precipitation. V. N.Kukubu, H.Saeki, A.Fujitsuka (Univ. of Electro-Communications, Tokyo, Japan).
Rep. Univ. Electro-Commun. (Japan), vol.33, no.2, p.247-56 (Feb. 1983).
For pt.IV see ibid., vol.32, no.1, p.49-57 (1981). The results of the determinations made from April 1979 to March 1980 around Tokyo are reported. Ten sampling stations were selected from Tokyo and Kanagawa Prefecture. The precipitations were recovered every month. The samples were filtered and rain and insoluble materials were separated as in preceding reports. Total amount of rain water, pH values, total amount of insoluble materials, redox potential, Na, K, Ca, Mg, F, Cl, and SO_4 are determined. The variations of chemical composition of precipitation and of the chemical constituents are discussed. Secular change of the chemical constituents is also described. (5 refs.)

110599 The current status of the knowledge of stratospheric ozone. H.Suzuki (Chem. Div., Daikin Kogyo Co., Osaka, Japan).
Refrigeration (Japan), vol.58, no.666, p.355-71 (April 1983). In Japanese.
Reviews the use of freon gas and its connection with the ozone problem. The author considers atmospheric structure and the characteristics of the ozone layer in the stratosphere. The emergence of theories related to the depletion of the ozone layer by chlorofluorocarbons (CFCs) is reconsidered and a comparison is made between predicted and observed changes. CFC sinks and photochemical reactions are discussed and presently observed changes in the ozone layer are analyzed and compared to the latest theories. Effects of ozone depletion on the flora and fauna are examined and global efforts to control CFC use are described. (10 refs.) *M.J.C.*

110600 Circumglobal transport of the El Chichon volcanic dust cloud. A.Robock, M.Matson (Dept. of Meteorology, Univ. of Maryland, College Park, MD, USA).
Science (USA), vol.221, no.4606, p.195-7 (8 July 1983).
The stratospheric dust cloud from the 4 April 1982 eruption of El Chichon volcano in southern Mexico was observed to travel completely around the world in a 3-week period. Images from satellites operated by the National Oceanic and Atmospheric Administration were used to prepare daily maps of the location of the volcatile dust cloud, which is the largest and longest-lasting one so far observed with satellite imagery. (2 refs.)

110601 Some properties of the radioactivity of radon and thoron daughters in certain meteorological conditions. O.Sima (Facultatea de Fizica, Univ. Bucuresti, Bucuresti, Rumania), C.Dovlete, M.Alexandrescu.
Stud. & Cercet. Fiz. (Rumania), vol.35, no.6, p.537-45 (1983). In Rumanian.
The radioactivity of Rn-222 and Rn-220 daughter products in aerosols was measured 12 times a day during two periods in autumn (September 1977) and winter (February 1978). The results are discussed in connection with several meteorological parameters. The strong influence of the snow layer thickness on the thoron flux from soil to atmosphere is demonstrated. The correlation of aerosol radioactivity with some factors that condition the turbulent diffusion in the boundary layer is also presented. (12 refs.)

110602 Experimental validation of a spectral direct solar radiation model. R.Guzzi, G.Lo Vecchio (Istituto di Fisica, Univ. di Ferrara, Ferrara, Italy), R.Rizzi, G.Scalabrin.
Sol. Energy (USA), vol.31, no.4, p.359-63 (1983).
A model of spectral direct radiation of the Sun at the ground compared with the spectral measurements performed by a monochromator has evidenced a satisfactory agreement. However, some discrepancies, mainly in the shorter wavelength range, have been evaluated. In order to point out the causes of these discrepancies a long series of data of direct integral radiation, water vapour content, aerosol turbidity together with standard meteorological data were measured. These causes are defined by means of a statistical analysis. (16 refs.)

110603 Contribution to the study of solar radiation in Burgos, Spain. A.de Miguel, J.Bilbao (Dept. Mecanica y Termologia, Colegio Univ. de Burgos, Burgos, Spain).
Sol. Energy (USA), vol.31, no.4, p.365-75 (1983).
A series of daily measurements of global solar radiation on horizontal surface realized during the period 1978-82 in Burgos, Spain, is analysed. The mean decadic values show fluctuations, in the spring and at the beginning of the summer especially. The absolute maximums generally appear in July with values that oscillate between 23 and 26 MJm^{-2}, and the minimums in January or December with values between 4 and 5 MJm^{-2}. Averaging the analogous months the authors obtain the maximum in July with a value of 23 MJm^{-2}. The authors have studied the elemental statistic characteristics and remark that the interquartile range is small in the winter months and increases in the spring and summer. The number of the days in which the radiation has remained inferior to a given value has been calculated in the frequency analysis, remarking that in the days corresponding to the period of the winter appear radiation values inferior to 10 MJm^{-2} and only 3% of July days are below this value. The authors have defined and determined the potential radiation and have calculated the extraterrestrial radiation in order to know the attenuation of global radiation in its passage through the atmosphere. The authors remark that the energy percentage transmitted by the atmosphere increases from winter to summer, a maximum value of 59% is obtained in July and a minimum of 30% in December. The atmospheric transparency without clouds oscillates between 71% in the spring and 62% in the winter. (8 refs.)

110604 An interpretation of the coefficients of the Angstrom equation. K.J.A.Revfeim (Meteorological Service, Wellington, New Zealand).
Sol. Energy (USA), vol.31, no.4, p.415-16 (1983).
In the report which suggested a linear relationship between global radiation and relative sunshine duration Angstrom simply referred to the coefficients as 'constants', with no physical interpretation being given. A physical model was developed by the author in 1981 to better utilize the information content of hourly sunshine fractions which is the common method of measuring suncard burns. This model has a simple interpretation, in terms of the mean and variance of sunshine fractions, which has the same form as the Angstrom equation. This model and its interpretation of the Angstrom equation is discussed. (8 refs.)

110605 Estimation of the total solar radiation from meteorological data in the Italian climatic area. O.A.Barra (Dept. of Phys., Univ. of Calabria, Cosenza, Italy).
Sol. Energy (USA), vol.31, no.4, p.427-8 (1983).
The Sabbagh-Sayigh-El Salam model [1977] developed for Saudi-Arabia has been properly modified in order to work in the Italian climatic area. The total solar radiation is evaluated by the model with a relative error never greater than 10 per cent, i.e. of the same order of magnitude as the errors affecting the available experimental data. The same model can probably be extended to the whole Mediterranean area or to other temperate climates with simple small variations of the numerical values of the model parameters. The model gives the total solar radiation for all the sites where meteorological data are available and it is absolutely reliable for solar system design purposes. (14 refs.)

110606 Mesoscale numerical weather forecasting. N.F.Vel'tishchev, A.A.Zhelnin, V.Z.Kisel'nikova, E.M.Pekelis, D.Ya.Pressman (Hydrometeorological Res. Center, USSR).
Sov. Meteorol. & Hydrol. (USA), no.4, p.1-9 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.4, p.5-15 (1982).
A model for the local forecasting of meteorological elements based on the equations of deep convection considering Coriolis force is described. (20 refs.)

110607 Spatial correlation functions of humidity in Western Siberia and northern Kazakhstan. L.P.Kuznetsova, T.A.Mozhina (Inst. of Water Problems, USSR).
Sov. Meteorol. & Hydrol. (USA), no.4, p.35-9 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.4, p.44-9 (1982).
Seasonal spatial correlation functions of humidity at the level of isobaric surfaces 850 and 700 mb and moisture content in the troposphere calculated from the mean monthly values of the indicated characteristics during the period 1961-1970 for Western Siberia and Northern Kazakhstan are examined. (6 refs.)

110608 Attenuation of signals in hydrometeors on satellite communication links. M.B.Kaplunov.
Telecommun. & Radio Eng. Part 1 (USA), vol.36, no.8, p.30-4 (Aug. 1982). Translation of: *Elektrosvyaz (USSR)*, vol.36, no.8, p.34-6 (Aug. 1982).
The attenuation of signals by hydrometeors (rain, snow, fog, etc.) is a substantial obstacle in the widespread use of frequencies above 10 GHz, assigned to satellite communications. A large volume of statistical data on signal atte-

nuations in satellite links has been gathered during recent years. This data enables the method described to be used to calculate the energy parameters of satellite communication lines as they apply to cases of practical importance, such as significantly large ranges between the stations and the time-division multiple access. The calculations are reduced to simple formulas and graphs. (5 refs.)

110609 A method for calculating the attenuation of radio waves in rain on ground links. E.A.Larin.
Telecommun. & Radio Eng. Part 1 (USA), vol.36, no.8, p.48-55 (Aug. 1982). Translation of: *Elektrosvyaz (USSR)*, vol.36, no.8, p.48-55 (Aug. 1982).
The possibility of constructing wideband communications systems, followed by the solution of the problem of their electromagnetic compatibility with other radio devices is the basic reason for the present investigations of the propagation of radio waves at frequencies above 10 GHz. The method for predicting the probable attenuation of radio signals in the rain was derived by processing a large volume of meteorological data. It was possible to detect the required variations of the spatial parameters of the rain as functions of its average parameters at the point of observation. (11 refs.)

110610 Increasing the accuracy of signal level computations on tropospheric radio links. O.N.Kiselev.
Telecommun. & Radio Eng. Part 1 (USA), vol.36, no.8, p.56-7 (Aug. 1982). Translation of: *Elektrosvyaz (USSR)*, vol.36, no.8, p.54 et seq. (Aug. 1982).
Outlines statistical methods for calculating mesoinhomogeneities in tropospheric radio links. (5 refs.)

110611 The gain in signal stability when using adaptive receiving antennas for long-distance tropospheric communications links. O.P.Frolov.
Telecommun. & Radio Eng. Part 1 (USA), vol.36, no.9, p.26-9 (Sept. 1982). Translation of: *Elektrosvyaz (USSR)*, vol.36, no.9, p.44-6 (Sept. 1982).
The low level of the received signal from LTP (long-distance tropospheric propagation) communication links results in the need to use receiving antennas with a large aperture area. In the situation under consideration, it is good practice to use reflector type antennas which 'pick up' an incident tropospheric wave and reflect it to the focal region. The positioning in the focal region of a special radiator with control elements which change the field distribution in the aperture of the radiator, provides a complex interface between the distribution of the external field and the inherent distribution of the adaptive radiator. (4 refs.)

110612 On the instability of internal Alfven-gravity waves in stratified shear flows. A.S.Narayanan (Dept. of Appl. Maths., Indian Inst. of Sci., Bangalore, India).
Z. Angew. Math. & Phys. (Switzerland), vol.34, no.4, p.545-9 (July 1983).
Internal Alfven-gravity waves and their stability characteristics for an inviscid, nondissipative, Boussinesq fluid undergoing shear in the presence of a lower rigid boundary is studied. The model consists of a layer of constant shear capped by a layer of constant velocity. The Brunt-Vaisala frequency is assumed to be uniform throughout the fluid. The unstable modes have wavelengths which are close to those of the internal Alfven-gravity waves which propagate from the troposphere into the ionosphere. (10 refs.)

110613 Wave propagation and remote sensing. D.T.Gjessing (Royal Norwegian Council for Sci. & Industrial Res., Kjeller, Norway).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.xvii-xxx
In general terms, an object probed by electromagnetic waves can be characterized by the distribution of scatterers along and transverse to the propagation direction, the chemical surface structure of the object, the surface temperature and the motion pattern. A unified set of first order expressions derived from basic physical principles characterizing the scattering object is presented. From these it is shown how the propagation medium affects the results of the various remote sensing techniques. In exactly the same way the factors which characterize the propagation medium in relation to communications are derived. It is shown that in regard to the influence of the propagation medium, the problems related to communications are very much unified with those of remote sensing. (10 refs.)

110614 Wave propagation in precipitation. P.DeLogne (Lab. de Telecommunications, Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.xxxi-xli
The emphasis of the paper is on fundamental concepts and on the development and justification of a unified theoretical model. The latter is applied to several topics and attention is drawn to some unsolved problems and potential research areas. (13 refs.)

110615 Analysis of multipath fading observations on certain microwave paths in British Columbia. N.Owen (British Columbia Telephone Co., Canada), E.Lee, M.Kharadly.
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.3-11
The paper gives the results of measurements carried out on twelve microwave links throughout the Province of British Columbia, Canada. The links are representative of those in three of the five main topographic-climatic regions of this large province. The salient features of the microwave links on the paths are given. The observations are given in terms of worst-month multipath fading probability as a function of fade depth, the number of fading events and the variation of monthly fading time over the measurement period. The diurnal fading characteristics of several paths are also shown. The analysis involves comparisons of certain parameters derived from the observations with those given in the literature and generalized in the CCIR formula. An attempt is made to explain the observations in terms of terrain and climate. (15 refs.)

110616 The PACEM experiment on line of sight multipath propagation. M.Sylvain, F.Baudin, C.Klapisz, J.Lavergnat, S.Mayrargue, J.P.Mon, B.Nutten, M.Rooryck (CNET, Issy-les-Moulineaux, France).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.13-23
This paper describes an experiment aimed at giving a physical insight into situations leading to multipath propagation (MP). The experiment ran over a two-month period on an overland 37 km path. It associated a wide band microwave link analyzer and measurements of temperature, humidity and wind from the ground up to 300 m. Furthermore acoustic sounders monitored the temperature structure of the lower atmosphere and a two frequency lidar gave humidity profiles. From the data, it is hoped (1) to point out the specific meteorological situations leading to MP, (2) to get a physical insight into the behaviour of the propagation medium under these conditions, and (3) to derive short term evolutive models for the temperature and humidity in the boundary layer. (34 refs.)

110617 Microwave multipath from sea reflections—the Bay of Fundy. A.R.Webster, W.I.Lam (Centre for Radio Sci., Univ. of Western Ontario, London, Ontario, Canada).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.25-30
The distribution in amplitude of direct and sea reflected rays on two separate microwave links across the Bay of Fundy are examined. Resultant fading statistics are also presented for the two data sets, which were obtained during different seasons, and these show significant differences. It is suggested that the root cause of much of the deep fading is the formation of atmospheric layers below the line of sight. (5 refs.)

110618 Rates of change of propagation medium transfer functions during selective fadings. L.Martin (CNET, Lannion, France).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.31-5
In France, on a 50 km path, propagation medium transfer functions have been recorded during multipath fadings. Some typical parameters of amplitude distortion curves, measured in the 11.25-11.65 GHz band, have been selected to characterize selective fadings. Rates of change of these parameters give information about variations of the selectivity phenomenon. The theoretical statistical laws which are best fitted to the experimental statistical distributions of these rates of change are log-normal. An attempt to relate the rates of change of one of these parameters to variations of tropospheric layers in the lower atmosphere is presented. (6 refs.)

110619 Effect of 'anomalous' tropospheric M-profiles over the sea on SHF field strengths. V.A.Kabanov, F.V.Kivva, V.A.Kortunov, V.G.Sinitsin, I.S.Tourgenev (Inst. of Radiophys. & Electronics, Acad. of Sci., Kharkov, Ukrainian SSR).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.47-8
The statistics of radio frequency field strengths (wavelengths $\lambda=30$ cm; 3 cm and 0.8 cm) and of vertical refractive index profiles were measured on several maritime paths of different lengths. The profiles were monitored with microwave refractometers both at the transmitter and receiver sites and at intermediate points of the path out at sea, in the latter case with the aid of airborne instruments. (2 refs.)

110620 Measurements of radio refractive index profiles at tropical and equatorial regions and their influence on line-of-sight microwaves links. N.R.Dhein (Centro de Estudos em Telecomunicacoes, Univ. Catolica, Rio de Janeiro, Brazil).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.49-55
This work deals with tropospheric propagation conditions in tropical and equatorial regions of Brazil, based on measurements of the vertical structure of lower atmosphere and microwave fading. The high probability of anomalous propagation phenomena has been a characteristic of line-of-sight microwave links in these regions. The fine structures of refractive index were obtained through the vertical displacement of refractometer along a tower and showed that tropospheric duct is the main cause of these fadings. A refractometer system furnished a continuous recording of the K-factor. Thus, it was possible to observe a large variation of this parameter along the day and to include this variation in the statistics. (7 refs.)

110621 Propagation anomalies in a 4, 7 and 11 GHz line of sight path. G.Roux, J.P.Mon (CNET, Issy-les-Moulineaux, France).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.57-68
An experiment aimed at giving some insight into the meteorological conditions leading to multipath propagation was conducted during two summer months in the south-west of France. The level of three carriers at 4, 7 and 11 GHz were recorded on a 48 km LOS path and simultaneously acoustic sounding monitoring of the lower atmosphere was performed at midpath together with temperature, humidity and pressure recording at four levels of an instrumented tower. Intense fading occurred almost every night. In this paper, a statistical study of the radioelectric and meteorological events observed is worked out and the analysis of a specific case is presented. (11 refs.)

110622 Statistics of radio refractivity and atmospheric attenuation in tropical climates. L.B.Kolawole (Dept. of Phys., Univ. of Ife, Ile-Ife, Nigeria).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.69-75
The statistics of radio refractivity and atmospheric absorption of centimetre and millimetre waves in the different climates of Africa are reported. Four main surface refractivity patterns are identified in line with the major climate regions of the continent. The seasonal variations of the surface refractivity are explained by a general consideration of the weather system across the continent. It is shown that the surface refractivity, N_s and ΔN, the refractivity decrease in the first kilometre height are well correlated over Africa and from this correlation the empirical relationship $\Delta N=-2.30 \exp(0.008630\, N_s)$ was deduced. (11 refs.)

110623 A comparison of radio-wave and in situ observations of tropospheric turbulence and wind velocity. M.H.A.J.Herben, W.Kohsiek (Dept of Electrical Engng., Eindhoven Univ. of Technol., Eindhoven, Netherlands).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.79-87
The importance of radio-wave scintillations introduced by tropospheric turbulence for both telecommunication and meteorological research is indicated. Amplitude, phase and phase-difference measurements of scintillation were performed at 30 GHz on an 8.2 km line-of-sight path. In-situ measurements of temperature and humidity fluctuations and wind velocity and direction were done about midway on the propagation path. The measuring systems are described, and theory is presented to derive the refractive-index structure parameter C_n^2 and wind velocity v from radio-wave scintillations and the in situ measurements. Formulas are given to scale C_n^2 and v with height. Finally, results of the experiments are presented and discussed. (21 refs.)

110624 Upper tropospheric structures observed with VHF radar at Arecibo. A.T.Waterman (Stanford Univ., Stanford, CA, USA), P.Czechowsky.
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.89-94
Data taken during December 1980 using a 50 MHz radar of the German SOUSY group and the large antenna at Arecibo are reported and analyzed. Data were taken at eight zenith angles and two azimuths (east and north).

Received power showed a rapid decrease in the lower 11 km, with a much slower decrease above, up to 20 km. Marked and persistent layers were present, the two strongest being at 14 km and 17 km. Measurements of echo power vs. zenith angle and estimates of Richardson's number indicated an atmospheric structure different from isotropic turbulence, thereby implying either a strong anisotropy or quasicoherent layers. Comparison of wind measurements with the radiosonde at San Juan showed good agreement in magnitude but less good agreement in direction. (15 refs.)

110625 Amplitude scintillation in propagation paths above 10 GHz. P.Basili, P.Ciotti, G.D'Auria, A.Silberman, D.Solimini (Istituto di Elettronica, Univ. di Roma, Rome, Italy), E.Matricciani.
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.95-101
After a theoretical introduction based on a spectral approach, experimental data taken on a 35 GHz line-of-sight radio link over the urban area of Rome, Italy, and on the 11 and 17 GHz earth-space path of the SIRIO propagation experiment are reported. Field amplitude distributions, covariance functions and spectral densities are reported for various meteorological conditions. Significant parameters of spectra of log-amplitude fluctuations, such as cut-off frequency and asymptotic values are discussed. For the SIRIO experiment, spectra of the sky brightness temperature fluctuations measured during the analyzed scintillation events are also reported. (7 refs.)

110626 An offsetting technique to study scintillations in direction of arrival in earth-space paths. E.Vilar, P.Lo, G.Weaver, H.Smith (Dept. of Electrical & Electronic Engng., Portsmouth Polytech., Portsmouth, England).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.103-10
This paper is concerned with the investigation of fluctuations in the direction of arrival in an earth-space path, and more specifically with the possibilities offered by the technique of offsetting a high gain antenna so that these fluctuations appear as fluctuations in amplitude superimposed on the usual amplitude scintillations. The paper introduces the method and the supporting preliminary theoretical background. This is followed by a description of the technique for the data analysis and remote sensing of the turbulent path. Results are presented and discussed together with theoretical and practical limitations. The receiving system is briefly explained. (12 refs.)

110627 Results obtained from attenuation measurements of the Deutsche Bundespost OTS-propagation experiment. F.Dintelmann (Forschungsinst. der Deutschen Bundespost, Darmstadt, Germany).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.113-17
Attenuation results obtained from radiometer and OTS-beacon measurements at 11.6 GHz are reviewed for a four-year period. Besides the average annual exceedance of attenuation and the worst-month statistics the diurnal variation of attenuation is investigated in particular. To this end an average day is defined and cumulative distributions of attenuation for eight consecutive three-hour periods are analysed. It is shown that during the afternoon and night hours the probability to exceed specified fade levels is much higher than for the average year but lower than for any month. Fade duration statistics are presented for a number of thresholds. For medium fade levels the distributions were found to be very similar. (8 refs.)

110628 First global results of the European Space Agency OTS propagation campaign. A.Laloux, M.Van Schingen, P.Sobieski (Lab. de Telecommunications, Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium), G.Brussaard.
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.119-25
During the OTS propagation measurement campaign, the European Space Agency has collected an important database. This paper describes the first global results of the processing of this database. Radiometer calibration and analysis of attenuation and crosspolarisation for different frequencies and polarisations are discussed on a global statistical basis or using an event by event approach. (2 refs.)

110629 Experimental study of propagation characteristics in millimeter wave region. Y.Furuhama, T.Manabe, T.Ihara, K.Tohma, K.Kitamura, Y.Imai (Radio Res. Labs., Min. of Posts & Telecommunications, Tokyo, Japan).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.165-71
A propagation experiment at 50.4, 81.8, 140.7, and 245.5 GHz has been conducted on a horizontal path of 810 m since October 1982. Preliminary results of the experiment are introduced. In the case of heavy rainfall whose rate is greater than several 10 mm/h, there is no distinctive difference among the attenuations at 81.8, 140.7, and 245.5 GHz, and furthermore the attenuation at 245.5 GHz is slightly smaller than that at 140.7 GHz around the peak of rainfall. Attenuations due to fog and water vapor are also observed. The maximum variation due to fog at 245.5 GHz is about 1.8 dB and this, under the Rayleigh approximation, corresponds to the floating liquid water content of about 0.15 g/m^3. (8 refs.)

110630 Theoretical and experimental study of propagation attenuation for rain in equatorial and tropical areas. F.Moupfouma, J.Tiffon (CNET, Issy-les-Moulineaux, France).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.185-92 In French.
Rain attenuation prediction depends on the raindrop size spectrum of a given climatic region. Raindrop size distributions for the equatorial and tropical climates are presented. These were indirectly calculated from data collected during 16 months in the People's Republic of Congo. Predicted line of sight attenuation, derived from this distribution, is compared with experimental data collected in the Ivory Coast. Finally, various results of a 2 months experiment performed at 13 GHz in the Ivory Coast on a radio link in vertical and horizontal polarisations are presented. (17 refs.)

110631 Rain rate profile effects on radiowave attenuation above 10 GHz. Z.W.Zhang, H.J.Li, C.Q.Zhang (Wuhan Univ., Wuhan, China).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.193-6
Using the data from weather radar and considering the inhomogeneity of rain, a model of rain rate profile without depending on frequency was obtained. Total rain attenuation over earth-space path above 10 GHz can be calculated simply using this model. In this paper rain attenuation for frequencies of 12 GHz, 20 GHz, 30 GHz with elevations of 23°, 45°, 60° are obtained. The results both from calculation and from experiment made at The Radio Wave Propagation Laboratory of Wuhan University and other authors agree very well. It shows that this model of rain rate profile can be applied generally. (7 refs.)

110632 Statistics on the fine scale structure of rain in Stockholm 1977-79. L.Falk (Nat. Defence Res. Inst., Linkoping, Sweden).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.197-9
Data based on three years measurements of rain rates south of Stockholm 1977-79 with a network of 24 rain gauges have been used to investigate the fine scale structure of rain with particular regard to slant-path propagation. Statistics were calculated for annual, monthly and daily variations of rain rates and the spatial correlation was used to study the extension of rain cells as well as path averages connected with rain attenuation. (2 refs.)

110633 100 GHz open-resonator measurements of artificial precipitation and fog propagation parameters. D.J.Harris, S.Pickard (Univ. of Wales Inst. of Sci. & Technol., Cardiff, Wales).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.201-5
An open-resonator is used at 100 GHz to investigate the extinction properties of individual falling water drops and the attenuation of artificial advection fogs. The fog attenuation is also measured simultaneously at 0.63 μm wavelength. The measured extinction cross-section of water drops in the 2.8 to 5.8 mm diameter range are very close to the predictions using Mie theory and the Ray model for calculation of the complex refractive index at 100 Ghz. For a falling water drop with near-terminal velocity, the cross-section for horizontal polarisation is on average 5% greater than for vertical polarisation. Attenuations in fog range up to 10 dBm^{-1} at 0.63 μm and 40 dBkm^{-1} at 100 Ghz, the ratio of the two being approximately 500 for most conditions. This is greater than predictions using given particle size distributions for heavy fog, but recent observations which suggest a considerable sub-micron particle content could explain the discrepancy. (17 refs.)

110634 Prediction of rain attenuation based on point rain rate statistics for Alexandria, Egypt. H.N.Kheirallah (Dept. of Electrical Engng., Alexandria Univ., Alexandria, Egypt).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.219-24
Rain rate data collected over the period of 28 years in Alexandria is presented. Statistical distributions for the over-the-year and the worst-month data are shown and compared with distributions suggested by the CCIR for the region. Corresponding attenuation statistics on hypothetical terrestrial and earth-space links are then given indicating that rain attenuation should not be neglected when designing microwave links operating above 10 GHz in the vicinity of Alexandria. (9 refs.)

110635 Influence of raindrop oscillations on coherent forward scattering of microwaves in rain. M.Chandra, N.J.McEwan, P.A.Watson (Dept. of Electrical & Electronic Engng., Univ. of Bradford, Bradford, England).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.239-45
Using a previously proposed model for raindrop oscillations together with point matching scattering computations, the effective scattering amplitudes of oscillating raindrops for coherent forward scattering have been calculated. Results are also given for raindrops possessing modified axial ratios deduced from radar-distrometer measurements and for non-oscillating Pruppacher-Pitter oblate raindrops. The propagation parameters relating to the coherent field of microwaves propagating through rain are given for 11.575 GHz and 20.0 GHZ. The results for the three rain models are compared between themselves and with an empirical A/XPD relation. (14 refs.)

110636 Capability of surface-based clear-air Doppler radar for monitoring meteorological properties in elevated layers. E.E.Gossard (NOAA, Univ. of Colorado, Boulder, CO, USA), R.B.Chadwick, T.Detman, J.Gaynor.
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.413-24
Radars and acoustic sounding systems sense properties of the turbulence structure of the atmosphere. If atmospheric turbulence can be related to the mean gradient parameters, radars and acoustic sounders can provide information about height profiles of quantities such as temperature and refractive index as well as wind. In this paper turbulent and mean quantities were measured on the 300-m meteorological tower at Erie, Colorado, USA, and the relationships between the turbulent and mean gradient quantities were examined in order to evaluate hypotheses for simplifying the kinetic energy balance and refractive index variance equations. FM-CW radar measurements of Doppler spectral width were also made for comparison with tower-measured velocity spectra. Height distributions of ϵ within stable layers are shown and viscous cutoff radar wavelengths calculated. (6 refs.)

110637 Radar modeling of space diversity associated with slant path rain attenuation at variable path angles, frequencies, and drop size distributions. J.Goldhirsh (Appl. Phys. Lab., Johns Hopkins Univ., Laurel, MD, USA).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.437-45
Single and joint terminal slant path attenuation statistics at frequencies of 28.56 and 19.04 GHz have been derived employing a radar data base obtained over a three year period at Wallops Island, Virginia. Statistics were independently obtained for path angles of 20°, 45°, and 90° for purposes of examining how path angle influences both single terminal and joint probability distributions. A prediction technique is demonstrated to work well for calculating both single and joint terminal distributions at other path angles. Both diversity gains and autocorrelation function dependence on site spacing were determined employing the radar modeling results. Comparisons with other investigators are presented. (11 refs.)

110638 Attenuation of radio waves by atmospheric wet ice and mixed phase hydrometeors. Y.M.M.Antar, A.Hendry (Div. of Electrical Engng., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.455-61
Observations of radio wave attenuation by wet ice and mixed phase hydrometeors along a propagation path are reported. Included are further studies on attenuation by snow flakes in the melting region during stratiform precipitation, attenuation by wet snow flakes during a snow storm, and attenuation by hail on an Earth-space path. Polarization diversity radar measurements at 16.5 GHz along with some satellite beacon attenuation measurements at 28.56 GHz are presented. Only situations in which rain effects along the path were small are considered. (14 refs.)

110639 Assessment of the intrinsic rain profile parameters from radar and raingauge data. C.Capsoni, G.Macchiarella, M.Mauri, A.Paraboni (Politecnico di Milano, Milano, Italy).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.463-8
This paper presents some statistics of the intrinsic rain profile parameters obtained from meteorological radar and from raingauge data. These parameters are merely meteorological but encompass the whole profile related information needed for evaluating path-integrated parameters such as link attenuation, anisotropy etc. Areas to which these results apply are: attenuation prediction methods, short-term frequency scaling, modelling of rain structures and others. The single and bidimensional statistics here presented are all of conditioned type in order to link them to some variable (such as point rain-intensity or attenuation) the long-term statistic of which is well known for the locality of interest. (12 refs.)

110640 Effect of large-scale anisotropic refractive index inhomogeneities on the strength of the coherent VHF signal component beyond the horizon. A.V.Kukushkin, V.D.Freulicher, I.M.Fuchs (Inst. of Radiophys. & Electronics, Acad. of Sci., Kharkov, Ukrainian SSR).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.487-93
The propagation of microwaves through a non-uniform troposphere with anisotropic random inhomogeneities of the refractive index, characterized by horizontal scale lengths of several hundred meters, is shown to be reducible to the problem of wave propagation through a random stratified medium. The effect of this random stratification upon the field in the 'near trans-horizon' region, i.e. 100 to 200 km from the transmitter, is estimated. The expressions for the field moments obtained in the paper allow explaining the greater fading depths which acompanied a growth in the coherent component in some experiments. The average intensity of the signal grows with the RMS fluctuations in the refractive index, even if the average gradient thereof is too small for producing enhanced refraction. (11 refs.)

Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium ... See Entry 105033

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92.60S Climatology

110641 A general circulation model study of January climate anomaly patterns associated with interannual variation of equatorial Pacific sea surface temperatures. M.L.Blackmon (Nat. Center for Atmospheric Res., Boulder, CO, USA), J.E.Geisler, E.J.Pitcher.
J. Atmos. Sci. (USA), vol.40, no.6, p.1410-25 (June 1983).
A general circulation model has been run in the perpetual January mode to produce several long-term simulations, each distinguished by a different imposed equatorial Pacific sea surface temperature. From each of these simulations the authors have extracted an eight-member ensemble of 90-day averaged fields. Ensemble-mean difference maps are presented. These results are compared with observational studies in the literature that present difference maps of Northern Hemisphere winter fields composited according to some index related to the two extremes of equatorial Pacific sea-surface temperature variation. The results show many anomaly patterns of high statistical significance that are also in good agreement with those observed. In the tropics, these include 990 mb wind, sea level pressure and rainfall anomalies constituting the Southern Oscillation, as well as a 200 mb height anomaly at all longitudes. (26 refs.)

110642 The influence of poloidal motions and latent heat release on the equilibrium ice extent in a simple climate model. B.Saltzman (Dept. of Geology & Geophys., Yale Univ., New Haven, CT, USA), A.D.Vernekar.
J. Atmos. Sci. (USA), vol.40, no.6, p.1426-34 (June 1983).
A zonal-average, annual-mean, statistical-dynamical climate model governing two domains (the atmosphere and a subsurface medium consisting of either ice or 'swamp'), and including the dynamics of mean poloidal motions and the hydrologic cycle as well as the ice-albedo feedback, is integrated numerically as a function of the solar constant. The adiabatic effect of the mean poloidal motion is to cool the system in the region of the ascending branch of the Ferrel cell (thereby promoting an advance of the equilibrium ice extent in this region) and to warm the system in the region of the descending branch (hence posing a 'barrier' to the ice advance in this region). This latter barrier effect is amplified as the solar constant is reduced because the subtropical descending motion increases in magnitude as the ice advances. (24 refs.)

110643 Climatic information over the last century deduced from a detailed isotopic record in the south pole snow. J.Jouzel, L.Merlivat (Lab. de Geochimie Isotopique, CENS, Gif-sur-Yvette, France), J.R.Petit, C.Lorius.
J. Geophys. Res. (USA), vol.88, no.C4, p.2693-703 (20 March 1983). [received: Sept. 1983]
A continuous and very detailed deuterium profile was obtained from the analysis of about 900 firn samples from the south pole representing the snow accumulated over the last 100 years. Seasonal variations are well preserved in the firn, allowing the samples to be dated back to 1887 with an accuracy probably better than 5 years. Snow accumulation rates are calculated. From a thorough examination of data relative to the very well documented 1957-78 period, mean annual and maximum deuterium values and annual deuterium amplitude are shown to be correlated with the corresponding mean annual and summer temperatures and the annual temperature amplitude. Winter temperature and deuterium minima are poorly correlated, which is attributable to the large temperature inversion during winter. As a whole, this work is very encouraging for the use of stable isotopes as a tool for past temperature reconstruction over periods for which only weak variation are expected. (48 refs.)

110644 140000-yr isotope climatic record from raised coral reefs in New Guinea. P.Aharon (Dept. of Geology, Louisiana State Univ., Baton Rouge, LA, USA).
Nature (GB), vol.304, no.5928, p.720-3 (25 Aug. 1983).
Reports the results of an oxygen isotope abundance study of the giant clam Tridacna gigas from a sequence of uplifted coral reefs in New Guinea which provides a detailed record of changes over the past 10^5 yr in the surface ocean isotope chemistry and temperature. The combined utilization of sea level and $^{18}O/^{16}O$ data allows a quantitative evaluation of ice volume and temperature factors. The results also contribute to resolving the question as to the exact time-relationship between temperature change at low latitudes and ice accumulation at the latitudes of the glacial ice caps. (36 refs.)

110645 Evidence from north-west Canada for an early Holocene Milankovitch thermal maximum. J.C.Ritchie (Scarborough Coll., Univ. of Toronto, Scarborough, Ontario, Canada), L.C.Cwynar, R.W.Spear.
Nature (GB), vol.305, no.5930, p.126-8 (8 Sept. 1983).
According to the Milankovitch theory of global climatic change, maximum summer solar radiation at high latitudes of the northern hemisphere occurred at 10000 yr BP. In particular, it predicts summer solstice radiation greater by 9-10%. This article summarizes pollen record data from sites in the northwest corner of Canada that directly support the Milankovitch hypothesis of climate change. (22 refs.)

110646 The geologic record of climatic change. T.J.Crowley (Dept. of Phys., Univ. of Missouri, St. Louis, MO, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.4, p.828-77 (May 1983).
Reviews the principal results from paleoclimate studies. A secular change in global insolation receipt is due to a 20-30% increase in solar luminosity since the formation of the Earth. On time scales of 10^6-10^8 years, paleogeographic factors (e.g. continental drift and sea level changes) have contributed significantly to temperature changes associated with transitions between nonglacial and glacial states. The origin of polar ice caps may result from ocean circulation changes that were caused by plate tectonic processes. Fluctuations of ice volume on a time scale of 10^3-10^5 years correlate with insolation variations caused by orbital perturbations. (440 refs.)

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Contribution to the study of solar radiation in Burgos, Spain .... See Entry 110603

92.65 ATMOSPHERIC OPTICS

(see also 42.00 Optics)

110647 Extinction and liquid water content of fog at visible wavelengths. S.G.Jennings (Phys. Dept., Univ. Coll., Galway, Ireland).
Appl. Opt. (USA), vol.22, no.17, p.2514-15 (1983).
Recently, A.P. Lenham and M.R. Clay (see ibid., vol.21, p.4191, 1982) obtained high correlation for a linear relationship between a measured extinction coefficient in fog at wavelength $\lambda = 0.53$ μm and liquid water content. The liquid water content values were derived from number-size distribution histograms, which in turn were inferrred from transmission measurements at several wavelengths using an inversion algorithm. They also found that a high correlation between the infrared number concentration in the largest size category (6.4-12.8 μm radius) and the extinction coefficient. The purpose of the present author is to point out that high correlation between visible extinction and liquid water content for fog cannot be expected to hold in general. In addition, the correlation of number concentration with extinction is examined, and the conclusion is drawn that it is very unlikely in general for extinction to be linearly related to number concentration for fog size distributions at visible wavelengths. (8 refs.)

110648 Speckle statistics of atmospherically backscattered laser light. J.H.Churnside, H.T.Yura (Electronics Res. Lab., Aerospace Corp., Los Angeles, CA, USA).
Appl. Opt. (USA), vol.22, no.17, p.2559-65 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
The speckle pattern produced in laser light that has been backscattered by atmospheric aerosols is considered. The spatiotemporal correlation properties both of the optical field amplitudes and of the optical intensities are described. Analytical expressions are presented for the special cases of illumination by a short Gaussian pulse and by a CW source. (20 refs.)

110649 Comparison of calculated and measured spectral radiances of the atmosphere towards the zenith. M.Weller, U.Leiterer (Meteorologischer Dienst, Lindenberg, Germany).
Z. Meteorol. (Germany), vol.33, no.3, p.156-61 (1983). In German.
Compares calculated and measured spectral radiances of the atmosphere toward the zenith at 3200 m above the ground. Using the Schwarzschild-Eddington radiative transfer code its accuracy is in acceptable agreement with the accuracy of radiances and model input data which have been measured with a spectral photometer BAS. (9 refs.)

110650 Atmospheric infrared emission observed at altitude of 27000 to 28000 m. H.Sakai (Dept. of Phys. & Astron., Univ. of Massachusetts, Amherst, MA, USA), G.Vanasse.
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.366, p.165-72 (1983). (Modern Utilization of Infrared Technology VIII, San Diego, CA, USA, 26-27 Aug. 1982).
The molecules in the lower part of atmosphere are in thermal equilibrium with the local surrounding. The infrared emission resulting from their thermal excitation can be studied to determine their temperature and concentration profile in the atmosphere. The authors used a cryogenically cooled Fourier spectrometer mounted on a balloon-borne platform to study the infrared emission spectrum of atmosphere for this purpose. The experiment, which took place on October 7, 1981, at Holloman AFB, produced the analyzable data for more than two hours at altitude of 27000∼28000 m along the horizontal and the vertical line of sight. The spectral data extended from 550 cm^{-1} to 1000 cm^{-1} covering the CO_2 15 μ bands ($\Delta\nu_2=1$) with a resolution of 0.2 cm^{-1}. The data were found interesting on two accounts: (1) a continuum background feature was superimposed with the molecular emission feature; (2) the radiance level of the CO_2 15 μ bands observed along the horizontal line of sight varied by a much greater degree than expected. (8 refs.)

110651 Polarization structure of backscattering by water droplet and crystal clouds. V.E.Zuev, G.M.Krekov, M.M.Krekova.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.6, p.595-602 (June 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
The numerical solution of the nonstationary transfer equation in a vector form for the medium with anisotropic scattering centres has been obtained using the Monte-Carlo technique, using the scattering matrices measured experimentally. The numerical experiment has been carried out on polarization sounding of clouds with complex phase composition. The qualitative peculiarities of forming the backscattering signal from composed and crystal clouds are indicated which creates a physical basis for developing remote diagnostics methods. (12 refs.)

110652 On the problem of light scattering by horizontally inhomogeneous cloud. G.V.Mironova.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.6, p.603-12 (June 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
The problem of light propagation through the turbid medium layer modeling horizontally inhomogeneous cloud is solved in the small angle approximation by the perturbation method. The scattering coefficient variations are assumed to have the form of truncated Fourier series with the scattering phase function and the absorption coefficient being constant within the layer. The contribution of single scattering and multiple scattering into the total intensity of scattered light at various scattering angles and various thickness of the inhomogeneous layer is evaluated. The transformation of the horizontal distribution of the scattered light intensity is found to be dependent upon the layer level. (8 refs.)

110653 On a technique for operative correction for the transmission function in solving the problem of thermal sounding of the atmosphere. O.M.Pokrovskii, A.I.Belyavskii.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.6, p.613-21 (June 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
A modification of the technique for solution of the inverse problem in respect to the absorption characteristic of the atmosphere in the CO_2 15-μm band is discussed. The solution of the inverse problem is compared with the results of calculation of transmission fluctuations caused by variations in the profiles of water vapour, ozone, and aerosol in the troposphere and stratosphere. A scheme is discussed for latitudinal and zonal adjustment of an optical model for the solution of the thermal sounding problem using the data on peculiarities of the spatial-temporal structure of water vapour and ozone fields' fluctuations. (10 refs.)

110654 Comparison of radiative fluxes and flux divergences computed using different transmission functions under clear sky. T.I.Vassil'eva, M.G.Evseeva, E.L.Podolskaya.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.6, p.622-30 (June 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
New approximations of several integral transmission functions are proposed. Radiative fluxes, heating and cooling at various heights and latitudes in the cloudless atmosphere computed with different transmission functions or emissivities are presented. Comparison of results reveals that absorption of solar radiation in the near infrared is calculated correctly enough. Differences in computed longwave fluxes and coolings amount to 100% and more. The analytical approximation being of great importance, it must precisely describe both the transmission function and its derivative. (16 refs.)

110655 On meteorological parameter restoration from intraatmospheric measurements of optical refraction of cosmic sources. K.P.Gaikovich, A.S.Gurvich, A.P.Naumov.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.7, p.675-82 (July 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
Discusses the restoration of the refractive index and meteorological parameters profiles using intraatmospheric measurements of optical refraction of extraterrestrial sources. It is shown that if an observer is inside the atmosphere, the inverse problem is well specified with negative elevation angles and mathematically incorrect with positive ones. By the computer modelling, a possibility is investigated for the restoration of vertical profiles of temperature and pressure and estimates are given of the solution errors in the corresponding inverse problem. (14 refs.)

110656 Infrared absorption by rural organic aerosol. L.B.Galkina, Yu.S.Lyubovtseva, M.V.Shishkina, L.G.Yaskovich.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.7, p.683-95 (July 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
Using data from complex optical and mass spectrometric analyses of aerosol samples gathered in a purely rural (mountain) region near Abastumani, an evaluation is made of the contribution of organic submicron particles to aerosol absorption within the wavelength range $\lambda=2.5\text{-}12$ μm. The maximal absorption by the organic components is shown to be near $\lambda=3.4$ μm ($\alpha_{org}=8.0\times10^{-4}$ km^{-1}) and $\lambda=5.8$ μm($\alpha_{org}=3.3\times10^{-4}$ km^{-1}). A comparison is made of the contributions into absorption of different chemical constituents within a wide wavelength interval. (22 refs.)

110657 Infrared spectral radiance of the sky. A.Ben-Shalom, A.D.Devir, S.G.Lipson (Dept. of Phys., Technion-Israel Inst. of Technol., Haifa, Israel).
Opt. Eng. (USA), vol.22, no.4, p.460-3 (July-Aug. 1983).
A method of calculating the self-radiance of the sky based on the LOWTRAN-4 computer code is described. The method is a significant improvement on that included as an option in LOWTRAN-4 itself as a result of two modifications: a) The authors' method, unlike the one included in LOWTRAN-4, takes into account the radiance scattered into the line of sight. b) The model of the atmosphere in the computer code must be divided into a certain number of layers, each one having approximately uniform conditions. The authors' method uses a correct optimal division. Consequently, the method gives a better agreement with the experimental data, especially for long optical paths in the lower layers of the atmosphere. (7 refs.)

110658 Analysis of Mount St. Helens ash from optical photoelectric photometry. J.A.Cardelli (Dept. of Astron., Univ. of Washington, Seattle, WA, USA), T.P.Ackerman.
Publ. Astron. Soc. Pac. (USA), vol.95, no.569, p.451-6 (July 1983).
Presents data from optical photoelectric observations of standard stars taken 48 hours after the 1980 July 23 eruption of Mount St. Helens which yield optical properties of the suspended dust particles. The analysis of the data centers of the use of Mie theory for determining the mean particle size and the column density of the particles in the absorbing layer. (12 refs.)

110659 Propagation of narrow light beams in rain. A.G.Rogachevskii (Inst. of Atmospheric Optics, Acad. of Sci., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.12, p.1025-9 (Dec. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.12, p.1449-54 (Dec. 1982). [received: Sept. 1983]
The intensity of a narrow light beam in rain is analyzed within the framework of a Markov approximation. The intensity is investigated as a function of the optical depth and a parameter which is a quantitative criterion of the narrowness of the beam. Estimates of the limits of applicability of the single-scattering approximation and of the Bouguer law are obtained. The possibility of efficient intensity focusing in rain is demonstrated. (14 refs.)

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93.00 GEOPHYSICAL OBSERVATIONS, INSTRUMENTATION, AND TECHNIQUES

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Supra-annual variations of geopotential heights in the subtropical stratosphere .... See Entry 110526

Synoptic forcing of the planetary boundary layer: a case study from the PUKK experiment .... See Entry 110527

Effects of orography on Mediterranean lee cyclogenesis and its relationship to European blocking .... See Entry 110530

African wave disturbances in a general circulation model .... See Entry 110531

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An analysis of the ground temperature and reflectivity pattern about St. Louis, Missouri, using HCMM satellite data .... See Entry 110539

Severe storm observations using the microwave sounding unit .... See Entry 110543

Mt. St. Helens' aerosols: some tropospheric and stratospheric effects .... See Entry 110546

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The Group Agromet Monitoring Project (GAMP): application of Meteosat data for rainfall, evaporation, soil-moisture and plant-growth monitoring in Africa .. .... See Entry 110551

Relationships between macrocirculation atmospheric processes at levels from 10 up to 100 km over middle Asia .... See Entry 110552

The dynamical structure of the planetary boundary layer over the Arabian Sea, as deduced from constant-level balloon trajectories .... See Entry 110559

Case study of a hailstorm in Colorado. IV. Graupel and hail growth mechanisms deduced through particle trajectory calculations .... See Entry 110562

Measurement and interpretation of hailstone density and terminal velocity .... See Entry 110563

The role of cloud top entrainment in cumulus clouds .... See Entry 110564

A comparison between computed and measured oceanic winds near the British Columbia coast .... See Entry 110570

The influence of the Antarctic Peninsula on the wind field over the western Weddell Sea .... See Entry 110571

Dispersion limitations of oxidation in power plant plumes during long-range transport .... See Entry 110578

Simulation of the atmospheric response to soil moisture anomalies over Europe .... See Entry 110582

A study of meteorological patterns associated with a lake confined by mountains—the Dead Sea case .... See Entry 110584

Chemical composition of precipitation. V .... See Entry 110598

Circumglobal transport of the El Chichon volcanic dust cloud .... See Entry 110600

Spatial correlation functions of humidity in Western Siberia and northern Kazakhstan .... See Entry 110607

Analysis of multipath fading observations on certain microwave paths in British Columbia .... See Entry 110615

Microwave multipath from sea reflections—the Bay of Fundy .... See Entry 110617

Rates of change of propagation medium transfer functions during selective fadings .... See Entry 110618

Measurements of radio refractive index profiles at tropical and equatorial regions and their influence on line-of-sight microwaves links .... See Entry 110620

Statistics of radio refractivity and atmospheric attenuation in tropical climates .... See Entry 110622

Climatic information over the last century deduced from a detailed isotopic record in the south pole snow .... See Entry 110643

140000-yr isotope climatic record from raised coral reefs in New Guinea .... See Entry 110644

Evidence from north-west Canada for an early Holocene Milankovitch thermal maximum .... See Entry 110645

Experience with the EM-60 electromagnetic system for geothermal exploration in Nevada .... See Entry 110694

Recent developments in the use of surface electrical methods for oil and gas exploration in the Soviet Union .... See Entry 110695

Variation of the microwave brightness temperature of sea surfaces covered with mineral and monomolecular oil films .... See Entry 110706

Remote sensing of wetlands .... See Entry 110716

OH airglow phenomena during the 5-6 July 1982 total lunar eclipse .... See Entry 110751

Power spectra analysis of auroral occurrence frequency .... See Entry 110755

Effects of total solar eclipse of 16th February 1980 on the HF communications in India .... See Entry 110780

The solar eclipse of 26 Febrary 1979: introductory comments .... See Entry 110866

93.55 INTERNATIONAL ORGANIZATIONS, NATIONAL AND INTERNATIONAL PROGRAMS

110660 The International Satellite Cloud Climatology Project (ISCCP): The first project of the World Climate Research Programme. R.A.Schiffer (WCRP, WMO Secretariat, Geneva, Switzerland), W.B.Rossow.
Bull. Am. Meteorol. Soc. (USA), vol.64, no.7, p.779-84 (July 1983).
The ISCCP was approved as the first project of the World Climate Research Programme and began its operational phase in July 1983. Its basic objective is to collect and analyze satellite radiance data to infer the global distribution of cloud radiative properties in order to improve the modeling of cloud effects on climate. (10 refs.)

93.65 DATA ACQUISITION AND STORAGE

110661 The estimation and removal of a linear drift from stacked data. P.L.McFadden, S.C.Constable (Res. School of Earth Sci., Australian Nat. Univ., Canberra, ACT, Australia).
J. Geophys. (Germany), vol.53, no.1, p.52-8 (1983).
In exploration systems with digital data acquisition the process of stacking is frequently performed to reduce the requirement for memory space. If the observations are corrupted by a drift then this drift is not averaged out by the stacking process. A robust method for least squares linear estimation and removal of the drift is presented together with an analysis of the errors involved. Examples with both synthetic and field data are presented to show the improvement in accuracy of signal recovery achieved by drift removal. (no refs.)

Combination and comparison of various filtering techniques in processing gravity data .... See Entry 110685

VLF signal recognition by cross-spectral analysis .... See Entry 110686

93.85 INSTRUMENTATION AND TECHNIQUES FOR GEOPHYSICAL RESEARCH

110662 Measurement of minor constituents in the middle atmosphere from IR limb emission spectra: a feasibility study. H.Oelhaf, H.Fischer (Meteorological Inst., Univ. of Munich, Munich, Germany).
Appl. Opt. (USA), vol.22, no.17, p.2515-18 (1983).
The feasibility of detecting fifteen trace constituents (O_3, CO_2, H_2O, CH_4, CO, N_2O, NO, NO_2, HNO_3, F-11, F-12, NH_3, SO_2, HF and HCl) against atmospheric background has been studied from IR limb emission spectra (4-100 μm) at various tangent heights in the middle atmosphere. The main properties of the mid- and/or far-IR bands of the molecule under investigation are compared, and specific problems (e.g. sparseness of atmospheric measurement, lack of line data, line wing shape) are indicated. The results of the investigations are discussed separately for each band or portion of a band. The calculations are mainly presented as graphs generally consisting of three types of figure for each species: (1) so-called S^*m spectra; (2) emission spectra for the two spectral resolutions of 0.1 and 1 cm^{-1}; (3) radiance profiles for selected spectral features corresponding to the 1-cm^{-1} resolution. (8 refs.)

110663 Remote sensing of stratospheric and mesospheric winds by gas correlation electrooptic phase-modulation spectroscopy. D.J.McCleese, J.S.Margolis (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Appl. Opt. (USA), vol.22, no.17, p.2528-34 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
A method is described for directly measuring atmospheric winds in the 20-120 km altitude interval from a spacecraft. The principle of operation of the wind sensor is the measurement of the Doppler shift between the spectral absorption lines of a gas in a cell within the instrument and the thermal emission lines of the same gas in the atmosphere. The wind measurements are to be made with a spacecraft-borne gas correlation spectrometer viewing the limb of the atmosphere. The measurement of the wind-induced Doppler shift between the two spectra, and thence the magnitude of the wind itself, is accomplished by phase modulating the incoming thermal radiation (equivalent to frequency modulation) by means of an electrooptically active crystal to determine the frequency shift required to reestablish exact correlation between the lines in the cell and the lines from the atmosphere. Results of numerical simulations of the wind-sensor performance are presented showing the noise-equivalent-wind to be between 1 and 5 m/sec over most of the stratosphere and mesosphere. (17 refs.)

110664 Passive and active remote sensing of atmospheric precipitation. Y.Q.Jin, J.A.Kong (Dept. of Electrical Engng. & Computer Sci., MIT, Cambridge, MA, USA).
Appl. Opt. (USA), vol.22, no.17, p.2535-45 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
Both passive and active remote sensing of atmospheric precipitation are studied with the vector radiative transfer equations by making use of the Mie scattering phase functions and incorporating the raindrop-size distributions. For passive remote sensing the authors employ the Gaussian quadrature method to solve for the brightness temperatures. For active remote sensing an iterative approach carrying out to the second order in albedo is used to calculate for the bistatic scattering coefficients, the backscattering cross sections/unit volume, and the interchannel cross talks. The calculated results are plotted as a function of rainfall rates and compared to various available experimental data. The theoretical model is easily applied to the remote sensing of aerosol particles, smoke, fog, and haze at infrared and visible frequencies. (11 refs.)

110665 PRESTO: a programmable etalon spectrometer for twilight observations. W.A.Gault, R.H.Weins, G.J.Gotshalks, R.A.Koehler, G.G.Shepherd (York Univ., Toronto, Ontario, Canada).
Appl. Opt. (USA), vol.22, no.17, p.2551-5 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
A Fabry-Perot spectrometer specifically designed for measuring airglow intensities in twilight has been built using a feedback-controlled etalon from Queensgate Instruments, London. A single etalon passband (FWHM = 0.015 nm at 558 nm) is isolated by a narrowband (0.2-nm) interference filter. The passband of the etalon can be shifted in a random fashion by a digital command to a controlling circuit. Observing time is, therefore, used efficiently because only wavelengths of interest need be observed. Responsivity of the system is 1.3 counts $\sec^{-1}$ R^{-1} at 558 nm. The optics are contained in an outdoor climate-controlled enclosure connected by cables to a microcomputer at the indoor observing station. The computer controls all functions of the instrument and is capable of running long complex observing routines unattended using parameters specified by the observer. These parameters include meridian angles, filters (up to eight), integration times, and etalon steps. Some examples of twilight measurements are given. (9 refs.)

110666 Inverse methods for remote determination of properties of optically thick atmospheres. N.J.McCormick (Dept. of Nuclear Engng., Univ. of Washington, Seattle, WA, USA).
Appl. Opt. (USA), vol.22, no.17, p.2556-8 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
Methods of using CW and pulsed electromagnetic sources are compared for determination of the coefficients of the Legendre polynomial expansion of the single-scattering phase function from measurements of the multiply scattered radiance emerging from the surfaces of the atmosphere. Quadrature formulas are presented with which to calculate the angular moments of the radiance needed for the methods. (5 refs.)

110667 Evaporation derived from optical and radio-wave scintillation. W.Kohsiek (Royal Netherlands Meteorological Inst., De Bilt, Netherlands), M.H.A.J.Herben.
Appl. Opt. (USA), vol.22, no.17, p.2566-70 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
The determination of the evaporation from scintillation measurements at several wavelengths is discussed. The refractive-index structure parameter C_n^2 derived from the observed amplitude scintillation on a 30-GHz radio link is compared to a spot measurement of this quantity at a much lower height than that of the radio link. After free convection height scaling, a difference of a factor of 3 is found. This factor is discussed. A calculation of the evaporation from the observed radio-wave scintillation yields good agreement with calculations based on the Priestley-Taylor formula. (20 refs.)

110668 Multicolor laser altimeter for barometric measurements over the ocean: theoretical. C.S.Gardner, B.M.Tsai, K.E.Im (Dept. of Electrical Engng., Univ. of Illinois, Urbana, IL, USA).
Appl. Opt. (USA), vol.22, no.17, p.2571-7 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
The optical path length from a satellite to the Earth's surface is strongly dependent on the atmospheric pressure along the propagation path. Surface pressure can be measured by using a two-color laser altimeter to observe the change with wavelength in the optical path length from a satellite to the ocean surface. The statistical characteristics of the ocean-reflected pulses and the expected measurement accuracy are evaluated in terms of the altimeter parameters. The results indicate that a pressure accuracy of a few millibars is feasible. (9 refs.)

110669 Multicolor laser altimeter for barometric measurements over the ocean: experimental. J.B.Abshire, J.E.Kalshoven,Jr. (NASA Goddard Space Flight Center, Greenbelt, MD, USA).
Appl. Opt. (USA), vol.22, no.17, p.2578-85 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
Measurement theory and results from testing a breadboard multiwavelength (355-, 532- and 1064-nm) laser altimeter over horizontal paths are presented. They show that pressure accuracies of 3 mbar can be achieved when ranging at nadir to cube corner targets when using a 500-psec resolution waveform digitizer and utilizing new calibration techniques. Streak camera-based receivers will be required for the same or higher accuracies when ranging to the ocean surface. System design calculations for aircraft and spaceborne experiments are presented. (16 refs.)

110670 New technological developments for the remote detection of atmospheric hydroxyl radicals. I.S.McDermid, J.G.Laudenslager, T.J.Pacala (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Appl. Opt. (USA), vol.22, no.17, p.2586-91 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
New developments in the areas of narrowband tunable excimer lasers, high-resolution high-rejection optical filters, and wavelength measurement devices are considered for application to the remote sensing of atmospheric hydroxyl radicals. The conclusion is that an increase in the SNR of 10^4 could readily be gained through the use of these new devices. Also, considerable reductions in size and electrical energy consumption could be realized. (28 refs.)

110671 Frequency-doubled CO_2 lidar measurement and diode laser spectroscopy of atmospheric CO_2. J.L.Bufton, T.Itabe (Instrument Electro-Optics Branch, NASA Goddard Space Flight Center, Greenbelt, MD, USA), L.L.Strow, C.L.Korb, B.M.Gentry, C.Y.Weng.
Appl. Opt. (USA), vol.22, no.17, p.2592-602 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
A lidar instrument based on pulsed frequency-doubled carbon-dioxide lasers has been used at 4.88 μm for remote sensing of atmospheric carbon dioxide. A tunable-diode laser spectrometer provided the high-resolution spectroscopic data on carbon-dioxide line strength and line broadening needed for an accurate differential absorption measurement. Initial field measurements are presented, and instrument improvements necessary for accurate carbon dioxide measurement are discussed. (30 refs.)

110672 Airborne measurements of laser backscatter from the ocean surface. J.L.Bufton (NASA Goddard Space Flight Center, Greenbelt, MD, USA), F.E.Hoge, R.N.Swift.
Appl. Opt. (USA), vol.22, no.17, p.2603-18 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
Laser backscatter data for the ocean surface near nadir have been acquired from an airborne lidar platform. The unique capability of this lidar instrument to scan both transmitted laser beam and receiver field of view up to 15° off nadir have made these data sets possible. Backscatter data were collected on eight separate missions using laser wavelengths at 337 and 532 nm and 9.5 μm. Statistics of the mean, standard deviation, and probability density function of backscatter were computed and analyzed in terms of prior analytical work that relates backscatter to wind speed and mean-square wave-slope statistics. The authors found the full width at half-maximum of the Gaussian-shaped mean backscatter pattern to range from 11 to 24° and the normalized standard deviation at a nadir-viewing angle to range from 0.1 to 0.6. They calibrated mean backscatter at nadir for the ocean surface in terms of an effective Lambertian reflectance by comparison of beach sand and ocean backscatter. Results were 16 and 24% reflectance on two missions where calibration was possible. The data are compared with prior laser backscatter measurements and the general literature on optical scattering from the ocean surface. (47 refs.)

110673 Target reflectance measurements for calibration of lidar atmospheric backscatter data. M.J.Kavaya, R.T.Menzies, D.A.Haner, U.P.Oppenheim, P.H.Flamant (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Appl. Opt. (USA), vol.22, no.17, p.2619-28 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
Wavelength and angular dependence of reflectances and depolarization in the 9-11 μm region are reported for four standard targets: flowers of sulfur, flame-sprayed aluminum, 20-grit sandblasted aluminum, and 400-grit silicon carbide sandpaper. Measurements are presented and compared using a CW CO_2 grating-tunable laser in a laboratory backscatter apparatus, an integrating sphere, and a coherent pulsed TEA-CO_2 lidar system operating in the 9-11 μm region. Reflectance theory related to the use of hard targets to calibrate lidar atmospheric backscatter data is discussed. (21 refs.)

110674 Balloon-borne remote sensing of stratospheric constituents. D.G.Murcray, F.J.Murcray, A.Goldman, F.H.Murcray, J.J.Kosters (Phys. Dept., Univ. of Denver, Denver, CO, USA).
Appl. Opt. (USA), vol.22, no.17, p.2629-40 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
Remote-sensing techniques are generally considered as a means of obtaining data concerning the concentration species at altitudes not accessible to the observing platform; however, in the case of remote-sensing measurements of species in the lower stratosphere a considerable advantage in profile resolution can be obtained by making the measurements from balloons. Data concerning species of interest in the photochemistry of the ozone layer were obtained by balloon flights employing remote-sensing instruments making measurements in the wavelength region from the ultraviolet to millimeter wavelengths. The majority of the data were obtained using instruments to obtain data in the midinfrared wavelengths. Two techniques are generally used: solar absorption or atmospheric emission. Descriptions of the instrumentation used by the authors' group at the University of Denver to obtain data using both techniques are given. The techniques employed in the analysis of the data obtained with these instruments are discussed, and recent results are presented. The potential of both techniques for obtaining data of interest in the photochemistry of the ozone layer is also discussed. (7 refs.)

110675 Passive radiometry for vertical sounding from meteorological satellites. W.L.Smith (Dev. Lab., NOAA Nat. Environmental Satellite, Data & Information Service, Madison, WI, USA).
Appl. Opt. (USA), vol.22, no.17, p.2641-3 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
This paper summarizes the different types of passive radiometers flown on meteorological satellites for vertically sounding the lower atmosphere. (15 refs.)

110676 Balloon-borne diode-laser absorption spectrometer for measurements of stratospheric trace species. R.T.Menzies, C.R.Webster, E.D.Hinkley (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Appl. Opt. (USA), vol.22, no.17, p.2655-64 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
A stratospheric trace species measurement concept is presented which utilizes tunable infrared diode lasers as sources for sensitive in situ absorption spectroscopy in selected wavelength regions. As an embodiment of this concept, the balloon-borne laser in situ sensor (BLISS) is a high-resolution absorption spectrometer designed to provide measurements of the concentrations of stratospheric species and their diurnal variations. The instrument uses second-harmonic detection of the absorption of tunable diode laser (TDL) radiation (3-30 μm) in a 1-km path length defined by a retroreflector lowered 0.5 km below the BLISS gondola. A He-Ne laser and co-aligned TV camera with CID imaging are used for retroreflector tracking under microprocessor control. Four TDLs will provide simultaneous measurements of molecular species in the 20-40 km altitude range, the predicted minimum-detectable mixing ratio at 30 km being typically ≤ 0.1 ppbv. (9 refs.)

110677 Tests of an inversion algorithm for spectrally resolved limb emission. R.D.Sharma (US Air Force Geophys. Lab., Hanscom Air Force Base, MA, USA), A.Zachor.
Appl. Opt. (USA), vol.22, no.17, p.2665-9 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
Spectrally resolved Earth limb radiance profiles were inverted to recover concentration and temperature profiles in the non-LTE altitude regime. These simulations used synthetic spectra for the optically thin NO fundamental band near 5.3 μm. The purpose of the study was to test a nonlinear inversion algorithm used previously to invert real data obtained in the Spectral Infrared Rocket Experiment. Specifically, the tests consisted of attempts to retrieve singly and doubly peaked excited density vs. altitude profiles and kinetic temperatures vs. altitude from the synthetic spectral data with and without added noise. A nonlinear inversion algorithm was used rather than the formal inverse of the Abel integral equation because it offers promise for species/bands that are not optically thin. (9 refs.)

110678 Atmospheric sounding from a geostationary satellite. W.P.Menzel (Space Sci. & Engng. Center, Univ. of Wisconsin-Madison, Madison, WI, USA), W.L.Smith, G.S.Wade, L.D.Herman, C.M.Hayden.
Appl. Opt. (USA), vol.22, no.17, p.2686-9 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
A case is presented to demonstrate the accuracy of the soundings from a geostationary platform with the visible infrared spin-scan radiometer atmospheric sounder (VAS) on GOES-5. VAS radiances for this case are consistent with TOVS high resolution infrared radiation sounder radiances. VAS temperature profile retrievals agree well with those observed by radiosonde. Initializing the retrieval process with ground-based Profiler data renders an

improved product. Time variations in the atmospheric state are readily discernible from VAS soundings at ~2-h intervals. (7 refs.)

110679 Assessment of relative error sources in IR DIAL measurement accuracy. N.Menyuk, D.K.Killinger (MIT Lincoln Lab., Lexington, MA, USA).
Appl. Opt. (USA), vol.22, no.17, p.2690-8 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
An assessment is made of the role the various error sources play in limiting the accuracy of infrared differential absorption lidar measurements used for the remote sensing of atmospheric species. An overview is presented of the relative contribution of each error source including the inadequate knowledge of the absorption coefficient, differential spectral reflectance, and background interference as well as measurement errors arising from signal fluctuations. (56 refs.)

110680 Spectral pattern recognition in IR remote sensing. A.S.Zachor (Atmospheric Radiation Consultants Inc., Acton, MA, USA).
Appl. Opt. (USA), vol.22, no.17, p.2699-703 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
The basic concepts and some of the methods of pattern classification are reviewed. The problem of detecting and quantifying a mixture of gases is discussed as an application of spectral pattern recognition to atmospheric IR remote sensing. (10 refs.)

110681 Method for investigating the abundance of elements in the Earth's interior. I.P.Nedyalkov (Inst. of Nuclear Res. & Energy, Bulgarian Acad. of Sci., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.5, p.619-22 (1983).
A method for the experimental determination of the distribution of the proton density and the neutron density within the Earth is proposed. These data, once elaborated, make it possible to study in an indirect way the abundance of elements in the Earth. The method described explores the possibilities of neutrino physics. It consists in measuring the attenuation of neutrino and antineutrino beams passed through the Earth in different directions. (15 refs.)

110682 Determination of sea surface temperatures and atmospheric correction values for infrared images on the base of data of the metrological satellite NOAA 5. I.Haupt, H.Billing, S.Jobst (Inst. fur Meteorologie, Freie Univ. Berlin, Berlin, Germany).
Contrib. Atmos. Phys. (Germany), vol.56, no.3, p.295-321 (1983).
Describes a method of deducing the sea surface temperatures and the effective atmospheric absorption from IR satellite measurements without detailed knowledge of the atmospheric conditions. Assuming that the sea surface temperature can be considered as more or less constant during a certain period, from the difference of the 'quasisimultaneously' measured temperatures the limb darkening effect can be deduced, i.e. the magnitude of the radiation absorbed in the atmosphere. Comparison with simple model calculations shows that, as a first approximation, the radiative transfer can be described as an effective absorption, increasing with the path length. (25 refs.)

110683 A method for evaluating the effect of crack geometry on the mechanical behavior of cracked rock masses. M.Oda (Dept. of Foundation Engng., Saitama Univ., Saitama, Japan).
Mech. Mater. (Netherlands), vol.2, no.2, p.163-71 (Aug. 1983).
Discontinuities like faults and joints (called cracks) are of widespread occurrence in rock masses in situ, with very complicated geological setting. The complexity, especially in their geometry, is no doubt a major obstruction to develop a useful theory for evaluating the mechanical behavior of cracked rock masses. An index measure (called fabric tensor) which has been introduced to show crack geometry is further discussed to see if it is useful for evaluating the mechanical behavior of rock masses in situ. Based on some acceptable simplification, an overall elastic compliance for cracked materials is successfully formulated in terms of the fabric tensor. Furthermore, with the help of geometrical probability, the fabric tensor is expressed in terms of in situ measurable quantities. These results strongly suggests that the concept of fabric tensor is useful in the analysis of cracked rock masses. (18 refs.)

110684 The IT method for the harmonic tidal prediction. F.Stravisi (Istituto Talassografico di Trieste, Trieste, Italy).
Boll. Oceanol. Teor. & Appl. (Italy), vol.1, no.3, p.193-204 (July 1983).
With respect to the seven major constituent tides M_2, S_2, N_2, K_2, K_1, O_1, P_1 commonly used in tidal prediction by means of the classical harmonic method, formulae are reported for the computation of the time dependent nodal factors f and of the arguments $V+u$. A fast converging Newton Fourier iterative procedure for the high and low waters computation is described. The related Fortran subroutines are listed. (5 refs.)

110685 Combination and comparison of various filtering techniques in processing gravity data. V.Bezvoda (Faculty of Sci., Charles Univ., Prague, Czechoslovakia), K.Segeth, C.Tomek.
Ann. Geophys. (France), vol.1, no.3, p.229-34 (May-June 1983).
The comparison of the linear filtering of gravity data in the space and wave number domains has shown a good agreement of both the ways employed. This is made particularly clear when processing in the wave number domain, the trend corresponding to a two-dimensional polynomial of low degree is subtracted in advance. In the space domain the filtering is easier, but the boundary region lost is too large. In the wave number domain, after subtracting the trend, the boundary region lost is substantially smaller. Moreover, this kind of filtering seems to be not only faster and easier to proceed, but also more flexible. Practical examples are presented of the gravity data measured in the sedimentary Vienna Basin. (19 refs.)

110686 VLF signal recognition by cross-spectral analysis. D.Jones (British Antarctic Survey, Cambridge, England), F.Lefeuvre, M.Parrot.
Ann. Geophys. (France), vol.1, no.3, p.253-8 (May-June 1983).
A method is described whereby magnetospheric VLF signals can be preprocessed and so reduce the amount of data that has to be telemetered (from satellites or remote Antarctic stations). The method entails the use of the cross-spectral phase, and in particular its stationarity with time, to extract the signal. The technique has been tested on natural VLF emissions recorded on GEOS 1 and the results illustrate that, not only do they support the predictions made on the basis of the earlier simulations, but they also allow the emissions to be viewed from a new perspective. They permit information to be obtained on the propagation characteristics of the waves which was not possible from the cross-spectral power or from the coherence function. The potential of the method for distinguishing signal from noise and for displaying wave propagation characteristics is illustrated using VLF hiss and chorus observed on GEOS 1. (8 refs.)

110687 High-throughput digital SAR processing. M.Jones (Mission & Tech. Coordination Office, European Space Operations Centre, Darmstadt, Germany), J.-C.Degavre, J.P.Guignard.
ESA J. (Netherlands), vol.7, no.2, p.145-62 (1983).
Work done within ESA on the definition of SAR-processing requirements and study of processing technology is reviewed. This work has been driven by the need for fast-delivery processing for the Synthetic-Aperture Radar (SAR) on ERS-1 (the first European remote-sensing satellite). The demands of ERS-1 SAR fast-delivery processing are described and compared with those for other remote-sensing missions. The computer loads involved are analysed by reference to results of theoretical analysis and benchmarking. The current status of processor selection for ERS-1 is described. (22 refs.)

110688 Amplitude calibration of spaceborne Synthetic Aperture Radars. D.N.Held (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
ESA J. (Netherlands), vol.7, no.2, p.163-7 (1983).
The quantitative use of Synthetic Aperture Radar (SAR) data requires that the imagery be well-calibrated. The paper discusses some of the fundamental problems that have been encountered in the past during attempts to calibrate SAR imagery, some recent successful experiments conducted with Seasat SAR data, and a proposed programme for the calibration and validation of the radar imagery from the forthcoming SIR-B SAR. (no refs.)

110689 Tunable diode laser systems for measuring trace gases in tropospheric air. H.I.Schiff, D.R.Hastie (York Univ., Downsview, Ontario, Canada), G.I.Mackay, T.Iguchi, B.A.Ridley.
Environ. Sci. & Technol. (USA), vol.17, no.8, p.352A-64 (Aug. 1983).
Describes the use of tunable diode laser absorption spectrometers for measuring nitrogen oxides in clean and polluted tropospheric air. The authors have used this spectrometer in a mobile system capable of in situ measurements of the oxides of nitrogen and other trace atmospheric gases. (27 refs.)

110690 Compensation of marine seismic data for the effects of highly variable water depth using ray-trace modeling—A case history. B.Dent (Cities Service Co., Tulsa, OK, USA).
Geophysics (USA), vol.48, no.7, p.910-33 (July 1983).
Variable water depth can cause severe degradation of marine seismic data. This paper presents a technique for correcting the effects of water depth variation and is a case history of applying the technique to a line of data from the Philippines offshore. The line crosses a deep submarine valley. (6 refs.)

110691 Geothermal prospecting with Shallo-Temp surveys. L.A.LeSchack (LeSchack Associates Ltd., Long Key, FL, USA).
Geophysics (USA), vol.48, no.7, p.975-96 (July 1983).
The Shallo-Temp survey is an inexpensive and rapid 'first look' geophysical technique that is useful in planning reconnaissance drilling geothermal exploration programs. The technique is based on making many soil temperature measurements at 2-m depths over a given exploration area and correcting these measurements for the effects of elevation and surface geologic and meteorologic conditions. The output from the model is the normally expected 2-m temperature for the given site at the date for which input data were provided. The difference between the measured and computed 2-m temperature data represents effects of geothermal heat flow. A Shallo-Temp residual map is compared both to a 2-m temperature map for a specific date (September, 1977) and to a mean annual 2-m temperature map for the Coso known geothermal resource area producing the same anomaly pattern in each case. (40 refs.)

110692 Butterworth dip filters. D.Hale, J.F.Claerbout (Dept. of Geophys., Stanford Univ., Stanford, CA, USA).
Geophysics (USA), vol.48, no.8, p.1033-8 (Aug. 1983).
Dip filters enable a geophysicist to discriminate between various seismic events on the basis of apparent dip. The frequency-wavenumber (w,k) domain seems an attractive domain to perform dip filtering because it permits the application of an arbitrary transfer function of dip. Seismic applications of dip filtering, however, seldom require the flexibility offered by the (w,k) domain; one may often be willing to sacrifice this flexibility to obtain features not possible with (w,k) domain filters, but readily available with time-space (t,x) domain filters. Examples are (1) time and space variability, (2) flexible treatment of computational grid boundaries, and (3) an efficient, recursive implementation. The authors describe a (t,x) domain dip filtering method with these features. (5 refs.)

110693 The resonant acoustic pulser—a continuous-frequency marine seismic source. H.C.Hardee (Geophys. Div., Sandia Nat. Labs., Albuquerque, NM, USA).
Geophysics (USA), vol.48, no.8, p.1082-9 (Aug. 1983).
A marine seismic source is described which produces a continuous low-frequency (10-100 Hz) harmonic signal. High acoustic power levels (~20 kW) are reached by using a resonant system. The seismic source has been successfully tested in lake and ocean environments. Geophysical applications are discussed and modifications are described which would allow the source to be operated in a swept-frequency mode. (12 refs.)

110694 Experience with the EM-60 electromagnetic system for geothermal exploration in Nevada. M.Wilt, N.E.Goldstein (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA), M.Stark, J.R.Haught, H.F.Morrison.
Geophysics (USA), vol.48, no.8, p.1090-101 (Aug. 1983).
Lawrence Berkeley Laboratory (LBL) conducted controlled-source electromagnetic (EM) surveys at three geothermal prospects in northern Nevada to test and demonstrate the applicability of LBL's EM-60 system to geothermal exploration. During the late summer and early fall of 1979, over 40 soundings were made in Panther Canyon (Grass Valley), near Winnemucca; Soda Lakes, near Fallon; and McCoy, west of Austin. The EM-60 is a frequency-domain system using three-component magnetic detection. For the surveys reported ±65 A was applied to a 100-m diameter four-turn horizontal loop, generating a dipole moment $>10^6$ mks over the frequency range 10^{-3} to 10^3 Hz. With such a source loop and a remote magnetic reference for noise cancellation, soundings were made at transmitter-receiver separations of up to 4 km over the frequency range of 0.05 to 500 Hz. This has yielded a maximum depth of exploration to 2 km or more, adequate for the purposes of the geothermal investigations. (24 refs.)

110695 Recent developments in the use of surface electrical methods for oil and gas exploration in the Soviet Union. B.R.Spies (Bur. of Mineral Resources, Canberra, Australia).
Geophysics (USA), vol.48, no.8, p.1102-12 (Aug. 1983).
In late 1979, the author visited the Soviet Union under the auspices of the Australia-USSR agreement on scientific cooperation, with the purpose of studying recent developments in electrical and electromagnetic (EM) methods. This paper presents a summary of the use and applications of those methods in oil and gas exploration, and includes a number of case histories. (22 refs.)

110696 Electrode configuration influence on resistivity measurements about a spherical anomaly. R.J.Lytle, J.M.Hanson (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
Geophysics (USA), vol.48, no.8, p.1113-19 (Aug. 1983).
The trade-offs involved with subsurface resistivity probing are studied for the case of a spherical anomaly. In particular, two-, three-, and four-electrode configurations are investigated. The three- and four-electrode configurations have similar results and have significantly better remote detection capabilities than does a two-electrode configuration. Cross-borehole probing is capable of detecting anomalous conditions at a greater range than is single-borehole probing. (17 refs.)

110697 Theoretical and experimental approaches to the geophone spurious frequency. Shi Jung Chen (AMF Geo Space Co., Houston, TX, USA), Ch.Dalton.
Geophys. Prospect. (Netherlands), vol.31, no.4, p.574-90 (Aug. 1983).
The geophone spurious frequency is modeled at the resonance of the planar motion of a spider spring carrying a moving mass. An analytic solution is found using the Castigliano method by assuming that the spring arm is a single-mode vibrating cantilever beam. The spring shape is found from this analysis. A dimensional analysis is used as an approximate method for general design. Based on the theoretical result, a rotational fixture and a translational fixture were designed for experimental purposes. A low-noise fixture and a phase-averaging technique provide the amplitude and spurious resonance in the frequency domain. (6 refs.)

110698 The autobalancer—an automatic system for the reduction of power-line interference with seismic signals. L.Ensing.
Geophys. Prospect. (Netherlands), vol.31, no.4, p.591-607 (Aug. 1983).
Since the early years of seismic surveying, field engineers and observers have been faced with the appearance of interference at power-line frequency (and harmonics) on seismic records. Such interference is picked up from the ground surface through electric leakage between geophone leads and ground. To minimize power-line interference, the autobalancer automatically performs a balancing procedure by adjusting two potentiometers on each channel. (4 refs.)

110699 Transformation of resistivity sounding measurements obtained in one electrode configuration to another configuration by means of digital linear filtering. A.T.Basokur (Ankara Univ., Besevler-Ankara, Turkey).
Geophys. Prospect. (Netherlands), vol.31, no.4, p.649-63 (Aug. 1983).
The technique of digital linear filtering is used for transformation of apparent resistivity data from one electrode configuration into another. Usually filter spectra are determined via the discrete Fourier transforms of input and output functions. In this paper, the transformation of the apparent resistivities is presented for four electrode configurations (Wenner, the two-electrode, Schlumberger, and dipole configurations). Sinc responses for determination of the derivative of apparent resistivities are given in analytical form. (12 refs.)

110700 Estimation of formation temperature from borehole measurements. M.N.Luheshi (Geophys. Res. Branch, BP Petroleum Dev. (Overseas), London.Ltd.,England).
Geophys. J. R. Astron. Soc. (GB), vol.74, no.3, p.747-76 (Sept. 1983).
A new numerical method is described for modelling the thermal disturbance around a borehole and a comparison is made with the commonly used line source model. The numerical model generally gives an estimate of the equilibrium formation temperature which is up to about 20 per cent higher than the 'Horner plot' method. The relaxation of the borehole temperature is sensitive to the contrast between the thermal properties of the drilling fluid and of the surrounding rock as well as to the disturbance time. The importance of vertical temperature gradients and fluid motion (both free convection in the borehole and flow in the formation) is also examined. It is found that vertical temperature gradients are unlikely to be important provided temperatures are measured more than 10 borehole radii above the bottom. Convective heat transfer can be important under some drilling conditions. (21 refs.)

110701 Sounding of the atmosphere with CW lidar. A.V.Sinyavskii.
Izv. Akad. Nauk Arm. SSR Fiz. (USSR), vol.17, no.1, p.39-41 (1982). In Russian.
A method for the investigation of atmospheric fogs using a CW laser is proposed. The processing of post-detector data allows one to discriminate the jamming of atmospheric aerosol return for small values of S/N ratio. (5 refs.)

110702 Augmenting LANDSAT MSS data with topographic information for enhanced registration and classification. K.Seidel, F.Ade (Inst. for Communication Technol., Zurich, Switzerland), J.Lichtenegger.
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.252-8 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
Deals with problems arising in the classification of LANDSAT MSS data from rugged terrain. A digital terrain model (DTM) was found to be useful in several ways. For registration by cross-correlation, mountain ridges were extracted from both a synthetic image based on the DTM and a LANDSAT image. Information from the DTM, from thematic maps, and meteorological data were all used as ancillary data to aid in rapid snow cover determination without direct ground control in a large catchment area. In addition it is shown that the use of the DTM not only allows the assessment of relative and absolute snow distribution within given elevation zones, but also permits the extrapolation of snow cover into areas partly covered with clouds. (17 refs.)

110703 The Thematic Mapper—an overview. J.L.Engel (Santa Barbara Res. Center, Goleta, CA, USA), O.Weinstein.
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.258-65 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
The Thematic Mapper (TM) is a second-generation Earth resources sensor built by Hughes Aircraft Company for NASA for the LANDSAT series of spacecraft. The TM was placed in orbit aboard the LANDSAT-D spacecraft in July of 1982. Its predecessor, the Multispectral Scanner (MSS) has flown on LANDSAT's 1 through 3 and accompanies the TM on LANDSAT-D. The need for improved performance was recognized prior to the launch of the first MSS on LANDSAT-1 in 1972. The performance specifications for the TM were formulated to produce performance improvements in the next generation sensor. This paper will provide an overview of TM and will briefly discuss the LANDSAT-D mission and orbit, TM design, instrument performance, and program status. (no refs.)

110704 On the sampling problem in radiation budget studies. K.T.Kriebel, A.E.Pietrass (Deutsche Forschungs -und Versuchsanstalt fur Luft -und Raumfahrt e.V., Oberpfaffenhofen, Germany).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.271-8 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
The radiation budget is the difference of downwelling and upwelling flux densities at a reference surface, whereas the quantity measured by narrow field of view instruments is the directional radiance. Insufficient knowledge of its angular anisotropy causes errors in the derived radiation budget. A new formulation is presented of the constraints in sampling the angular directions of the hemisphere over a mesoscale target area, introduced by scan patterns and by orbit repeat cycles. Comparison by simulation of line scanner, conical scanner (CSR), and Nimbus-7 ERB scanner in orbits with short and long repeat cycle reveals the latter orbit and the CSR as best suited to sample all directional classes. (21 refs.)

110705 Mapping and analysis of aerial conductivity measurements from INPUT system over geothermal areas. V.S.Jordon (Geo-Centers, Inc., Newton, MA, USA), K.U.Sivaprasad, D.V.Smith.
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.278-84 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
Remotely sensed electromagnetic data taken with an INPUT system for the US Geological Survey in aerial surveys over a known geothermal resource area have been reduced and plotted in a gray scale format for two- and three-dimensional projections of the apparent subsurface conductance. The apparent conductance is calculated using both the channel ratio method and the theoretical two-layer model of the Earth. Matching the survey data to the two-layer model gave good results consistent with the ratio method of apparent conductance calculation and permitted the construction of maps of horizontal slices of apparent conductance at different depths into the Earth, from one to fifty metres. The channel ratio and horizontal slice maps of apparent conductance give a picture of the apparent conductance which is consistent with known topographical features of the regions. (5 refs.)

110706 Variation of the microwave brightness temperature of sea surfaces covered with mineral and monomolecular oil films. H.-J.Blume (NASA Langley Res. Center, Hampton, VA, USA), H.Huhnerfuss, W.Alpers.
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.295-300 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
Airborne microwave radiometer measurements over mineral and monomolecular oil films and adjacent clean sea surfaces are reported. An artificial crude-oil spill experiment in the New York Bight area showed a brightness temperature increase of the sea surface at 1.43 GHz as expected from a multilayered system with different dielectric constants. However, a monomolecular surface-film experiment with oleyl alcohol conducted in the North Sea during MARSEN in 1979 showed a strong brightness temperature depression at 1.43 GHz and no change in brightness temperature at 2.65 GHz. It is postulated that the monomolecular layer, because of its physical and chemical properties, polarized the underlying water molecules so strongly that the emissivity decreased from 0.31 to 0.016. It is estimated that the effective dielectric constant changed from 90 to 5.2×10^4. Because these phenomena occurred at 1.43 GHz it may be concluded that this frequency is very close to the center of a new anomalous dispersion region resulting from a restructuring of the water layer below the surface film. (17 refs.)

110707 Improvement of moisture estimation accuracy of vegetation-covered soil by combined active/passive microwave remote sensing. F.T.Ulaby, M.C.Dobson, D.R.Brunfeldt (Remote Sensing Lab., Univ. of Kansas Center for Res. Inc., Lawrence, KS, USA).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.300-7 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
The measured effects of vegetation canopies on radar and radiometric sensitivity to soil moisture are compared to first-order emission and scattering models. The models are found to predict the measured emission and backscattering with reasonable accuracy for various crop canopies at frequencies between 1.4 and 5.0 GHz, especially at angles of incidence less than 30°. The vegetation loss factor $L(\theta)$ increases with frequency and is found to be dependent upon canopy type and water content. In addition, the effective radiometric power absorption coefficient of a mature corn canopy is roughly 1.75 times that calculated for the radar at the same frequency. Comparison of an L-band radiometer with a C-band radar shows the two systems to be complementary in terms of accurate soil moisture sensing over the extreme range of naturally occurring soil-moisture conditions. (14 refs.)

110708 Amplitude and phase errors involved in retrieving depolarized radar cross section measurements. A.J.Blanchard, R.W.Newton, B.R.Jean (Remote Sensing Center, Texas A&M Univ., College Station, TX, USA).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.314-19 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
The response of radar systems to linearly polarized (both like and cross polarized) interaction processes associated with Earth/land targets is studied theoretically. Particularly disconcerting is the general lack of agreement near nadir between depolarized radar data and the theoretical models which attempt to describe these processes. In this paper consideration is given to the geometry of the measurement situation and the nonideal nature of realistic antennas in an attempt to quantify possible measurement system error. The results indicate that induced system error can account for several dB of error in the depolarized measurement. These errors are most significant at the nadir measurement configuration. (14 refs.)

110709 Atmospheric water-vapor profiling by ground-based radiometry at 22 and 183 GHz. J.I.H.Askne, B.G.Skoog (Dept. of Electron Phys., Chalmers Univ. of Technol., Gothenburg, Sweden).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.320-3 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
The possibility to determine water-vapor profiles by combining observations at 21.0 and 31.4 GHz with observations at frequencies near the 183.3-GHz resonance line has been investigated. It is demonstrated that the accuracy of the retrieved profiles will be improved in the height interval 0 to 2 km. In this height interval the presence of inversion layers is one of the main uncertainties. As an alternative to 183-GHz observations, an active sensor can be used to indicate the presence of an inversion layer. It is shown that the improvement of the accuracy would then be of the same order as obtained with a 183-GHz system. (14 refs.)

110710 Synthetic aperture radar imaging from an inclined geosynchronous orbit. K.Tomiyasu, J.L.Pacelli (General Electric Co., Valley Forge Space Center, Philadelphia, PA, USA).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.324-9 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
Images of Earth can be produced with an assumed synthetic aperture radar (SAR) on a satellite platform undergoing a nutating relative motion from geosynchronous altitude. From a 50° inclined circular orbit, the contiguous United States can be imaged in about 3 h of segmented operation at 100-m resolution with 4-azimuth-look averaging. The 2450-MHz transmitter radiates

1312 W of average power from a steerable 15-m-diam antenna. The SAR can image daily an area bounded longitudinally and latitudinally. (14 refs.)

110711 Remote sensing of soil moisture: recent advances. T.J.Schmugge (Hydrological Sci. Branch, NASA Goddard Space Flight Center, Greenbelt, MD, USA).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.336-44 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
In the past few years there have been many advances in the understanding of microwave approaches for the remote sensing of soil moisture. These advances include a method for estimating the dependence of the soil's dielectric constant on its texture; the use of percent of field capacity to express soil moisture magnitudes independently of soil texture; experimental and theoretical estimates of the soil moisture sampling depth; models for describing the effect of surface roughness on the microwave response in terms of surface height variance and the horizontal correlation length; verification of the ability of radiative transfer models to predict the microwave emission from soils; and experimental and theoretical estimates of the effects of vegetation on the microwave response to soil moisture. This research has demonstrated that it is possible to remotely sense soil moisture in the surface layer of the soil (about 0-5 cm). In addition there have been simulation studies indicating how remotely sensed surface soil moisture may be used to estimate evapotranspiration rates and root-zone soil moisture. (42 refs.)

110712 A compact high-resolution Michelson interferometer for passive atmospheric sounding (MIPAS). P.Burkert (Kayser-Threde GmbH, Munich, Germany), F.Fergg, H.Fischer.
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.345-9 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
More precise information on the chemistry, dynamics, and energy budget of the middle atmosphere can be derived from globally and simultaneously measured concentration profiles of a substantial number of atmospheric trace gases. Such a data base can be obtained from infrared limb spectra which are recorded by spaceborne instruments. Fourier transform spectrometers are especially appropriate for such a task. In this paper are discussed characteristic features and performance parameters of a compact high-resolution (0.05 cm^{-1}) rapid-scanning (1 s) interferometer for measurements in the 2 to 15-μm region. Technical data of a cryogenic version as well as of an uncooled satellite instrument are presented. (17 refs.)

110713 The Ocean Color Experiment (OCE) on the second orbital flight test of the Space Shuttle (OSTA-1). H.van der Piepen (DFVLR, Inst. fur Optoelektronik, Oberpfaffenhofen, Germany), H.H.Kim, W.D.Hart, V.Amann, H.Helbig, A.F.G.Fiuza, M.Viollier, R.Doerffer.
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.350-7 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
The Ocean Color Experiment was one of the six remote-sensing experiments which for the first time were launched and successfully operated on board of the second flight of the Space Shuttle during November 1981. The experiment consists of a multispectral image scanner dedicated to the measurement of water color and its interpretation in terms of major water constituents and circulation patters. The objectives of the experiment, the test site selection, and associated activities are described. The actual mission and results of an initial data analysis is discussed. (13 refs.)

110714 The dielectric properties of wet materials. G.Paul de Loor (Phys. Lab. TNO, The Hague, Netherlands).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.364-9 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
In microwave remote sensing, knowledge of the dielectric properties of the materials observed (vegetation, soils) is important for the interpretation of the recorded reflection or emission and for the design of models for this reflection or emission. Although there exists no simple law which describes the properties of a heterogeneous system when the properties of its components are known, boundaries can be indicated for the permittivity of such a system. Heterogeneous systems containing water, such as wet soils and plant material, have very complex dielectric properties due to the role of the conductivity. However, at the higher microwave frequencies, in particular above the *S*-band, these conductivity effects play only a minor role and the free water is most important. By knowing the permittivity of wet materials the penetration depth can be determined. In all practical cases this depth is smaller than the wavelength used for the observations. (22 refs.)

110715 Comparison of several techniques to obtain multiple-look SAR imagery. F.-K.Li (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA), C.Croft, D.N.Held.
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.370-5 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
Synthetic aperture radar imagery is contaminated by coherent speckle noise. In order to improve interpretability, multiple-look images are usually generated. In this paper, the authors examine the performance of several classes of techniques to generate such multiple-look imagery. The detailed impulse responses and the signal-to-speckle noise ratios obtained by the various techniques are presented. It is found that by using several types of image domain filters, the signal-to-speckle noise ratio can be improved over the conventional discrete mixed-integrator while keeping the equivalent rectangular resolution constant. (13 refs.)

110716 Remote sensing of wetlands. M.K.Butera (Earth Resources Lab., NASA/Nat. Space Technol. Labs., NSTL Station, MS, USA).
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.383-92 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
Demonstrates three examples of applying remote sensing technology to the delineation of wetlands in the United States. First, the results of a technique to identify roseau cane (Phragmites communis) using LANDSAT and aircraft MSS data are presented. Approximately 9700 ha. of Phragmites communis were identified in the Mississippi River delta using LANDSAT data. Second, the results of a technique to identify wetland communities, principally mangroves, in Florida using LANDSAT and aircraft MSS are presented. A cost analysis of the remote versus conventional ground-survey technique is provided. The LANDSAT MSS average classification accuracy for mangroves only versus all classes were 87 percent and 74 percent, respectively. The third example presents the results of a technique to delineate surface cover types in the southeast tidal/riverine system of the Savannah River. (12 refs.)

110717 Simulation of spaceborne stereo radar imagery: experimental results. V.H.Kaupp (Dept. of Electrical Engng., Univ. of Arkansas, Fayetteville, AR, USA), L.C.Bridges, M.A.Pisaruck, H.C.Macdonald, W.P.Waite.
IEEE Trans. Geosci. & Remote Sensing (USA), vol.GE-21, no.3, p.400-5 (1982). (1982 International Geoscience and Remote Sensing Symposium (IGARSS '82), Munich, Germany, 1-4 June 1982).
Computer simulation of radar imagery was used to investigate spaceborne stereo radar. The major conclusions reached are that stereo pairs representing different angles of incidence with the same look-direction appear best and that the angles of incidence and stereo intersection angle be matched to the slope and relief of terrain. A parametric tradeoff analysis was performed for eleven different angles of incidence over three different model areas. The eleven angles spanned the range from small- to large-incidence angles. The three model areas were selected as typical of relatively flat, moderately rough, and mountainous terrain. The stereo pair judged best for each model area are included. (20 refs.)

110718 Automatic AF-demagnetiser using a two-axis spin magnetometer. R.Hummervoll (Dept. of Geophys., Univ. of Bergen, Bergen, Norway).
J. Phys. E (GB), vol.16, no.9, p.888-91 (Sept. 1983).
A description of an automatic instrument is given, in which demagnetisation and subsequent measurement of the partially demagnetised rock sample is performed at the same field-free space. The rock samples are measured by a two-axis spin magnetometer which gives the three orthogonally magnetic components directly during the spin without the need to turn the sample in its holder. (4 refs.)

110719 Sea surface winds from Sun glitter observations. L.Wald, J.M.Monget (Ecole Nat. Superieure des Mines de Paris, Valbonne, France).
J. Geophys. Res. (USA), vol.88, no.C4, p.2547-55 (20 March 1983). [received: Sept. 1983]
Solar light reflected by the surface of the sea depends strongly on the sea state which is driven by the wind. The relationship between the reflected light and wind speed is described by the well-known model of Cox and Munk (1954, 1955). Using their model, a method is derived for the retrieval of the synoptic field of wind magnitude from measurements of the glitter pattern from space. This method is applied to data obtained by the TIROS-N satellite series. Comparison of the wind estimated in this way and the wind derived from isobaric charts shows very close agreement. The method is simple and has application over broad geographic areas. (26 refs.)

110720 The effect of oceanic whitecaps and foams on pulse-limited radar altimeters. Q.A.Zheng, V.Klemas (Coll. of Marine Studies, Univ. of Delaware, Newark, DE, USA), G.S.Hayne, N.E.Huang.
J. Geophys. Res. (USA), vol.88, no.C4, p.2571-8 (20 March 1983). [received: Sept. 1983]
Based on electromagnetic field theory of stratified media, the microwave reflectivity of a sea surface covered by whitecaps and foams at 13.9 GHz was computed. The computed results show that the reflectivity declines with increasing thickness of foams. The reflectivity of the sea surface without any whitecaps or foams is 0.6066 (20°C, *S*:35 per mille), but it will be less than 0.15 when the thickness of foam cover is more than 0.3 cm. While gathering the data of whitecap and foam coverage in situ and reviewing whitecapping models, it can be shown that the effect of oceanic whitecaps and foams on the measurement results of a pulse-limited radar altimeter working at high frequencies will not be negligible in high sea state conditions. (41 refs.)

110721 High-resolution spectral estimation of synthetic aperture radar ocean wave imagery. P.L.Jackson (Geological Sci. Dept., Univ. of Michigan, Ann Arbor, MI, USA), R.A.Shuchman.
J. Geophys. Res. (USA), vol.88, no.C4, p.2593-600 (20 March 1983). [received: Sept. 1983]
A new two-dimensional spectral estimation procedure, termed semicausal, is applicable to analysis of ocean gravity waves. Spectral estimates of both reference functions and actual synthetic aperture radar data of ocean waves have been generated using semicausal techniques and compared to fast Fourier transform estimates of identical data sets. The semicausal method can successfully generate spectral estimates of truncated data sets and data sets with two closely spaced frequency components. The semicausal estimate is sensitive to the autoregressive order and exhibits spectral splitting in some cases. Its noise sensitivity is similar to that of the Fourier transform. (15 refs.)

110722 GPS aiding of ocean current detemination. S.N.Mohan (Navigation Systems Section, Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
J. Astronaut. Sci. (USA), vol.31, no.2, p.281-313 (April-June 1983).
In situ ocean current measurements involving the use of shipborne acoustic profilers are dependent on accurate ship velocity information. Acoustic profilers permit measurement of the horizontal water velocity relative to the ship; however, absolute current velocity can be obtained only if the velocity of the ship relative to an Earth-fixed coordinate reference is known. Available navigation sources such as LORAN-C, Transit and Omega suffer from limitations in coverage; and with the exception of Transit, in accuracy as well. The NAVSTAR Global Positioning System (GPS) has the potential to extend coverage as well as improve navigational precision. GPS user application in the marine environment is as yet new and is a subject of current investigation. The author presents an accuracy analysis using a shipboard GPS receiver and coverage from the existing constellation of GPS navigation satellites. (20 refs.)

110723 The WPL profiler: a new source of mesoscale observations. P.K.James (Meteorological Office Radar Res. Lab., RSRE, Malvern, England).
Meteorol. Mag. (GB), vol.112, no.1333, p.229-36 (Aug. 1983).
A ground-based system being developed at the Wave Propagation Laboratory in Boulder, Colorado, is able, unmanned, to provide atmospheric profiles up to tropospheric heights. The output from this system is continuous in time and thus is potentially a useful source of information for short-period forecasters. (12 refs.)

110724 Oscillations of moored current meters and their effect on the measurement of current variables. V.M.Kushnir, V.I.Remchukov (Marine Hydrophys. Inst., Acad. of Sci., Sevastopol, Ukrainian SSR).
Oceanology (USA), vol.22, no.2, p.239-44 (1982). Translation of: *Okeanologiya (USSR),* vol.22, no.2 (1982). [received: Aug. 1983]
A recorder of the relative current velocity and angular deviations from the longitudinal, transverse and vertical axes of the current meter is described. Methods of statistical data processing are analysed in order to determine the contribution of different components to the total variance of the velocity measuring error. Results of measurements performed at different depths in the Caribbean Sea are discussed. (9 refs.)

110725 Aircraft-borne lightning sensor. W.L.Wolfe (Optical Sci. Center, Univ. of Arizona, Tucson, AZ, USA).
Opt. Eng. (USA), vol.22, no.4, p.456-9 (July-Aug. 1983).
Describes an instrument that has been used to measure the spatial and temporal distributions of lightning strokes as seen from a high-altitude aircraft platform. It consists of two separate sensors. One has a lens, selectable filters, and a 50×50 element array of photodiodes. The second has an identical lens, filters, and a single detector that covers the same total field of view. (4 refs.)

110726 Tradeoffs among several synthetic aperture radar image quality parameters: results of a user survey study. F.K.Li, M.L.Bryan (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Photogramm. Eng. & Remote Sensing (USA), vol.49, no.6, p.791-803 (June 1983).
A synthetic aperture radar (SAR) is a complex remote sensor. In such remote sensing systems there are a number of options available for tradeoffs by the system designer. In this study the author analyzes the effects of adjusting the 'number of multiple looks' (i.e. the amount of incoherent averaging used in producing the imagery), the 'resolution' (i.e. the number of quantization levels per sample of the raw SAR signal). Several scenes obtained by the Seasat SAR were processed in a variety of ways and studied by a group of interpreters. Their responses were tabulated with respect to the particular scene and the different processing parameters which were used to produce the images. It is concluded that the relative importance for image interpretation is, in decreasing order, resolution, number of multiple looks, and number of bits. (18 refs.)

110727 Spectral characterization of the Landsat-4 MSS sensors. B.L.Markham, J.L.Barker (NASA, Goddard Space Flight Center, Greenbelt, MD, USA).
Photogramm. Eng. & Remote Sensing (USA), vol.49, no.6, p.811-33 (June 1983).
Relative spectral response data for the Landsat-4 and Landsat-4 backup multispectral scanner subsystems (MSS), the protoflight and flight models, respectively, are presented and compared to similar data for the Landsat 1, 2, and 3 scanners. Channel-by-channel (six channels per band) outputs for soil and soybean targets were simulated and compared with each band and between scanners. The two Landsat-4 scanners proved to be nearly identical in mean spectral response but they exhibited some differences from the previous MSS's. (6 refs.)

110728 A weather radar correction procedure for real-time estimation of surface rainfall. C.G.Collier, P.R.Larke, B.R.May (Meteorological Office Radar Res. Lab., Malvern, England).
Q. J. R. Meteorol. Soc. (GB), vol.109, no.461, p.589-608 (July 1983).
Several sources of error have been identified in measuring rainfall by radar. In this paper, the authors discuss these sources of error as they affect the calibration of a radar system using raingauge data. Present calibration techniques are considered, and the need for procedures based upon a knowledge of the structure of precipitation systems is noted. Finally, a new procedure is described, and its performance assessed for a number of cases of frontal and convective rainfall. (21 refs.)

110729 One possibility for predicting the Delingier effect from solar radio-emission data. L.P.Morozova (Inst. of Appl. Geophys., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.10, p.795-7 (Oct. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.10, p.1115-18 (Oct. 1982). [received: Sept. 1983]
The possibility is considered of predicting the Delingier effect seven days in advance from the criterion of an excess of the current level of radio-emission intensity at $\lambda=3.2$ cm over a floating threshold which depends on the solar activity index $F_{10.7}$. The prediction is quasioptimal, minimizing the total losses due to omission and spurious detection of the effect, and based on data of 1978-1981 it provides a probability of correct detection on the order of 90%. (6 refs.)

110730 Remote radio determination of the altitude gradient of the temperature in the near-surface layer of the atmosphere. S.A.Zhevakin (Radiophys. Sci. Res. Inst., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.10, p.797-806 (Oct. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.10, p.1119-30 (Oct. 1982). [received: Sept. 1983]
A procedure is proposed for the determination of the value of the near-surface temperature gradient of the atmosphere a averaged over the near-surface layer of the atmosphere (several hundred meters thick) from the brightest temperatures at two viewing angles. It is shown that the optimal absorption line for making the measurements is the $\lambda\sim5$ mm ($\nu\simeq59$-62 GHz) oxygen multiplet. It is noted that the accuracy of the determination of the quantity a by the proposed procedure is several times higher than by the usual procedure of recovering the temperature distributions of the atmosphere at frequencies $a=53$-55 GHz. (17 refs.)

110731 The measurement of atmospheric extinction and brightness temperature at millimeter wavelengths. S.A.Pelyushenko (Sci.-Res. Inst. of Radiophys., USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.11, p.906-13 (Nov. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.11, p.1269-78 (Nov. 1982). [received: Sept. 1983]
Discusses a technique for determining the total vertical extinction in the atmosphere (in the 6-8 mm band) which permits both radio emission of the Earth and anisotropy of the side lobes of an antenna beam to be correctly taken into account. The author derives the dependence of the total vertical extinction in the atmosphere on the absolute humidity near ground level from measurements at wavelengths of 6.3, 6.7, and 8.6 mm. (13 refs.)

110732 Method of measuring the vertical ozone distribution by an optical method on meteorological rockets. N.I.Brezgin (Central Aerological Obs., USSR).
Sov. Meteorol. & Hydrol. (USA), no.4, p.79-84 (1982). Translation of: *Meteorol. & Gidrol. (USSR)*, no.4, p.100-5 (1982).
The main components of photometers and a method of measuring the vertical ozone distribution using meteorological rockets MR-12 and M-100 by an optical method are described. The atmospheric ozone content is calculated by several methods. The error of measuring the vertical ozone distribution by the optical method is estimated theoretically. To check the theoretical estimate, the results obtained in different spectral intervals on one meteorological rocket and in two launches of meteorological rockets conducted with an hour interval were compared. (16 refs.)

110733 Clear weather laser radar. C.E.Harris (Equipment Dev. Labs., Raytheon Co., Sudbury, MA, USA), J.A.Dunkin.
Electro/81 Conference Record, New York, USA, 7-9 April 1981 (El Segundo, CA, USA: Electron. Conventions 1981), p.34/3/1-8
This paper describes an airborne LIDAR system designed for the measurement of atmospheric velocities under conditions of clear weather from ground level to jet transport flight levels. The design of the CO_2 MOPA transmitter and filter bank processor are discussed, performance evaluations of the system are presented and some of the results of atmospheric measurements are presented. (2 refs.)

110734 Effects of the atmosphere on image resolution in microwave radiometry. G.d'Auria, D.Solimini (Istituto di Elettronica, Univ. di Roma, Roma, Italy).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.259-67
Effects of the atmosphere and the radiometer antenna on the attainable image resolution has been analyzed. The use of a de-convolution process to improve resolution is discussed together with errors introduced when correcting for atmospheric effects. Accuracy of resolution is taken into account following the Backus-Gilbert approach and a trade off between resolution and noise suppression is sought. Errors caused by the atmosphere are derived for realistic meteorological conditions. (12 refs.)

110735 Mesopheric water vapour measured with an airborne sensor. G.K.Hartman (Max-Planck-Inst. fur Aeronomie, Lindau, Germany), K.F.Kunzi, E.Lobsiger.
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.269-71
A mm-wave radiometer measuring the thermal emission from rotational transitions of the H_2O-molecule is well suited to obtain height information on the mixing ratio of water vapour in the stratosphere and mesosphere. The strong 183 GHz resonance (wavelength ~1.6 mm) allows sufficient signal to noise ratio for relatively short integration times of minutes, however the large amount of water vapour in the troposphere requires an observing altitude at or near the tropopause. The microwave sensor used on the German meteorological research aircraft Falcon in several flights during 1982 permits to retrieve the water vapour distribution between 30 and 80 km. The preliminary data analysis shows typical volume mixing ratios below 3 ppm above 50 km with no significant maximum at the stratopause as found with ground based 22 GHz measurements. (9 refs.)

110736 Radiometric sensing of the atmospheric boundary layer. P.Ciotti, A.Silbermann (Istituto di Elettronica, Univ. di Roma, Rome, Italy), D.Solimini, E.R.Westwater.
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.281-8
Radiometry is a convenient and powerful remote sensing technique in meteorology. Sufficiently sensitive instruments operated on suitable wavelength bands are able to sense small scale fluctuations of meteorological variables and the fast temporal response makes radiometry an attractive technique for remotely monitoring the boundary layer of the atmosphere. To evaluate ground-based radiometry for boundary layer observations, an experiment was carried out at the NOAA Boulder Atmospheric Observatory, where a 300 m instrumented tower provides adequate atmospheric truth. The output of an infrared radiometer set at the base of the tower was recorded on several days and with different meteorological conditions, together with data collected by the sensors at the various levels of the tower. From the temporal data series correlation is apparent between the characteristics of the radiometer output and the structure of the atmospheric boundary layer. (12 refs.)

110737 ART and SIRT correction factors in geotomography. C.A.Balanis, H.W.Hill, K.A.Freeland (Dept. of Electrical Engng., West Virginia Univ., Morgantown, WV, USA).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.335-9
A new correction factor is introduced which, when utilized with the iterative reconstruction techniques of the ART and SIRT, provides images of high resolution. In addition, the utilization of the newly formed correction factor results in reconstructions which converge at a faster rate. The reconstruction quality of each image is judged by its corresponding Euclidean distance. (9 refs.)

110738 Stability improvements in geotomographic inversion methods. R.Radcliff (Dept. of Electrical & Computer Engng., Ohio Univ., Athens, OH, USA), C.A.Balanis, H.W.Hill.
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.341-6
The accuracy, validity, and range of application of geophysical tomography (geotomography) has recently been significantly improved by the incorporation of refraction and first-order reflection into the inversion process. This is done by the means of an iterative refinement scheme, which exhibits stability problems under certain conditions. In this paper, the stability improvements of selective smoothing and path elimination are introduced which, along with guidelines for their application developed through experience with many computer simulations, results in a much more stable geotomographic technique. Several examples of reconstructions obtained by this technique are given and compared with those obtained by traditional straight-line geotomography. (11 refs.)

110739 On electromagnetic methods in geophysical probing. V.Hansen (Inst. fur Hoch- und Hochstfrequenztech., Ruhr-Univ. Bochum, Bochum, Germany).
Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium, Louvain-la-Neuve, Belgium, 9-15 June 1983 (Paris, France: ESA 1983), p.399-404
The electromagnetic field is analysed for a wire antenna above a stratified structure as a model of the Earth. For the current on the wire an integral equation is formulated using the Green's function of the structure. The complete set of equations for the Green's function are discussed and solved including the effect of surface and leaky waves. The integral equation is solved by the method of moments. Inferred from the current the input impedance, the mutual coupling of two antennas and the field in the layers are discussed and interpreted in terms of the structure parameters. (12 refs.)

Application of Nuclear Techniques in Geothermal Investigations Consultants Meeting .... See Entry 105018

Wave Propagation and Remote Sensing. Proceedings of URSI Commission F Symposium .... See Entry 105033

Third Joint Conference on Applications of Air Pollution Meteorology .... See Entry 105036

Layer response to a sinusoidal electromagnetic excitation by an impulse approximation of a thin plate .... See Entry 106679

Gravity interpretation of two dimensional fault structures using Hilbert transforms .... See Entry 110275

Inertial surveying and geodesy .... See Entry 110276

Analytic comparison of apparent polar wander paths	See Entry 110281
Airborne resistivity mapping using a multifrequency electromagnetic system	See Entry 110284
The integral-finite-difference method for calculating transient electromagnetic fields in a horizontally stratified medium	See Entry 110285
Peninsula effects in central Japan and their relation to the electrical conductivity structure	See Entry 110292
Computer synthesis of geomagnetic palaeosecular variations	See Entry 110294
Interpretation methods for magnetometer arrays	See Entry 110297
Accuracy of the initial phase and the phase velocity of surface waves with special reference to the single-station method	See Entry 110301
Structural inversion of salt dome flanks	See Entry 110313
Computing true amplitude reflections in a laterally inhomogeneous Earth	See Entry 110314
Migration in the presence of a rugged interface with high velocity contrast	See Entry 110316
Wide angle seismic profiling in the ocean using a towed sonobuoy	See Entry 110324
^{40}Ar/^{39}Ar age spectrum analysis of detrital microclines from the southern San Joaquin Basin, California: an approach to determining the thermal evolution of sedimentary basins	See Entry 110328
Cation-ratio dating: a new rock varnish age-determination technique	See Entry 110344
Quantitative measurement of the mass-color of zircon in igneous rocks from the Kujyu volcanic region, central Kyushu	See Entry 110345
Automatic three-layer, three-dimensional deconvolution of the Pays de Bray anticline	See Entry 110367
Multispectral remote sensing of saline seeps	See Entry 110372
Comparison of multifrequency band radars for crop classification	See Entry 110374
Method for retrieving the true backscattering coefficient from measurements with a real antenna	See Entry 110375
Classification of agricultural crops in radar images	See Entry 110376
Computer simulation of speckle in a synthetic aperture radar image pixel	See Entry 110377
Application possibilities of passive remote-sensing systems in the millimeter-wave region	See Entry 110378
Radar backscattering properties of corn and soybeans at frequencies of 1.6, 4.75, and 13.3 GHz	See Entry 110379
Model for atmospheric corrections to microwave brightness temperature data	See Entry 110382
Nimbus 7 SMMR observations of the Bering Sea ice cover during March 1979	See Entry 110406
Norwegian remote sensing experiment: evaluation of the Nimbus 7 scanning multichannel microwave radiometer for Sea Ice research	See Entry 110409
SEASAT-derived ocean surface topography: comparison with coincident Kuroshio hydrographic data	See Entry 110437
Determination of the pressure along a closed hydrographic section. I. The ideal case	See Entry 110462
Ocean acoustic tomography: rays and modes	See Entry 110480
Delineation of seasonal changes of chlorophyll frontal boundaries in Mediterranean coastal waters with Nimbus-7 Coastal Zone Color Scanner data	See Entry 110489
CTR notes: simple method for estimating atmospheric absorption at 1 to 15 GHz	See Entry 110522
Satellite observation of the Earth radiation budget	See Entry 110523
Determination of H_2O and CH_4 profiles from data of a nadir to limb scanning balloon-borne radiometer	See Entry 110525
Propagation characteristics at 35 and 78 GHz for spaceborn altimeters	See Entry 110528
On a technique for operative correction for the transmission function in solving the problem of thermal sounding of the atmosphere	See Entry 110653
The estimation and removal of a linear drift from stacked data	See Entry 110661
First bistatic oblique-incidence ionograms between digital ionosondes	See Entry 110785
New tools for magnetospheric research	See Entry 110792
Advanced low altitude infrared Earth sensors	See Entry 110847
Linear wide angle Sun sensor for spinning satellites	See Entry 110859
Remote sensing by IR heterodyne spectroscopy	See Entry 110920

94.00 AERONOMY AND SPACE PHYSICS

94.10 PHYSICS OF THE NEUTRAL ATMOSPHERE

(for planets, see 96.30)

110740 Perturbations of the upper atmosphere caused by flow over an isolated mountain. N.N.Pertsev.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.6, p.570-5 (June 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
The steady flow over an isolated mountain for uniform background fields of temperature and wind is examined using linear theory. An asymptotic solution for lee waves is obtained. For isolated mountains of specific form a map of lines of equal wave amplitudes and wave phases on the sphere of 100 km radius is constructed. The solution is compared with two-dimensional one and with three-dimensional solution obtained with the hydrostatic assumption. (12 refs.)

110741 Neutral and ion gas heating by auroral electron precipitation. M.H.Rees (Geophys. Inst., Univ. of Alaska, Fairbanks, AK, USA), B.A.Emery, R.G.Roble, K.Stamnes.
J. Geophys. Res. (USA), vol.88, no.A8, p.6289-300 (1 Aug. 1983).
The physical and chemical processes responsible for neutral gas heating resulting from energetic electron bombardment of the atmosphere are quantitatively described. The neutral heating efficiency, defined as the local heating per unit energy deposition, is evaluated for a range of typical auroral electron spectra, and it is shown that the altitude profile of the efficiency is independent of the electron spectrum. The efficiency is sensitive to the neutral atmosphere (composition, density, temperature) but differences can be minimized by adopting a pressure coordinate in place of the altitude. Over half the energy input rate associated with energetic particle precipitation goes into neutral heating, while less than 5% leads to ion heating. The coupling between particle precipitation and joule heating is discussed, and a parameterized Pedersen conductance curve is presented. (38 refs.)

110742 The response of thermospheric atomic nitrogen to magnetic storms. M.J.Engebretson (Dept. of Phys., Augsburg Coll., Minneapolis, MN, USA), K.Mauersberger.
J. Geophys. Res. (USA), vol.88, no.A8, p.6331-8 (1 Aug. 1983).
Neutral composition data obtained by the open-source neutral-mass spectrometer on the polar orbiting Atmosphere Explorer D satellite during the periods October 31 to November 15, 1975, and January 5 to 15, 1976, are used to characterize the response of thermospheric atomic nitrogen densities to geomagnetic activity. The results support current models showing that N is produced and transported out of the auroral zone during geomagnetic disturbances. (39 refs.)

110743 Rocket-based investigations of $O(^3P)$, $O_2(a^1\Delta_g)$ and OH* ($\nu=1$, 2) during the solar eclipse of 26 February 1979. W.R.Pendleton,Jr., K.D.Baker, L.C.Howlett (Utah State Univ., Logan, UT, USA).
J. Atmos. & Terr. Phys. (GB), vol.45, no.7, p.479-91 (July 1983). (Meeting of the American Geophysical Union on the Total Solar Eclipse of 26 February 1979, Toronto, Ont., Canada, May 1980).
Discusses the results of an in situ investigation of selected atmospheric minor constituents above Red Lake, Ontario, Canada, during the total solar eclipse of 26 February 1979. The species $O(^3P)$ and $O_2(a^1\Delta_g)$ were investigated at about 25 min before second contact, and OH* was examined at totality. Measurements were carried out with instrumentation aboard sounding rockets and provided useful information on these species over a range of altitudes which included the mesosphere and the lower thermosphere in the former case and a narrow region in the vicinity of the mesopause in the latter case. (42 refs.)

110744 Seasonal variation of solar atmospheric tides at meteor heights. T.Tsuda, T.Aso, S.Kato (Radio Atmospheric Sci. Center, Kyoto Univ., Gokanosho, Uji, Japan).
J. Geomagn. & Geoelectr. (Japan), vol.35, no.3, p.65-86 (1983).
Systematic observation with the Kyoto meteor radar (35°N, 136°E) has been continuing since the end of 1977. A seasonal variation of diurnal and semidiurnal solar atmospheric tides at meteor heights has been studied by using meteor radar data. Monthly average behaviours of these tidal components have been summarized for the period from March 1979 to November 1980. Vertical profiles and harmonic dials of these components have been investigated in comparison with other interference between propagating the evanescent modes. The evanescent mode becomes dominant in summer, while the propagating mode appears in winter. As for the semidiurnal tide, the $S_{2,2}$ mode is fundamental in summer, and the $S_{2,4}$ mode becomes apparent in winter. (24 refs.)

110745 Noctilucent clouds over Western Europe during 1982. D.H.McIntosh, M.Hallissey (Dept. of Meteorology, Univ. of Edinburgh, Edinburgh, Scotland).
Meteorol. Mag. (GB), vol.112, no.1333, p.245-9 (Aug. 1983).
Summarizes the observations of noctilucent cloud over Western Europe during 1982, as reported to the Department of Meteorology, University of Edinburgh. Brief notes of the displays enlarge on the facts listed i.e. forms discernible, tropospheric cloud conditions, photographs and sketches available. Co-ordinates of the observing stations and selected details of elevation and azimuth are presented. Routine hourly observations were made at 12 Meteorological Stations in the United Kingdom and at Reykjavik in Iceland when darkness permitted. (no refs.)

110746 Dynamics of the Earth's thermosphere. R.G.Roble (Nat. Center for Atmospheric Res., Boulder, CO, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.217-33 (March 1983).
This review covers the progress made in understanding thermospheric dynamics based on work published from 1979 to 1982 with some overlap of work published in 1978. Although all aspects of thermospheric dynamics are considered, emphasis is placed on the global circulation, temperature, and compositional structure of the thermosphere. (290 refs.)

110747 Neutral and ion composition of the thermosphere. D.G.Torr (Centre for Atmospheric & Space Sci., Utah State Univ., Logan, UT, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.245-62 (March 1983).
Reviews developments during the period 1979-82 in thermospheric chemistry and composition, thermal structure, energy sources and energy budget. The discussion is limited to middle and low latitudes. (195 refs.)

110748 Middle atmospheric electrodynamics. M.C.Kelley (School of Electrical Engng., Cornell Univ., Ithaca, NY, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.273-5 (March 1983).
Reviews of 1979-82 studies of the physics and chemistry of the Earth's middle atmosphere in general and in middle atmosphere electrodynamics in particular. New techniques which have been developed to study this region and several exciting and controversial results accruing from this effort are discussed. (34 refs.)

110749 Minor constituents in the stratosphere and mesosphere. S.Solomon (Aeronomy Lab., NOAA, Boulder, CO, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.276-83 (March 1983).
Presents a survey of research in the field of middle atmosphere chemistry from 1979 to 1982. The possiblity of anthropogenic perturbation to the stratospheric ozone layer, particularly as a result of chlorocarbons, remained a subject of interest, and has been studied with increasingly detailed models during this period. A great deal of data on the distributions of many important species have been obtained, leading to substantial progress in the understanding of the processes controlling the photochemistry of minor species in the middle atmosphere. (222 refs.)

110750 Middle atmosphere dynamics. D.L.Hartmann (Dept. of Atmospheric Sci., Univ. of Washington, Seattle, WA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.283-90 (March 1983).
Reviews efforts of scientists in the United States to understand the large-scale dynamics and climatology of the middle atmosphere, which have appeared in the literature between January 1979 and September 1982. The body of the

review is divided into six sections and followed by a final section suggesting a few of the areas where progress may be expected in the future. The six major subject headings are: (1) new phenomena; (2) large-scale waves and instabilities; (3) equatorial wave, mean-flow interaction—long-period oscillations; (4) extratropical wave,mean-flow interaction—sudden warmings; (5) climatology and general circulation of the middle atmosphere; and (6) transport of trace chemicals. (125 refs.)

Experimental studies of electron-ion recombination .... See Entry 106586

Potential energy curves for dissociative recombination .... See Entry 106620

Parametric excitation of internal waves and convective instability in the fluid layer heated from above .... See Entry 107173

Air Force Rocket Propulsion Laboratory plume program: activities and plans .. .. See Entry 109934

Transition flow effects on plume radiation .... See Entry 109935

Relationships between macrocirculation atmospheric processes at levels from 10 up to 100 km over middle Asia .... See Entry 110552

A spectral model of the zonally averaged circulation in the middle atmosphere .... See Entry 110581

On the instability of internal Alfven-gravity waves in stratified shear flows .... See Entry 110612

Remote sensing of stratospheric and mesospheric winds by gas correlation electrooptic phase-modulation spectroscopy .... See Entry 110663

A proposal to use an upper atmosphere satellite tethered to the Space Shuttle for the collection of micro-meteoric material .... See Entry 110857

Near-circular satellite orbits in an oblate, diurnally varying atmosphere .... See Entry 110860

The effect of the geomagnetic field on the diffusion of meteor trails .... See Entry 110997

94.10Q Airglow and nightglow

110751 OH airglow phenomena during the 5-6 July 1982 total lunar eclipse. A.W.Peterson (Dept. of Phys. & Astron., Univ. of New Mexico, Albuquerque, NM, USA), G.W.Adams.
Appl. Opt. (USA), vol.22, no.17, p.2682-5 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
The first photographs of the OH airglow the authors took during a lunar eclipse revealed large (20-30 km) east-west waves from horizon to horizon which drifted northward at 10-15 m/sec. These waves were not typical of the ripples that have been found to be well-correlated with lower lunar transit. (7 refs.)

110752 Observations of optical emissions from precipitation of energetic neutral atoms and ions from the ring current. R.P.Rohrbaugh, B.A.Tinsley, H.Rassoul (Univ. of Texas, Austin, TX, USA), Y.Sahai, N.R.Teixeira, R.G.Tull, D.R.Doss, A.L.Cochran, W.D.Cochran, E.S.Barker.
J. Geophys. Res. (USA), vol.88, no.A8, p.6317-30 (1 Aug. 1983).
Observations of N_2^+ 1 N, H Balmer β(HB$a\beta$) and other emissions due to particle precipitation have been observed at two low-latitude sites (Mt. Haleakala, Hawaii, and Cachoeira Paulista, Brazil) and one mid-latitude site (McDonald Observatory, Southwest Texas). Results are compared for magnetic storms of April 13, 1981, and July 14, 1982. The emissions have the characteristics appropriate to the precipitation into the thermosphere of energetic neutral atoms and/or ions originating in the ring current. These characteristics include high rotational/vibrational excitation of the N_2^+ 1 N bands and at times the occurrence of HB$a\beta$ emission with the same onset time as the N_2^+ 1 N emission and partial correlation with it afterward. The latitude variation shows a strong increase from low to mid latitudes. The strongest emissions occur in the evening to midnight local time period, and the storm time variations shows strongest emissions during main phases. (36 refs.)

110753 Altitude profiles of OH and O_2 near infrared airglows in the evening twilight. T.Makino, H.Yamamoto, H.Sekiguchi (Dept. of Phys., Rikkyo Univ., Tokyo, Japan).
J. Geomagn. & Geoelectr. (Japan), vol.35, no.3, p.57-64 (1983).
The height distributions of the airglow emissions in the regions of 1.3 μm and 1.6 μm were observed by a rocket-borne radiometer 83 minutes after sunset at Uchinoura, Japan. The 1.6 μm emission from the lower vibrational levels of OH occurred in a wider height range and at a lower peak height by a few kilometers than the previous midnight profiles in the same wavelength region. The 1.3 μm emission, including the O_2 1.27 μm airglow and the OH airglow from higher vibrational levels, had a peak emission height at 90 km and a height width of 14 km. A possibility for a contribution of the HO_2 reaction to the formation of vibrationally excited OH is discussed in the light of the observed airglow profiles. (14 refs.)

PRESTO: a programmable etalon spectrometer for twilight observations .... See Entry 110665

Observations of large scale *F*-region irregularities using airglow emissions at 7774 Å and 6300 Å .... See Entry 110759

Inelastic scattering effects on photoelectron spectra and ionospheric electron temperature .... See Entry 110769

94.10S Aurora

110754 Auroral kilometric radiation induced by double layers. S.Bujarbarua (Inst. of Advanced Study in Sci. & Technol., Assam Sci. Society, Gauhati, India), M.Nambu.
J. Phys. Soc. Jpn. (Japan), vol.52, no.7, p.2285-8 (July 1983).
A new generation mechanism of the auroral kilometric radiation (AKR) is proposed. The induced bremsstrahlung interaction between the auroral electrons and the moving double layers is effective for the generation of the auroral kilometric radiation. The theory predicts the close correlation between the moving double layers and AKR. The model explains the fine structure of the AKR which is interpreted as the motion of the source region (double layers) down and up the magnetic field line at a velocity of about 10 km/sec.

110755 Power spectra analysis of auroral occurrence frequency. S.M.Silverman (Dept. of Phys., Boston Coll., Chestnut Hill, MA, USA), R.Shapiro.
J. Geophys. Res. (USA), vol.88, no.A8, p.6310-16 (1 Aug. 1983).
Power spectral analyses have been carried out on a data set of Swedish visual auroras for the period 1721 to 1943. Besides the anticipated 11-year, annual, and semiannual cycles, an unexpected peak near 1.4 years is found. The amplitude of this latter peak, while smaller than that of the 6-month and 12-month peaks, is statistically significant at between the 5% and 1% level and is found consistently in a sequence of spectra covering consecutive, overlapping, approximately 22-year data segments. The semiannual variation becomes extremely weak during the prolonged solar activity minimum at the beginning of the nineteenth century, and also shows some lessening during the prolonged solar activity minimum near the beginning of the twentieth century. The 1.4-year peak shows a strong modulation of about 65 to 68 years and an additional long-term trend of the order of centuries. The origin of this peak is unknown. (26 refs.)

110756 Generation of auroral arc elements in an inverted-V arc due to ion cyclotron turbulence. J.R.Kan (Geophys. Inst., Univ. of Alaska, Fairbanks, AK, USA).
J. Geophys. Res. (USA), vol.88, no.A8, p.6339-45 (1 Aug. 1983).
By using a two-dimensional particle simulation it is shown that the electrostatic ion cyclotron turbulence driven by the field-aligned current on auroral field lines can lead to striations of the current into east-west aligned current sheets of ion gyroradius scale ($L_a \sim \rho_i$). Physical mechanism of the striation can be identified with nonlinear mode couplings of ion cyclotron waves resulting in condensation of the wave energy into a zero-frequency mode. It is proposed that the auroral arc elements ($L_a \sim \rho_i$), which collectively give rise to the inverted-V arc ($L_v \gg \rho_i$), can be produced by the east-west aligned striations of the field-aligned current on inverted-V field lines. (30 refs.)

110757 US contributions to auroral aeronomy, 1979-1982. M.H.Rees (Geophys. Inst., Univ. of Alaska, Fairbanks, AK, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.241-5 (March 1983).
Reviews UV spectra, visible and near IR observations of the polar dayside cusp, atomic and molecular physics related to auroral studies, energetic particle transport, modelling, and X-ray imaging. (82 refs.)

A new radar auroral backscatter experiment .... See Entry 110782

Polar and auroral phenomena: a review of US progress during 1979-1982 .... See Entry 110791

94.20 PHYSICS OF THE IONOSPHERE

(for planets, see 96.30)

110758 Short wavelength gradient-drift waves at high latitudes. K.Schlegel, J.-P.St-Maurice (Max-Planck-Inst. fur Aeronomie, Katlenburg-Lindau, Germany).
Ann. Geophys. (France), vol.1, no.3, p.259-64 (May-June 1983).
The Farley-Buneman instability can easily excite irregularities as small as 15 cm in size at high latitudes. When these waves grow in amplitude they in turn generate irregularities of similar scale sizes. These secondary waves are strongly affected by the density gradients of the primary waves. The authors therefore discuss the behavior of these secondary gradient-drift waves within the framework of a kinetic theory, taking finite Larmor-radius effects and Debye-length effects into account. The solution is compared to existing fluid expressions. The dispersion relation is discussed in terms of some of the parameters which determine its solution. Growth rates and wave frequency curves are calculated. The waves with **k** components parallel to the magnetic field are studied. (16 refs.)

110759 Observations of large scale *F*-region irregularities using airglow emissions at 7774 Å and 6300 Å. Y.Sahai, J.A.Bittencourt, N.R.Teixeira, H.Takahashi (Inst. de Pesquisas Espaciais, Conselho Nacional de Desenvolvimento Cientifico e Tecnologico, Sao Paulo, Brazil).
Ann. Geophys. (France), vol.1, no.3, p.271-6 (May-June 1983).
Simultaneous scanning measurements of the atomic oxgyen 7774 Å and 6300 Å emissions, to study the dynamics of low-latitude large scale *F*-region irregularities, were carried out at Cachoeira Paulista (geographic coordinates 22.7°S, 45.0°W; geomagnetic latitude 11.95°S), Brazil, during the period October-November, 1980. The measurements were made with a two-channel photometer which permitted scanning observations both along and across the magnetic meridian. Observations at 7774 Å can detect large scale irregularities near the *F*-region peak height, whereas observations at 6300 Å detect such irregularities at an altitude about 50 km to 100 km lower, depending on the *F*-region height. On many nights, during spread-*F* conditions the presence of large intensity depletions of short duration were detected in both emissions. These depletions were observed to move towards the east in the east-west scans, and apparently towards the south in the north-south scans. Salient features of these observations are presented and discussed. (23 refs.)

110760 Studies on ionospheric scintillations recorded at Nagpur. M.S.Korde, G.N.Navaneeth (Dept. of Phys., Nagpur Univ., Nagpur, India).
Indian J. Radio & Space Phys., vol.12, no.2, p.33-6 (April 1983).
Ionospheric scintillations of 136 MHz plane polarized signals from the geostationary satellite ETS-II were observed at Nagpur, a low latitude station, during the period 1980-81. The onset time of scintillation was found to be predominantly around 1930 hrs LT. This has been explained in terms of sunset at the mean field height of the ionosphere. The diurnal and seasonal variation of scintillation activity has been analyzed. (13 refs.)

110761 Correlation between observed VLF phase deviation and solar X-ray flux during solar flares. P.Pant, H.S.Mahra, M.C.Pande (Uttar Pradesh State Obs., Naimi Tal, India).
Indian J. Radio & Space Phys., vol.12, no.2, p.40-2 (April 1983).
Correlation between the observed phase deviation of GBR 16 kHz VLF signals and the solar X-ray flux in the bands 0.5-4 and 1-8 Å during solar flare events has been studied. It is found that the unnormalized phase deviation show a better correlation with the observed X-ray flux than the correlation with the normalized phase deviations. The threshold X-ray flux to produce a detectable sudden phase anomaly has been estimated. (5 refs.)

110762 Dependence of frequency power law exponent of ionsopheric radiowave absorption on solar zenith angle. R.Chandrasekhar, P.Victor, D.I.Devi, D.N.M.Rao, T.S.N.Somayaji, K.V.V.Ramana (Dept. of Phys. , Andhra Univ., Waltair, India).
Indian J. Radio & Space Phys., vol.12, no.2, p.43-6 (April 1983).
A study of the effect of the solar zenith angle on the frequency power law exponent derived from simultaneous vertical incidence multifrequency ionospheric absorption measurements available from a number of low and midlatitude stations has shown that the exponent increases when deviative absorption becomes relatively more significant compared to non-deviative absorption. A numerical simulation using a double α-Chapman type absorbing zone yielded results identical to the experimental observations. (7 refs.)

110763 Effect of travelling ionospheric disturbances on HF phase-path measurements. K.N.Iyer (Dept. of Phys., Saurashtra Univ., Raijkot, India).
Indian J. Radio & Space Phys., vol.12, no.2, p.47-9 (April 1983).
The signature of travelling ionospheric disturbances on the phase-path measurements of obliquely propagating HF signals is theoretically computed using a model for a travelling wave disturbance along the calculated ray path. The phase-path at a single frequency and the differential phase-path between two frequencies are found to have periodic fluctuations, not necessarily of the

same period as that of the causative travelling disturbance. The results could be applied to the interpretation of frequency fluctuations of standard time transmissions. (7 refs.)

110764 Abnormal quiet days and the effect of geomagnetic activity on the diurnal variation of equatorial geomagnetic field. J.H.Sastri (Indian Inst. of Astrophys., Bangalore, India).
Indian J. Radio & Space Phys., vol.12, no.2, p.53-5 (April 1983).
It is shown that a conspicuous noontime positive deviation in the asymmetric component of the *H* field at equatorial electrojet stations, associated with the solar wind on quiet days with $A_p \sim 5$, is not manifest if 'abnormal quiet days' and hence the influence of counter-electrojet conditions associated with them are taken into consideration. It is pointed out that the noontime positive swing of the asymmetric component in the *H* field on quiet days with $A_p \sim 5$ at electrojet stations is primarily due to changes in the local ionospheric dynamo region rather than in the solar wind. (12 refs.)

110765 Ionospheric plasma bubble encounters or *F* region bottomside traversals?. R.F.Benson (Lab. for Planetary Atmospheres, NASA/Goddard Space Flight Center, Greenbelt, MD, USA), H.C.Brinton.
J. Geophys. Res. (USA), vol.88, no.A8, p.6243-52 (1 Aug. 1983).
In situ AE-C and AE-E ion composition measurements, together with Manila and Huancayo ionosonde electron density profiles, are used in an attempt to distinguish between spacecraft encounters with equatorial plasma bubbles which have been pinched off from below, those still in the formation stage, and spacecraft excursions below the steep ionization gradient at the bottom edge of the postsunset *F* layer. Such excursions can result from quasi-periodic oscillations of the altitude of the *F* layer—as deduced from the ion composition measurements during the circular orbit phase of the low-inclination satellite AE-E. These results have important theoretical implications in that they are consistent with placing the bubble generation region on the steep density gradient of the lower ledge of the *F* region where O^+ is the dominant ion. (61 refs.)

110766 A comparative study of VHF scintillation and spread *F* events over Natal and Fortaleza in Brazil. R.T.de Medeiros, M.A.Abdu, I.J.Kanto (Inst. de Pesquisas Espaciais, Conselho Nacional de Desenvolvimento Cientifico e Tecnologico, Sao Paulo, Brazil).
J. Geophys. Res. (USA), vol.88, no.A8, p.6253-8 (1 Aug. 1983).
A comparative study is carried out of the equatorial ionospheric irregularity occurrences, as observed by range spread *F* events over Fortaleza and satellite VHF signal scintillation event over Natal for a one-year period 1978. Close association is observed in the occurrences and the durations of the irregularities at the two stations. Marked diffrences in the seasonal behavior of the occurrences of the irregularity events over these two stations are noted with respect to that over Huancayo, most important of them being while the latter station presents equinoctial maxima in the occurrence rates the Brazilian station shows an additional December peak. This result is explained as possible evidence of magnetic declineation control of the spread *F* irregularity generation and its seasonal dependence. (26 refs.)

110767 Polarization electric fields in the nighttime F layer at Arecibo. R.G.Burnside, J.C.G.Walker (Dept. of Atmospheric & Oceanic Sci., Univ. of Michigan, Ann Arbor, MI, USA), R.A.Behnke, C.A.Gonzales.
J. Geophys. Res. (USA), vol.88, no.A8, p.6259-66 (1 Aug. 1983).
Incoherent scatter radar measurements made in 1981 and 1982 are used to determine the electrical conductivity of the nighttime E and F regions at Arecibo, Puerto Rico. The height-integrated Pedersen conductivity of the F region extends that of the E region by a factor of 10 on the average. The authors conclude that, for the solar maximum conditions they have studied, the local E region has little influence on nighttime F region electrodynamics. Simultaneous measurements of ion and neutral velocities are often inconsistent with the hypothesis that a fully developed electric polarization field is generated by dynamo action in the local F region. A better explanation of these results is obtained by including the influence of polarization fields that originate in the F region of the conjugate hemisphere. (31 refs.)

110768 The Joule heat production rate and the particle energy injection rate as a function of the geomagnetic indices AE and AL. B.-H.Ahn, S.-I.Akasofu (Geophys. Inst., Univ. of Alaska, Fairbanks, AK, USA), Y.Kamide.
J. Geophys. Res. (USA), vol.88, no.A8, p.6275-87 (1 Aug. 1983).
As a part of the joint efforts of operating six meridian chains of magnetometers during the IMS, magnetic records from 71 stations are used to deduce the distribution of electric fields and currents in the polar ionosphere for March 17, 18, and 19, 1978. As a continuation of this project, the authors have constructed hourly distribution maps of the Joule heat production rate, the particle energy injection rate and their sum over the entire polar region on the three days. For this purpose the conductivity distribution is inferred at each instant partially on the basis of an empirical method devised by Ahn et al. (1982). The particle energy injection rate is estimated similarly by using an empirical method. The data set thus obtained allows estimation of the global Joule heat production rate U_J, the global particle energy injection rate U_A and the sum U_I of the two quantities. It is found that the three global quantities (watt) are related almost linearly to the AE(nT) and AL(nT) indices. (24 refs.)

110769 Inelastic scattering effects on photoelectron spectra and ionospheric electron temperature. K.Stamnes, M.H.Rees (Geophys. Inst., Univ. of Alaska, Fairbanks, AK, USA).
J. Geophys. Res. (USA), vol.88, no.A8, p.6031-9 (1 Aug. 1983).
Three sets of inelastic scattering cross sections have been used by various investigators in energy degradation computations of photoelectrons. The effects of the three sets upon photoelectron spectra in the ionosphere, electron heating rates and temperature, and dayglow emissions are examined for solar minimum and solar maximum conditions. Comparison of individual cross sections shows large differences among the three sets, but the overall inelastic scattering, summed over states and species, is sufficiently similar such that the effects on the electron heating rate and temperature is only minor. Photoelectron spectra differ in details at energies below about 20 eV. The major difference is found in the excitation and emission rates of some features in the dayglow spectrum. (33 refs.)

110770 Production of auroral zone *E* region irregularities by powerful HF heating. F.H.Hibberd, E.Nielsen, P.Stubbe, H.Kopka, M.T.Rietveld (Max-Planck-Inst. fur Aeronomie, Katlenburg-Lindau, Germany).
J. Geophys. Res. (USA), vol.88, no.A8, p.6347-51 (1 Aug. 1983).
Production of ionospheric 1-m irregularities in the auroral zone *E* region by high power ionospheric heating has been observed by means of the STARE auroral radar. Irregularities were produced at night, on eight occasions, by using an *O* mode heating wave and on two occasions by using an *X* mode heating wave. The growth time of the irregularities is found to be approximately 30 s. Several physical possibilities to explain these findings are discussed, and a mechanism is suggested that is closely related to Sato's mechanism of quiet auroral arc formation. (15 refs.)

110771 Meeting of the American Geophysical Union on the Total Solar Eclipse of 26 February 1979.
J. Atmos. & Terr. Phys. (GB), vol.45, no.7 (July 1983).
Conference held at: Toronto, Ont., Canada. Date May 1980. The following topics were dealt with: solar eclipse of 26 February 1979, electron density, particle precipitation, lower ionosphere, Red Lake, Canada, E-region, NO, ion composition, D-region, O, O_2 OH, mobility, electrical parameters and differential Doppler measurements.

110772 Electron density and energetic particle precipitation observed during the eclipse of 26 February 1979. L.G.Smith, M.K.McInerney, H.D.Voss (Dept. of Electrical Engng., Univ. of Illinois, Urbana, IL, USA).
J. Atmos. & Terr. Phys. (GB), vol.45, no.7, p.427-36 (July 1983). (Meeting of the American Geophysical Union on the Total Solar Eclipse of 26 February 1979, Toronto, Ont., Canada, May 1980).
Electron density profiles and energetic particle fluxes are determined from two rockets launched, respectively, at the beginning and end of totality during the solar eclipse of 26 February 1979. These, and one other rocket at the same time of day on 24 February 1979, were launched from a temporary site near Red Lake, Ontario. The electron density profile from 24 February 1979 shows the electron density to be normal above 110 km, to rocket apogee. Below 110 km the electron density is enhanced, by an order of magnitude in the *D*-region, compared with data from Wallops Island at the same solar zenith angle. The enhancement is qualitatively explained. During totality, on 26 February 1979, the electron density above 100 km to rocket apogee is reduced by a factor of about three, as seen in other eclipses. Below 110 km, however, the electron density is much greater than observed during previous eclipses. The particle flux measured on the 26 February was an order of magnitude less than that on the 24 February but showed greater variability. (20 refs.)

110773 A model of the lower ionosphere above Red Lake, Canada, during the 26 February 1979 solar eclipse. R.D.Harris, L.C.Howlett, K.D.Baker (Space Measurements Lab., Utah State Univ., Logan, UT, USA).
J. Atmos. & Terr. Phys. (GB), vol.45, no.7, p.437-50 (July 1983). (Meeting of the American Geophysical Union on the Total Solar Eclipse of 26 February 1979, Toronto, Ont., Canada, May 1980).
Measurements of ionization sources, ionization profiles and minor atmospheric constituents were conducted during the 26 February 1979 solar eclipse above Red Lake, Canada. A model of the lower thermosphere is developed to describe the *D*- and *E*-regions of the ionosphere for this case with the model being guided by the measurements. During the eclipse a rather intense particle precipitation event was in progress. For this reason an auroral deposition code is coupled to a chemical-kinetics code to calculate degraded primary and secondary electron fluxes, ionization rates, positive ion and electron densities. The model is calibrated with the experimental measurements of electron flux below 100 km and electron density between 70 and 150 km. (25 refs.)

110774 Satellite observations of energetic electron precipitation during the 1979 solar eclipse and comparisons with rocket measurements. E.E.Gaines, W.L.Imhof, H.D.Voss, J.B.Reagan (Lockheed Palo Alto Res. Lab., Palo Alto, CA, USA).
J. Atmos. & Terr. Phys. (GB), vol.45, no.7, p.451-5 (July 1983). (Meeting of the American Geophysical Union on the Total Solar Eclipse of 26 February 1979, Toronto, Ont., Canada, May 1980).
During the solar eclipse of 26 February 1979, the P78-1 satellite passed near Red Lake, Ontario, at an altitude of ~600 km. On two consecutive orbits spanning the time of total eclipse, energetic electrons were measured with two silicon solid state detector spectrometers having excellent energy and angular resolution. Significant fluxes of precipitating electrons were observed near the path of totality. Comparisons of flux intensities and energy spectra with those measured from a Nike Orion and two Nike Tomahawk rockets launched near Red Lake before and during total eclipse give good agreement and indicate that the electron precipitation was relatively uniform for more than an hour and over a broad geographical area. (3 refs.)

110775 *E*-region nitric oxide concentrations inferred from the 26 February 1979 eclipse expedition. W.Swider, R.S.Narcisi (Air Force Geophys. Labs., Hanscom Air Force Base, MA, USA).
J. Atmos. & Terr. Phys. (GB), vol.45, no.7, p.457-60 (July 1983). (Meeting of the American Geophysical Union on the Total Solar Eclipse of 26 February 1979, Toronto, Ont., Canada, May 1980).
Nitric oxide (NO) concentrations are determined from the analysis of positive ion composition data obtained by AFGL for eclipse and post-eclipse conditions near Red Lake, Canada. Values of about 3×10^8 cm^{-3} for 105-110 km and about 3×10^7 cm^{-3} for 90 km have been established. A residual ion-pair production rate of about 50 cm^{-3} s^{-1} is estimated for eclipse totality at 110 km. A factor of two uncertainty is thought to be appropriate for all deduced values. The calculated NO concentrations appear be within the range of typical variations for this reason (late winter) and latitude (51°N). (11 refs.)

110776 Positive and negative ion composition measurements in the *D*-and *E*-regions during the 26 February 1979 solar eclipse. R.Narcisi, A.Bailey, G.Federico, L.Wlodyka (Air Force Geophys. Lab., Hanscom Air Force Base, MA, USA).
J. Atmos. & Terr. Phys. (GB), vol.45, no.7, p.461-78 (July 1983). (Meeting of the American Geophysical Union on the Total Solar Eclipse of 26 February 1979, Toronto, Ont., Canada, May 1980).
Two rockets bearing quadrupole mass spectrometers capable of measuring both positive and negative ion composition were launched from Red Lake, Canada, during the solar eclipse. Both instruments had liquid helium cryopumps and shock-attaching conical samplers. The payloads also contained two Gerdien condensers to measure total positive and negative ion concentrations and ion mobilities. Altitude control systems aligned the payloads with the velocity vector throughout ascent and descent. The positive ion composition, ionization, and negative ion distributions are discussed. Comparisons are made with prior negative ion measurements during similar daytime auroral zone absorption (AZA) events. Some characteristics of the precipitating particles are found from these and past observations in daytime AZA events. (14 refs.)

110777 Steady-state model of the *D*-region during the February 1979 eclipse. W.Swider, R.S.Narcisi (Air Force Geophys. Lab., Hanscom Air Force Base, MA, USA).
J. Atmos. & Terr. Phys. (GB), vol.45, no.7, p.493-8 (July 1983). (Meeting of the American Geophysical Union on the Total Solar Eclipse of 26 February 1979, Toronto, Ont., Canada, May 1980).
Significant electron precipitation of sufficiently stable duration permits the use of a steady-state model for the description of the charged particle distributions in the *D*-region during the eclipse of 26 February 1979. For the positive ions, thc current results support conclusions reached in conjunction with the SPE-disturbed *D*-region of November 1969. Again, the three-body process leading to the clustering of NO^+ with CO_2 is determined to be the principal loss mechanism for NO^+ ions below 80 km. Inexplicably, the loss of NO^+ by clustering with N_2 is only of equal importance, at most. Carbon

dioxide apparently is an important agent in hastening the formation of the heavier oxonium ions, $H_7O_3^+$ and $H_9O_4^+$. (29 refs.)

110778 *D*-region positive and negative ion concentration and mobilities during the February 1979 eclipse. T.D.Conley (Air Force Geophys. Lab., Hanscom Air Force Base, MA, USA), E.R.Hegblom, R.S.Narcisi.
J. Atmos. & Terr. Phys. (GB), vol.45, no.7, p.499-513 (July 1983). (Meeting of the American Geophysical Union on the Total Solar Eclipse of 26 February 1979, Toronto, Ont., Canada, May 1980).
Positive and negative ion concentrations and mobilities are obtained from an analysis of Gerdien condenser measurements on rocket flights, A10.802-1 and A10.802-2, during and after eclipse totality. The aerodynamic instrument calibration and the data analysis techniques are discussed. The concentrations at very low altitudes suggest that a relativistic electron precipitation event was occurring during the measurements. The ion concentration measurements along with electron density measurements made by other groups during the eclipse are used to calculate the negative ion: electron ratio, and the lumped parameter detachment rate. These results are compared with prior measurements during eclipse and solar proton events and code results are determined. (38 refs.)

110779 Differential Doppler measurements of the ionosphere during a solar eclipse. J.R.Clynch, D.S.Coco, B.A.Renfro (Appl. Res. Labs., Univ. of Texas, Austin, TX, USA).
J. Atmos. & Terr. Phys. (GB), vol.45, no.7, p.527-35 (July 1983). (Meeting of the American Geophysical Union on the Total Solar Eclipse of 26 February 1979, Toronto, Ont., Canada, May 1980).
The effects of the solar eclipse of 26 February 1979 on the ionosphere were measured using differential Doppler techniques. Navy navigation satellite passes were monitored at 12 sites located across the North American continent. These yield a measurement of the vertical columnar electron content along a north-south line. Different sites monitoring the same pass provide simultaneous observations of ionospheric variations along different longitude lines. Two satellite passes occurred during or just after the eclipse. These data show a shoulder just northward of the umbra region and a trough just behind the umbra containing large horizontal gradients. This sharp trough recovered quickly with a half-life of about 10 min. (3 refs.)

110780 Effects of total solar eclipse of 16th February 1980 on the HF communications in India. R.Sethuraman (Dept. of Electronics, Anna Univ., Madras, India), M.Mukunda Rao, C.Ravichandran.
J. Inst. Electron. & Telecommun. Eng. (India), vol.29, no.3, p.127-8 (March 1983). [received: Aug. 1983]
Measurements of field strength and fading observed on HF communication links Bombay-Madras and Nagpur-Madras on 13406 kHz and 9067 kHz respectively during the total solar eclipse of 16th February 1980 are presented. The observed behaviour at these two frequencies is explained in terms of absorption and fading. Field strengths on short waves record an increase during the eclipse. Marked increase in fading which is probably due to bending of the ionosphere at the time of totality is discussed. (9 refs.)

110781 foF2 response to IMF sector-boundary crossings. L.Triskova (Geophys. Inst., Czechoslovak Acad. of Sci., Praha, Czechoslovakia).
J. Geophys. (Germany), vol.53, no.1, p.68-71 (1983).
An analysis of night-time critical F2-layer frequencies in the equinoctial period of the 19th, 20th and 21st solar cycles has shown that the F2-layer response to sector-boundary crossings represents a response to the change of geomagnetic activity caused by the change of IMF polarity. For boundary crossings of the $+/-$ type, the critical frequencies in both hemispheres in general decrease in March and April, and increase in September and October while the reverse holds for $-/+$ crossings. (16 refs.)

110782 A new radar auroral backscatter experiment. E.Nielsen, W.Guttler (Max-Planck-Inst. fur Aeronomie, Katlenburg-Lindau, Germany), E.C.Thomas, C.P.Stewart, T.B.Jones, A.Hedberg.
Nature (GB), vol.304, no.5928, p.712-14 (25 Aug. 1983).
In 1982 a new radar auroral backscatter system, SABRE (Sweden and Britain Radar Experiment), commenced operation in northern Europe. Observations with this ground-based system allow estimates to be made of the electric fields in the auroral E-region. As an electric field probe, the coherent radar technique is unique in that measurements are made over a large area (~ 200000 km^2) with good spatial resolution (20×20 km^2) and with a temporal resolution of typically 20 s. The system field of view covers an *L*-value range 4.3-5.8. Observations of two pulsation events are presented. (19 refs.)

110783 Analytic solution for the two-frequency mutual coherence function for spherical wave propagation. D.L.Knepp (Mission Res. Corp., Santa Barbara, CA, USA).
Radio Sci. (USA), vol.18, no.4, p.535-49 (July-Aug. 1983).
The quadratic approximation for the phase structure function is used to obtain the two-frequency mutual coherence function for spherical wave propagation through a finite slab with transmitter and receiver located in free space on opposite sides of the slab. General analytic solutions are derived for two cases. In the first case the random slab is represented by a one-dimensional power spectrum of electron density fluctuations corresponding to propagation through elongated irregularities as would occur for an equatorial satellite link corresponding to propagation through elongated irregularities as would occur for an equatorial satellite link to a ground station. In the second case the random slab consists of isotropic ionization irregularities. Both cases taken together represent the extremes of the range of results to be expected for propagation through ionospheric fluctuations, solar wind irregularities, or ionization irregularities caused by barium cloud instabilities. (22 refs.)

110784 Ionospheric scintillations. D.M.Wu, N.Marcuvitz (Microwave Res. Inst., Polytech. Inst. of New York, Farmingdale, NY, USA).
Radio Sci. (USA), vol.18, no.4, p.589-607 (July-Aug. 1983).
A renormalization technique is applied to the problem of ionospheric scintillations. In the forward scattering limit, using a Markov approximation for ionospheric fluctuations and renormalized moment equations, the wave statistics for a plane or beam propagating through the ionosphere are derived. An experimental power spectrum, obtained from in situ measurements by the Explorer E satellite and corresponding to electron density fluctuations of 20%, is used to calculate the scintillation index S_4 for nighttime equatorial scintillations. (38 refs.)

110785 First bistatic oblique-incidence ionograms between digital ionosondes. J.W.Wright (Environmental Res. Lab., NOAA, Boulder, CO, USA), R.I.Kressman.
Radio Sci. (USA), vol.18, no.4, p.608-14 (July-Aug. 1983).
Identical digital ionosondes (dynasondes) at Brighton, Colorado and at White Sands Missile Range, New Mexico, 864 km distant, were synchronized for bistatic sounding in multifrequency and fixed frequency recording patterns. Three propagation modes are observed, identified, and reconciled with standard propagation theory; these include one-hop propagation by sporadic *E* (Es) and the *F*-region and two-hop (F-Es). The results encourage the concept of a global real time ionospheric monitoring network consisting of about 90 instruments that perform vertically incident and coordinated bistatic soundings, to yield a total of about 320 measurement 'locations'. (11 refs.)

110786 Development of a minicomputer atmospheric noise model. D.B.Sailors, R.P.Brown (Ocean & Atmospheric Sci. Div., Naval Ocean Systems Center, San Diego, CA, USA).
Radio Sci. (USA), vol.18, no.4, p.625-37 (July-Aug. 1983).
A practical but simplified atmospheric noise model in universal time for 1-MHz F_{am} usable in estimating system signal-to-noise ratios in microminicomputer-based HF propagation prediction systems is presented. Numerical mapping techniques were used to represent worldwide atmospheric noise in 24 numerical maps: one for each of six 4-hour UT time blocks and each of four 3-month periods. This representation results in a minimum reduction by one fifth in the number of coefficients necessary in computer memory over that of an earlier model in which the map represented an entire 24-hour day. (15 refs.)

110787 Variation of the inhomogeneity spectrum of the electron concentration in the lower ionosphere under the influence of powerful electromagnetic radiation. G.M.Teptin, Yu.M.Stenin (Kazan' State Univ., Kazan, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.11, p.886-90 (Nov. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.11, p.1244-8 (Nov. 1982). [received: Sept. 1983]
The variation of the spectrum of turbulent fluctuations in the electron concentration in the lower ionosphere under the influence of powerful electromagnetic radiation is considered. It is shown that under specified conditions the influence of powerful electromagnetic radiation on the region of effective scattering of radio waves can lead both to attenuation and amplification of the useful signal level. (10 refs.)

110788 Scattering of escaping electrons by helicon oscillations in a weakly magnetized plasma. V.B.Krasovitskii, V.G.Razdorskii (Sci.-Res. Inst. of Phys., Rostov-on-Don State Univ., Rostov, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.11, p.890-5 (Nov. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.11, p.1249-54 (Nov. 1982). [received: Sept. 1983]
The effect of escaping electrons in an ionospheric plasma in parallel electric and magnetic fields is discussed. It is shown that the driving of helicon oscillations under the conditions of cyclotron resonance is accompanied by elastic scattering of fast resonant particles by waves and by the isotropization of the distribution function of the escaping electrons and the development of a flux in velocity space. It is made clear that when a source of slow electrons is present there exists in the plasma a steady dynamic regime which is characterized by a steady-state spectrum of helicon turbulence. The spectrum of the oscillations and the flux of escaping electrons scattered transversely to the magnetic field are found. (14 refs.)

110789 The method of multiply reflected waves in the problem of the propagation of electromagnetic waves in regular waveguides. G.I.Makarov, L.A.Fedorova (Leningrad State Univ., Leningrad, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.12, p.977-96 (Dec. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.12, p.1384-409 (Dec. 1982). [received: Sept. 1983]
Various aspects of the discontinuity method are discussed which touch mainly on the theory of propagation of long and ultralong waves in an isotropic Earth-ionosphere waveguide channel. The article consists of three parts and an Appendix. In the first part the exact representations of the field are analyzed in detail: in the form of a sum of contour integrals, in the form of a modified (double infinite) series of zonal harmonics, and in the form of an expansion in plane waves. In the second part of this paper approximate representations of the field are discussed which are associated with the method of path integrals, the geometrooptical approximation of multiply reflected waves, and finally their quasigeometrooptical approximation, including the diffraction corrections of Wait. In the third part the application of the rigorous approach to the problem of representation of the field in a waveguide in the form of a series of multiply reflected waves is illustrated by the example of two model problems. Finally, a review of the papers devoted to the development and certain applications of the discontinuity method is given in the Appendix. Individual examples from acoustics, quasioptics, and mathematical physics, as well as from the theory of propagation of short radio waves around the Earth, are also given. (76 refs.)

110790 Ionospheric electrodynamics and irregularities: a review of contributions by US scientists from 1979 to 1982. A.D.Richmond (Space Environment Lab., NOAA, Boulder, CO, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.234-41 (March 1983).
Global-scale electrodynamic phenomena are considered separately, with the greater weight of the report going to global phenomena. (230 refs.)

110791 Polar and auroral phenomena: a review of US progress during 1979-1982. P.H.Reiff (Dept. of Space Phys. & Astron., Rice Univ., Houston, TX, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.418-33 (March 1983).
The quadrennium 1979-82 has been a highly active time in the field of polar and auroral research, with nearly 400 research papers and thirty general or topical review papers written by US authors. The author highlights progress in understanding auroral morphology, precipitating particle fluxes, the spectra and sources of upward-flowing particles, large-scale Birkeland currents, and theoretical and experimental advances in auroral-scale electrodynamics. (382 refs.)

110792 New tools for magnetospheric research. R.A.Greenwald (Appl. Phys. Lab., Johns Hopkins Univ., Laurel, MD, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.434-49 (March 1983).
Examines some of the new techniques that are being used to increase our understanding of the Earth's magnetosphere and the manner in which it couples to the high latitude ionosphere. Particular attention is devoted to experiments in which one attempts to modify the environment in the magnetosphere and high latitude ionosphere, and to the increased usage of incoherent and coherent scatter radars for high latitude studies of magnetosphere-ionosphere coupling. The author notes the trend toward developing constellations of satellites and ground-based instrumentation in order to obtain a better understanding of the global nature of magnetosphere-ionosphere coupling and the increased use of large computer-based suites of geophysical data. (178 refs.)

Experimental studies of electron-ion recombination .... See Entry 106586

Potential energy curves for dissociative recombination .... See Entry 106620

Electron energy deposition in the middle atmosphere .... See Entry 110569

One possibility for predicting the Delingier effect from solar radio-emission data .... See Entry 110729

Neutral and ion gas heating by auroral electron precipitation .... See Entry 110741

Observations of optical emissions from precipitation of energetic neutral atoms and ions from the ring current .... See Entry 110752

Generation of auroral arc elements in an inverted-V arc due to ion cyclotron turbulence ....See Entry 110756

Bias for spectral density estimates of electromagnetic wave field components in a magnetoplasma ....See Entry 110794

Effect of solar flare on the field intensity of VLF atmospherics ....See Entry 110796

Near-equatorial magnetospheric particles from ~1 eV to ~1 MeV ....See Entry 110809

The solar eclipse of 26 Febrary 1979: introductory comments ....See Entry 110866

Survey of meteor signal rates observed over a VHF forward-scatter link between Waltair and Dehra Dun ....See Entry 110996

The effect of the geomagnetic field on the diffusion of meteor trails ....See Entry 110997

94.30 PHYSICS OF THE MAGNETOSPHERE

(for planets, see 96.30)

110793 Identification of electromagnetic sources. F.Glangeaud, C.Latombe (ENSIEG, Saint-Martin-d'Heres, France).
Ann. Geophys. (France), vol.1, no.3, p.245-51 (May-June 1983).
Describes a study of natural electromagnetic waves generated in the magnetosphere by a wave-particle interaction process and presents results which identify two sources using six component signals. The authors identification needs all the information of the spectral matrix, especially its eigenvalues and eigenvectors. This spectral matrix is computed with classical Fourier methods. The authors see the property that the rank of the spectral matrix or the number of non-zero eigenvalues indicates the number of sources. As the eigenvalues are estimated a criterion to separate the significant eigenvalues is proposed. As it is known that there are two sources, the authors show that the identification of the sources is not possible without an hypothesis on the properties of the medium through which the waves propagate. With a rather realistic one it is possible to identify the two sources of Pc 1. (9 refs.)

110794 Bias for spectral density estimates of electromagnetic wave field components in a magnetoplasma. F.Lefeuvre, D.Lagoutte (Lab. de Phys. et Chimie de l'Environnement, Orleans, France).
Ann. Geophys. (France), vol.1, no.3, p.265-70 (May-June 1983).
The auto- and cross-power spectral densities of the electric and magnetic components of an electromagnetic wave field propagating in a magnetoplasma can be related to a wave distribution function (WDF) that specifies how the wave energy density is distributed with respect to the wave-number vector **K**. Those relations are used to evaluate the bias errors of the power spectral density estimates of the field components. As an application the WDF is assumed to be constant over the frequency band of analysis and the waves are supposed to propagate in the whistler mode. Under these hypotheses the power spectral densities of the magnetic components are unbiased while the power spectral densities of the electric components are systematically biased. (11 refs.)

110795 Geomagnetic implications of a simple IMF model. U.Villante, P.Francia, M.Vellante (Istituto di Fisica, Univ. di L'Aquila, L'Aquila, Italy).
Ann. Geophys. (France), vol.1, no.3, p.277-82 (May-June 1983).
Assuming that the strength of the interaction between the solar wind and the Earth's magnetosphere is only determined by the amount of the southward component of the interplanetary magnetic field as observed in a magnetospheric coordinate system (Russel and McPherron, 1973). The authors evaluated the geomagnetic consequences of a tilted current sheet corotating with the Sun. In addition to the semi-annual variation, the current sheet rotation may lead to the appearance, in the power spectra of the geomagnetic indices, of doublet structures with periods close to T_s and $T_s/2$, T_s being the period of the solar rotation as seen from Earth. The long term evolution of the geomagnetic activity may be related to the long term evolution of the current sheet orientation. (30 refs.)

110796 Effect of solar flare on the field intensity of VLF atmospherics. A.B.Bhattacharya, R.Bhattacharya (Dept. of Phys., Serampore Coll., Serampore, India).
Indian J. Radio & Space Phys., vol.12, no.2, p.56-8 (April 1983).
Observations of the integrated field intensity of VLF atmospherics reveal some interesting features due to their association with the ionospheric effects of a solar flare. The results obtained from an analysis of the observations from Oct. 1976 to Sep. 1979 are reported with an emphasis on the occurrences, time delay, duration and the magnitude. (4 refs.)

110797 Similarity in the characteristics of sweepers and VLF emissions. S.K.Trehan, S.Sekhar Dey, A.K.Sen.
Indian J. Radio & Space Phys., vol.12, no.2, p.62-3 (April 1983).
Sweepers have been observed to occur at random throughout the day and night and show a seasonal dependence on both amplitude and rate of occurrence. A close examination of the phenomena shows a great resemblance with the characteristics of VLF emissions. (7 refs.)

110798 Evolution of ion distributions across the nearly perpendicular bow shock: specularly and nonspecularly reflected-gyrating ions. N.Sckopke, G.Paschmann (Max-Planck-Inst. for Phys. und Astrophys., Garching, Germany), S.J.Bame, J.T.Gosling, C.T.Russell.
J. Geophys. Res. (USA), vol.88, no.A8, p.6121-36 (1 Aug. 1983).
Ion velocity space distributions measured with Los Alamos/Garching instruments on ISEE 1 and 2 across the Earth's bow shock have revealed that the nearly perpendicular shock reflects some fraction of the incident solar wind ions over a wide range of Mach numbers. The relative density of the reflected ions varies from 1-3% of the solar wind density at $M_A \approx 2$ to 15-25% at $M_A = 8$-12, in qualitative agreement with computer simulations and with predictions that indicate that such ions are needed to provide essential dissipation at the shock. These ions gyrate about **B** in the plasma rest frame with a speed of $\sim 2\, v_{in}$, where v_{in} is the normal component of the solar wind flow, and their density increases by ~2 orders of magnitude at the forward end of the 'foot' of the shock profile ~0.7 ion gyroradii upstream from the shock ramp. This is substantial evidence that the bulk of these ions have been reflected at the shock in a nearly specular fashion. Evidence also exists that a much smaller fraction is reflected nonspecularly. (35 refs.)

110799 Ray-tracing studies and path-integrated gains of ELF unducted whistler mode waves in the Earth's magnetosphere. C.Y.Huang, C.K.Goertz (Dept. of Phys. & Astron., Univ. of Iowa, Iowa City, IA, USA).
J. Geophys. Res. (USA), vol.88, no.A8, p.6181-7 (1 Aug. 1983).
Gyroresonance and Landau resonance interactions between unducted low-frequency whistler waves and trapped electrons in the Earth's plasmasphere have been studied. Ray paths for waves launched near the plasmapause have been traced. In agreement with findings by Thorne et al. (1979), the authors have found waves which return through the equatorial zone with field-aligned wave normal angles. However, when the growth along the ray path is calculated for such waves, assuming an electron distribution function of the form $E^{-n} \sin^m \alpha$, it is found that for all the waves considered, the local growth rate becomes negative before plasmapause reflection, limiting the total gain to small values. Most waves reach zero gain before reflection. This is the result of Landau damping at oblique propagation angles, which necessarily occurs before reflection can take place. It is concluded that the concept of cyclic ray paths does not provide an explanation for the generation of unguided plasmaspheric hiss. (21 refs.)

110800 Observational evidence of Z and L-O mode waves as the origin of auroral kilometric radiation from the Jikiken (EXOS-B) satellite. H.Oya, A.Morioka (Geophys. Inst., Tohoku Univ., Sendai, Japan).
J. Geophys. Res. (USA), vol.88, no.A8, p.6189-203 (1 Aug. 1983).
The Jikiken satellite, which had an initial pedigree and apogee of 250 km and 30050 km, respectively, and an orbit inclination of $-31°$, passed through critical regions where auroral kilometric radiation (AKR) spectra were obtained on at least five occasions during a period from January 31, 1979, to June 21, 1980. On all of these occasions the AKR spectra revealed cutoff phenomena at the local Z cutoff frequency, indicating a continuation of the spectra from the high-frequency side down to the Z mode wave frequency range and crossing over the local X cutoff frequency rather than being cut off at that frequency. Thus when observations were made near the low-latitude portion of the source region, the AKR waves generate spectra that continuously cover the frequency range corresponding to Z mode and L-O mode waves. The authors argue that the most plausible mechanism that gives a consistent interpretation of this spectral characteristic is the mode conversion theory. In other words, the plasma waves that are generated in the hybrid mode in the source regions are converted into Z mode waves that propagate toward dense plasma regions where the wave frequency coincides with the local plasma frequency and where a part of their energy is transferred to waves of the L-O mode that can escape toward outer space. (51 refs.)

110801 Type IPDP magnetic pulsations and the development of their sources. T.Pikkarainen, J.Kangas (Dept. of Phys., Univ. of Oulu, Oulu, Finland), B.Kiselev, N.Maltseva, R.Rakhmatulin, S.Solovjev.
J. Geophys. Res. (USA), vol.88, no.A8, p.6204-12 (1 Aug. 1983).
Intervals of pulsations of diminishing periods (IPDP) magnetic pulsations data have been analyzed from several recording campaigns and from stations that are widely spaced in both meridional and azimuthal directions. On the basis of their local time occurrence it seems useful to divide the events into at lest two main categories: $1400<\mathrm{LT}<1800$ and $1800<\mathrm{LT}<2400$. Those events which are not only observed at auroral latitudes typically develop slowly and extend at the most to 1 Hz, whereas those events that are observed at a low-latitude station may extent to several Hz. Simultaneous observations at several meridians extending over 100° show that the IPDP source region moves from east to west at a speed of 2-5° min^{-1}. There are necessarily no remarkable changes in frequency-time characteristics of IPDP pulsations. In the radial direction, IPDP wave frequency seems to be related to the He^{+} gyrofrequency in the equatorial plane. Observations are shown to be in general agreement with the evolution of the ion cyclotron instability in the plasma convection system of the magnetosphere. Several mechanisms seem to contribute simultaneously to the frequency shift of pulsations during IPDP events. (42 refs.)

110802 Longitudinal structure of substorm injections at synchronous orbit. R.L.Arnoldy, T.E.Moore (Space Sci. Center, Univ. of New Hampshire, Durham, NH, USA).
J. Geophys. Res. (USA), vol.88, no.A8, p.6213-20 (1 Aug. 1983).
From multiple-spacecraft measurements it is shown that the synchronous orbit manifestation of a substorm, i.e. plasma injection and magnetic field reconfiguration to dipolar, has an onset which expands both eastward and westward from a relatively narrow sector near midnight. For low-to-moderate geomagnetic activity the earliest onset sector at synchronous orbit is about 3 hours wide, skewed toward the evening side of midnight. Using a ground magnetometer network beneath the satellites, it is found that simultaneous westward motion of electrojet intensification is seen in the ground data over a larger longitudinal range than the magnetospheric signatures. This might be explained in terms of distortion of the nightside magnetic field at synchronous orbit. Plasma that has already been injected near midnight at synchronous altitude undergoes no further change as a result of the westward and eastward motion of the borders of the plasma. This suggests that the expansion does not represent new substorm activation. One can interpret these results in terms of an injection front wedge which makes hot plasma accessible to the inner magnetosphere and which spatially expands or propagates with time. (19 refs.)

110803 Particle and wave dynamics during plasma injections. H.C.Koons, J.F.Fennell (Space Sci. Lab., Aerospace Corp., Los Angeles, CA, USA).
J. Geophys. Res. (USA), vol.88, no.A8, p.6221-9 (1 Aug. 1983).
The SCATHA satellite measures particle and wave parameters as it moves outbound on the duskside from the plasmasphere into the plasma sheet. In many cases plasma waves are not observed in the quiescent plasma sheet prior to a plasma injection. The electron distribution function prior to entry into the plasma sheet is a nearly isotropic soft spectrum, $J(E) \sim 1/E$. Just inside the plasma sheet the spectrum begins to harden and becomes anisotropic, $J_{\perp} > J_{\parallel}$. As the satellite penetrates deeper into the plasma sheet, the spectrum further hardens, especially near $\alpha_0 \sim 90°$. At the injection the electron spectrum drastically hardens and often becomes peaked in the keV energy range. The pitch angle anisotropy is further enhanced in favor of $J_{\perp}$. The plasma wave emissions onset occurred as the time of the injection. Whistler mode waves are observed below the electron cyclotron frequency. Electrostatic waves are detected in bands between the electron cyclotron frequency harmonics. (20 refs.)

110804 An ISEE 3 high time resolution study of interplanetary parameter correlations with magnetospheric activity. D.N.Baker, R.D.Zwickl, S.J.Bame, E.W.Hones,Jr. (Los Alamos Nat. Lab., Los Alamos, NM, USA), B.T.Tsurutani, E.J.Smith, S.-I.Akasofu.
J. Geophys. Res. (USA), vol.88, no.A8, p.6230-42 (1 Aug. 1983).
From 1978 to 1982 the ISEE 3 spacecraft was in a 'halo' orbit around the Sun-Earth Lagrangian point L_1 approximately 240 R_E upstream of the Earth and was continuously in the upstream solar wind. In order to evaluate the efficacy of such a spacecraft as a real time interplanetary monitor to predict substorm activity and to measure solar wind energy input into the terrestrial magnetosphere, three periods in 1978 were selected in which to perform detailed correlation analyses between solar wind and interplanetary magnetic field (IMF) parameters and magnetospheric activity indices such as *AE* and *Dst*. High time resolution (1 min) averages of combined solar wind parameters and IMF parameters were used to perform linear cross-correlation analyses with the similarly averaged magnetospheric activity indices. A significant dependence of these results on levels of activity is found. (39 refs.)

110805 The season dependent distortions of the ring current. G.K.Mukherjee, R.Rajaram (Indian Inst. of Geomagnetism, Bombay, India).
J. Geomagn. & Geoelectr. (Japan), vol.34, no.11-12, p.619-32 (1982).
The seasonal variations of the plasma dynamics are investigated using the Mead-Fairfield model. It is shown that shifts in the mirror points and meridional drifts are introduced as a result of the season dependent tilt of the dipole axis with the Earth-Sun line. Other parameters like radial and azimuthal drifts and the bounce periods are free from seasonal variations. The maximum shift in the mirror points and latitudinal drifts are produced in particles bouncing close to the equator but the former peaks in the midnight meridian while the latter maximises (in magnitude) in the dawn and dusk sectors. A theoretical estimate is obtained for the seasonal geomagnetic variation associated with these distortions of the ring current. (16 refs.)

110806 A study of the mechanism of whistler-triggered VLF emissions. T.Yoshida, J.Ohtsu, M.Hayakawa (Res. Inst. of Atmospherics, Nagoya Univ., Aichi, Japan).
J. Geophys. (Germany), vol.53, no.1, p.59-67 (1983).
The conditions for triggering VLF emission by a natural whistler are studied, in terms of the length of interaction between whistler and electron determined by the unperturbed phase variation resulting from the spatial inhomogeneity and wave frequency variation. The computations are performed for a realistic magnetospheric model at $L=4.0$. It is found that the highest probability of VLF emission triggering occurs at an initial frequency slightly above 3 kHz in the whistler spectrum at a geomagnetic latitude $\sim -15°$ on the upstream side of the electron. (19 refs.)

110807 Resonance backscattering effect in the magnetospheric plasma. V.V.Krechetov, O.A.Mal'tseva, O.A.Molchanov (Inst. of Terrestrial Magnetism, Ionosphere, & Radio-wave Propagation, Acad. of Sci., Ukrainian SSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.10, p.786-90 (Oct. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.10, p.1103-8 (Oct. 1982). [received: Sept. 1983]
The effect of resonance backscattering of the signal (BSS) of a subauroral VLF transmitter ($L\approx4$) in the magnetosphere is analyzed. The experimental setup is described and the results obtained are presented. The main statistical relationships of BSS reception as a function of geomagnetic activity and local time are discussed. The BSS mechanism is discussed and ray trajectories, amplitude characteristics, BSS delays, and the zones of resonance absorption of the VLF signal are calculated. (15 refs.)

110808 Mechanism of nonlinear channelling of low-frequency waves. O.A.Molchanov, O.A.Mal'tseva, I.E.Sharko (Rostov-on-Don State Univ., Rostov-on-Don, USSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.10, p.790-4 (Oct. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.10, p.1109-14 (Oct. 1982). [received: Sept. 1983]
The possibility of nonlinear channelling of low-frequency waves in the Earth's magnetosphere in the process of merging with ion-cyclotron waves is considered. The characteristics of the merging process are determined and the channeling effect of the mechanism is demonstrated using the method of calculation of wave trajectories. (7 refs.)

110809 Near-equatorial magnetospheric particles from ~1 eV to ~1 MeV. D.T.Young (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.402-18 (March 1983).
Discusses near-equatorial populations of charged particles found within the Earth's magnetosphere. The review treats all aspects of near-equatorial particles. The structure of the report is based on a division of the near-equatorial particles into five populations: plasmasphere, suprathermal, plasma sheet, ring current, radiation belt. (271 refs.)

110810 Plasma boundaries and shocks. C.T.Russell (Inst. of Geophys. & Planetary Phys., Univ. of California, Los Angeles, CA, USA), E.W.Greenstadt.
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.449-62 (March 1983).
The authors discuss the bowshock, foreshock, interplanetary shocks, magnetosheath, magnetopause, boundary layer, plasma sheet, neutral sheet, polar cusp and plasma injection in magnetosphere. (273 refs.)

110811 Energy transfer in the quiet and disturbed magnetosphere. J.L.Burch (Dept. of Space Sci., Southwest Res. Inst., San Antonio, TX, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.463-73 (March 1983).
Progress on magnetospheric energy transfer reported during the 1979-82 quadrennium is reviewed. A discussion of the macroscopic control of magnetospheric phenomena by solar-wind dielectric and magnetic fields and kinetic pressure is followed by sections on energy transfer processes at the dayside magnetopause, in the magnetotail, near geosynchronous orbit, and at altitudes of $\approx1\ R_E$ above the auroral oval. Rapid progress in these areas has been stimulated primarily by ISEE and S3-3 observations and by the development of techniques for the large-scale computer simulation of plasma phenomena. (441 refs.)

110812 Modeling planetary magnetospheres. R.J.Walker (Inst. of Geophys. & Planetary Phys., Univ. of California, Los Angeles, CA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.495-507 (March 1983).
Advances in the development of models of the macroscopic properties of the magnetosphere are reviewed. The development of semiempirical models of the magnetospheric magnetic and electric fields is discussed. Models of magnetospheric storms and substorms in the inner magnetosphere and the magnetotail and reconnection are discussed. Global magnetohydrodynamic models of the interaction of the solar wind with the magnetosphere and five models of the magnetospheres of other planets are reported. (165 refs.)

Hydromagnetic waves in the magnetosphere .... See Entry 105055

Experimental studies of electron-ion recombination .... See Entry 106586

Potential energy curves for dissociative recombination .... See Entry 106620

Induction of currents in long submarine cables by natural phenomena .... See Entry 110296

VLF signal recognition by cross-spectral analysis .... See Entry 110686

foF2 response to IMF sector-boundary crossings .... See Entry 110781

A new radar auroral backscatter experiment .... See Entry 110782

Approximation solutions of the equations of motion of a charged particle in the field of a magnetic dipole .... See Entry 110813

The association of energetic particles and shocks in the heliosphere .... See Entry 110822

Plasma waves in planetary magnetospheres .... See Entry 110950

Terrestrial versus Jovian VLF chorus; a comparative study ... See Entry 110963

94.40 COSMIC RAYS

110813 Approximation solutions of the equations of motion of a charged particle in the field of a magnetic dipole. P.E.Kustaanheimo, J.Tutein (Danmarks Ingeniorakad., Lyngby, Denmark).
Astron. Nachr. (Germany), vol.304, no.3, p.125-31 (1983).
Three first-order differential equations which determine the trajectory are deduced. An approximate integration by means of elementary functions yields a set of formulae that give a 'window' in the sky inside which the source of a high energy cosmic ray must lie. (5 refs.)

110814 Overview of cosmic ray studies and associated topics (1979-1982). M.A.Shea (Air Force Geophys. Lab., Hanscom AFB, Bedford, MA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.R119-83003 (March 1983).
Discusses solar cosmic ray emission and the Solar Maximum Mission. Interplanetary propagation characteristics are discussed together with the interactions with the Earth's magnetosphere. Galactic cosmic ray abundances and origins are discussed. Future developments are discussed. (no refs.)

94.40C Origin and propagation outside the solar system

110815 Implications of HEAO 3 data for the acceleration and propagation of galactic cosmic rays. J.F.Ormes, R.J.Protheroe (Lab. for High Energy Astrophys., NASA Goddard Space Flight Center, Greenbelt, MD, USA).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.756-64 (15 Sept. 1983).
Reexamines the energy dependence of the mean escape length of cosmic rays from the Galaxy in the light of measurements of cosmic-ray abundances from the Danish-French experiment on *HEAO* 3. Comparing these data with results of propagation calculations, it is found that the energy dependence is steeper than previously thought. The authors discuss implications for the shape of the cosmic ray path length distribution at short path lengths and on the galactic wind model for the loss of cosmic rays from the Galaxy by convection. (70 refs.)

110816 Release of protons with energy $>10^{18}$eV from intergalactic magnetic field into interstellar magnetic field. A.K.Dasgupta (Federal Univ. of Technol., Bauchi, Nigeria).
Astrophys. & Space Sci. (Netherlands), vol.94, no.1, p.171-5 (July 1983).
Drift instabilities arising when accelerated protons are trapped in the intergalactic medium are examined. If α, the ratio of total (plasma+energetic particles) pressure and magnetic field pressure is larger than some value $\alpha\simeq0.1$ to 0.3, the magnetic trap is destroyed and protons are released into interstellar medium. If $\alpha<\alpha^*$, the trapped protons exhibit gradient instability due to magnetic drift resonance. This 'universal' instability results in rapid development of strong Alfven wave turbulence with small wavelengths transverse to the magnetic field. Particle diffusion due to the waves has a rather complicated character and appears to be weak as compared to quasilinear diffusion. (7 refs.)

110817 Boundary conditions for energetic particle transport at shocks. G.M.Webb (Max-Planck-Inst. fur Aeronomie, Katlenburg-Lindau, Germany).
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.163-71 (Aug. 1983).
Boundary conditions on the particle number density and current for energetic charged particles at a plane shock are derived, both for cases of scatter free propagation and convective-diffusive transport. The analysis is carried out for oblique shocks for which there is a frame of reference in which the electric field $\mathbf{E}=0$ everywhere. The boundary conditions are initially obtained in the $\mathbf{E}=0$ frame. The appropriate boundary condition in the observer's frame can then be obtained by Lorentz transformation. (34 refs.)

110818 Cosmic rays from the galactic centre. M.Giler (Phys. Dept., Univ. of Lodz, Lodz, Poland).
J. Phys. G (GB), vol.9, no.9, p.1139-49 (Sept. 1983).
An old model for the origin of cosmic rays is reinvestigated. It is shown that under the assumption of repeated explosions in the galactic centre separated in time by 10^7 yr, the last one being 10^6 yr ago, a number of observed cosmic-ray properties can be reproduced. Acceptable fits appear for the form of the energy spectrum of protons from 1-10^8 GeV and the mean grammage. The long-term near-constancy of the intensity is understandable. However, the observed anisotropy and the grammage distribution can be accounted for only if the diffusion in the disc is much smaller than that in the halo. (23 refs.)

110819 Ultrahigh-energy cosmic rays. S.N.Vernov, G.B.Khristiansen (Sci. Res. Inst. of Nuclear Phys., Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.1-11 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.3-11 (1982).
The authors present the results of a study of the primary very-high-energy cosmic radiation. They briefly explain the new methods which were realized. Particular attention is given to the results on the high energy spectrum of primary cosmic radiation in the interval of energies 10^{15}-10^{19} eV. The role of galactic cosmic rays of metagalactic origin is discussed, and also new mechanisms which ensure the acceleration of particles to energy of the order of more than 10^{19} eV. (31 refs.)

110820 The elemental and isotopic composition of galactic cosmic ray nuclei. R.A.Mewaldt (California Inst. of Technol., Pasadena, CA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.295-305 (March 1983).
Discusses progress in addressing the following question: In what ways is the composition of the matter that gets accelerated to be cosmic rays similar to, or different from, the composition of Solar System matter? The answers to this question are providing important new quantitative clues to the origin and evolution of this high-energy sample of matter from the Galaxy. The report is divided into three main sections, covering the composition of: 1) elements with nuclear charge $Z\leq28$; 2) ultraheavy ($Z\geq30$) nuclei; and 3) cosmic ray isotopes. (102 refs.)

Variations of cosmic-ray energy in interplanetary space .... See Entry 110821

Blast waves with cosmic-ray pressure .... See Entry 110882

Stability of the equilibrium distributions of interstellar gas, cosmic rays, and magnetic field in an external gravitational field .... See Entry 111176

The Cherenkov effect and plasma turbulent reactors .... See Entry 111256

94.40E Interplanetary propagation and effects

110821 Variations of cosmic-ray energy in interplanetary space. L.I.Dorman, M.E.Katz, Yu.I.Fedorov, B.A.Shakhov.
Astrophys. & Space Sci. (Netherlands), vol.94, no.1, p.43-95 (July 1983).
A consistent theory of energy exchange between high-energy charged cosmic-ray particles and the random inhomogeneities of a magnetic field frozen in the moving solar wind plasma is developed. It is shown that the mode of

the particle energy variations at a given law of plasma velocity variation in space is determined by the specific form of the particle distribution function. The equation for the density of cosmic-ray energy is obtained. Consideration is given to the generation of a charged particle energy spectrum in the course of multiple scatterings by the random inhomogeneities of the magnetic field. (39 refs.)

Approximation solutions of the equations of motion of a charged particle in the field of a magnetic dipole .... See Entry 110813

The association of energetic particles and shocks in the heliosphere .... See Entry 110822

Cosmic-ray modulation and the anomalous component .... See Entry 110826

94.40H Energetic solar particles and photons

110822 The association of energetic particles and shocks in the heliosphere. M.A.Lee (Space Sci. Res. Center, Univ. of New Hampshire, Durham, NH, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.324-8 (March 1983).
Reviews the theory of shock acceleration and extensions of that theory developed during the last four years and recent observations and applied theoretical work on energetic particle enhancements in association with each shock or class of shocks within the heliosphere. The Earth's bow shock and other planetary bow shocks are discussed. Corotating events and shocks produced by large solar flares which propagate through the Sun's corona and out through interplanetary space are considered. Shock-spike events, post-shock enhancements, and energetic storm particle events which have all been observed from 0.3 AU to 25 AU are discussed. The origin of solar cosmic rays is discussed. The author addresses the solar wind termination shock. (145 refs.)

Pulsations of cosmic rays before solar proton bursts from ground-based observational data .... See Entry 110827

94.40K Solar modulation and geophysical effects

110823 Interaction mean-free-path of cosmic-ray Fe in air. J.H.Crane, D.D.Guo, M.H.Israel, J.Klarmann (Dept. of Phys., Washington Univ., St. Louis, MO, USA).
Astrophys. & Space Sci. (Netherlands), vol.94, no.1, p.201-9 (July 1983).
The interaction mean-free-path of cosmic-ray iron in air is determined by observing the change in flux as a function of atmospheric depth. A large detector and a large variation in altitude during the balloon flight result in a high precision measurement. The result is in agreement, though slightly larger than the mean-free-path deduced from the measurements of interactions of iron on different targets at the Bevalac accelerator. (20 refs.)

110824 Abundance of cosmic-ray elements from sulfur to nickel as a function of atmospheric depth. J.H.Crane, M.H.Israel, J.Klarmann (Dept. of Phys., Washington Univ., St. Louis, MO, USA), J.F.Ormes, R.J.Protheroe.
Astrophys. & Space Sci. (Netherlands), vol.94, no.1, p.211-22 (July 1983).
The measured elemental composition of cosmic rays with charge $16\leq Z\leq 28$ as a function of atmospheric depth is compared with a propagation calculation including energy loss. The resulting composition at the top of the atmosphere has better precision than previously possible on balloon borne experiments, and agrees well with the only satellite data available in this charge range. The extrapolation method also provides checks on assumed cross-sections for interactions of cosmic rays in air. (21 refs.)

110825 The composition, propagation and acceleration of energetic solar particles: a review of United States research 1979-1982. R.E.McGuire (NASA Goddard Space Flight Center, Greenbelt, MD, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.305-18 (March 1983).
Discusses major developments in American research related to solar energetic particles, both observational and theoretical, during the last four years (late 1978 to late 1982). The organization of the review is divided into three major sections, loosely defined on the basis of (1) time independent measurement (e.g. solar event-averaged elemental, isotopic and charge state composition, electron and ion spectra), (2) time dependent measurement (e.g. intensity and anisotropy versus time, at multiple energies and for multiple species) subdivided into the topics of interplanetary propagation and coronal transport/storage, and (3) the question of the injection and primary acceleration mechanisms. (197 refs.)

110826 Cosmic-ray modulation and the anomalous component. F.C.Jones (Lab. for High Energy Astrophys., NASA/Goddard Space Flight Center, Greenbelt, MD, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.318-24 (March 1983).
Discusses advances in cosmic-ray modulation observation and theory and in the study of the anomalous component of the cosmic radiation. It concentrates primarily on advances made in American research and reported in the open literature during the years 1979-82. (87 refs.)

110827 Pulsations of cosmic rays before solar proton bursts from ground-based observational data. S.A.Starodubtsev, A.T.Filippov, N.P.Chirkov (Inst. for Cosmosphys. Res. & Aeronomy, Acad. of Sci., USSR).
Sov. Astron. (USA), vol.26, no.6, p.736-7 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1229-30 (Nov.-Dec. 1982).
Fluctuations of the neutron component of cosmic rays during 11 solar flares in the period from 1967 to 1981 are investigated on the basis of five-minute data of ground stations. It is found that pulsations of cosmic rays with periods of 30-40, 60-90, and, rarely, 120-160 min are observed a day before the rise in the flux of relativistic particles from a solar flare. (3 refs.)

Approximation solutions of the equations of motion of a charged particle in the field of a magnetic dipole .... See Entry 110813

Photon and helium energy spectra above 1 TeV for primary cosmic rays .... See Entry 110828

94.40L Composition and energy spectra

110828 Photon and helium energy spectra above 1 TeV for primary cosmic rays. T.H.Burnett (Inst. for Cosmic Ray Res., Univ. of Tokyo, Tokyo, Japan), S.Dake, M.Fuki, J.C.Gregory, T.Hayashi, R.Holynski, R.W.Huggett, S.D.Hunter, J.Iwai, W.V.Jones, A.Jurak, J.J.Lord, O.Miyamura, H.Oda, T.Ogata, T.A.Parnell, T.Saito, T.Tabuki, Y.Takahashi, T.Tominaga, J.W.Watts, B.Wilczynska, R.J.Wilkes, W.Wolter, B.Wosiek.
Phys. Rev. Lett. (USA), vol.51, no.11, p.1010-13 (12 Sept. 1983).
Energy spectra of protons and helium nuclei in the primary cosmic rays were measured above 1 TeV in a series of balloon flights of emulsion chambers. Differential spectra may be represented by power laws of indices -2.81 ± 0.13 and -2.83 ± 0.20 for protons and He, respectively. No index charge was observed for either species over the energy ranges 5-500 TeV for protons and 2-50 TeV/nucleon for He. Intensities were consistent with extrapolations of previously published data below 1 TeV/nucleon. (18 refs.)

110829 An underground search for anomalous penetrating particles such as massive magnetic monopoles. T.Mashimo, S.Orito, K.Kawagoe, S.Nakamura, M.Nozaki (Dept. of Phys., Faculty of Sci., Univ. of Tokyo, Tokyo, Japan).
Phys. Lett. B (Netherlands), vol.128B, no.5, p.327-32 (1 Sept. 1983).
The authors have searched for anomalous cosmic-ray particles in a wide velocity range ($3\times10^{-4}<\beta<1$) by accurately measuring the time of flight and the dE/dx of downward and upward particles with six layers of scintillator hodoscopes placed 250 m underground. No anomalous candidate has been found other than the relativistic muons, setting an upper limit on the flux of 1.5×10^{-12} cm^{-2} s^{-1} sr^{-1} for magnetic monopoles in the velocity range $6\times10^{-4}<\beta<1$. Similar upper limits on the flux are obtained also for slow massive integrally- or fractionally-charged particles and also for relativistic fractionally-charged leptons. (22 refs.)

110830 Rigorous saddle-point method for cosmic-ray integral electron spectra. J.Sidhanta (Dept. of Phys., Charuchandra Coll., Calcutta, India), R.K.Roychoudhury, D.P.Bhattacharyya.
Phys. Rev. D (USA), vol.28, no.5, p.1113-16 (1 Sept. 1983).
It is established here that the saddle-point method of contour integration, when applied with more than customary rigor, gives a new general formula for integral electrons spectra for electron-initiated showers. The lowest-order approximation to this general formula, though much simpler than those widely used, exactly reproduces the curves represented by the latter. (2 refs.)

Cosmic rays from the galactic centre .... See Entry 110818

Ultrahigh-energy cosmic rays .... See Entry 110819

The elemental and isotopic composition of galactic cosmic ray nuclei .... See Entry 110820

Abundance of cosmic-ray elements from sulfur to nickel as a function of atmospheric depth .... See Entry 110824

The composition, propagation and acceleration of energetic solar particles: a review of United States research 1979-1982 .... See Entry 110825

Cosmic-ray modulation and the anomalous component .... See Entry 110826

Derivation of gamma ray spectrum at high altitude from the recent primary cosmic ray spectrum using gamma ray bundle extensive air shower results and electromagnetic cascade theory .... See Entry 110831

Inelasticity of nucleus-nucleus collisions and composition of high-energy cosmic rays .... See Entry 110834

Neutrino energy production spectra in a relativistic plasma .. See Entry 110835

Neutrino emission from black holes .... See Entry 111126

The Cherenkov effect and plasma turbulent reactors .... See Entry 111256

94.40N Extensive air showers

110831 Derivation of gamma ray spectrum at high altitude from the recent primary cosmic ray spectrum using gamma ray bundle extensive air shower results and electromagnetic cascade theory. D.P.Bhattacharyya, A.Mukhopadhyay, P.Pal (Dept. of Theoretical Phys., Indian Association for the Cultivation of Sci., Calcutta, India), R.K.R.Choudhury.
Indian J. Phys. Part B, vol.57B, no.2, p.166-76 (April 1983). [received: Sept. 1983]
The flux and energy spectrum of electromagnetic component like gamma rays in the energy region 0.5-10 TeV has been calculated from the authors' primary cosmic ray spectrum. This is based on the chemical composition data of Japanese American Cooperative Emulsion Experiments and Goddard Space Flight Centre results viz. the total primary nucleon spectrum follows the form. (17 refs.)

110832 High-energy hadrons in extensive air showers. B.V.Sreekantan, S.C.Tonwar, P.R.Viswanath (Tata Inst. of Fundamental Res., Colaba, Bombay, India).
Phys. Rev. D (USA), vol.28, no.5, p.1050-66 (1 Sept. 1983).
Various attempts to interpret the experimental results on high-energy hadrons in extensive air showers of size $\sim10^5$-10^6 at mountain altitudes in terms of the characteristics of high-energy particle interactions have yielded ambiguous results due to apparently large differences between results from different experiments using different types of hadron detectors. In an attempt to understand these differences the authors have studied the response of different types of detectors to showers with multiple hadrons incident over the detector area. The simulations suggest that large-area nonvisual detectors overestimate the energies of high-energy hadrons. The energy overestimation depends on the type and the size of the detector, the energy of the high-energy hadron, the shower size, and the observational altitude. They discuss the results from the experiment at mountain altitude laboratory at Ooty where they have studied this problem by comparing the response of a burst detector placed inside a multiplate cloud chamber with the visual information from the chamber. The observations show that large discrepancies between the results from different experiments are mostly due to the differences between the response functions of the detectors and that measurements with visual detectors give the most reliable data on the number of high-energy hadrons in air showers. They also show that three experiments which have used burst detectors agree well with each other and with the cloud-chamber experiment if appropriate corrections are applied. They have compared these measurements with the expectations from Monte Carlo simulations of air showers using scaling models for high-energy particle interactions and find that the observed number of hadrons in a shower are too few compared to the expected number. They show that changes in the interaction model which affect only particles in the central region do not have any significant effect on the expected number of high-energy hadrons in a shower. These results imply that either hadron-air-nucleus collisions are very different at high energies $\sim10^6$ GeV in the fragmentation region compared to hadron-hadron collisions or there is substantial violation of scaling in the fragmentation region in hadron-hadron interactions at air-shower energies. (46 refs.)

Rigorous saddle-point method for cosmic-ray integral electron spectra .... See Entry 110830

Inelasticity of nucleus-nucleus collisions and composition of high-energy cosmic rays .... See Entry 110834

94.40R High-energy interactions

110833 Interaction with a large multiplicity registered in photoemulsion. V.A.Sobinyakov, Ch.A.Tret'yakova, V.Ya.Shestoperov (Sci. Res. Inst. of Nuclear Phys., Moscow Univ., Moscow, USSR).
Moscow Univ. Phys. Bull. (USA), vol.37, no.6, p.89-90 (1982). Translation of: *Vestn. Mosk. Univ. Ser. 3 (USSR)*, vol.37, no.6, p.77-8 (1982).
The authors present the results of measurements of angles of 527 relativistic particles which are created in the interaction of an aluminum nucleus with the nucleus of the photoemulsion. (5 refs.)

110834 Inelasticity of nucleus-nucleus collisions and composition of high-energy cosmic rays. T.K.Gaisser, T.Stanev (Bartol Res. Found., Franklin Inst., Univ. of Delaware, Newark, DE, USA).
Phys. Rev. D (USA), vol.28, no.3, p.464-7 (1 Aug. 1983).
Current experiments to determine the chemical composition and energy spectra of primary-cosmic-ray nuclei around 10^{14} eV maximize collecting power by using thin calorimeters of large area that measure primarily the electromagnetic fraction of the energy released when the nucleus interacts. Estimates of this fraction are model-dependent and differ by nearly a factor of 2 for a range of reasonable models. The authors discuss the consequences of this for composition studies using emulsion chambers. (16 refs.)

Variations of cosmic-ray energy in interplanetary space .... See Entry 110821

Derivation of gamma ray spectrum at high altitude from the recent primary cosmic ray spectrum using gamma ray bundle extensive air shower results and electromagnetic cascade theory .... See Entry 110831

High-energy hadrons in extensive air showers .... See Entry 110832

94.40T Muons and neutrinos

110835 Neutrino energy production spectra in a relativistic plasma. F.Giovannelli (Inst. of Space Astrophys., CNR, Frascati, Italy), S.Karakula, W.Tkaczyk.
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.121-5 (Aug. 1983).
Determines the neutrino and antineutrino energy production spectra in a relativistic plasma. The considered plasma temperature range is 10^{11}-10^{13}K. The maximum of the neutrino energy production spectrum is at the energy $E_{\nu}=31$ MeV. The antineutrino and electron-neutrino production spectra from μ^{+} decay have maxima at 40 MeV. The cooling rate coefficient for a relativistic plasma emitting neutrinos is considered for various mean kinetic energies of the protons. The energy attenuation time for a relativistic plasma is estimated and briefly discussed. (18 refs.)

An underground search for anomalous penetrating particles such as massive magnetic monopoles .... See Entry 110829

Neutrino emission from black holes .... See Entry 111126

94.40V Cosmic-ray effects in meteorites and terrestrial matter

The association of energetic particles and shocks in the heliosphere .... See Entry 110822

94.60 INTERPLANETARY SPACE

(see also 96.60 Solar physics)

110836 Momentum flux invariance in the solar wind. D.J.Mullan (Bartol Res. Found., Franklin Inst., Univ. of Delaware, Newark, DE, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.325-8 (1 Sept. 1983).
Uses *ISEE C* data to confirm the result of Steinitz and Eyni (1980) that the momentum flux in the solar wind is invariant relative to velocity structures. (3 refs.)

110837 Corotating pressure waves without fast streams in the solar wind. L.F.Burlaga (Lab. for Extraterrestrial Phys., NASA Goddard Space Flight Center, Greenbelt, MD, USA).
J. Geophys. Res. (USA), vol.88, no.A8, p.6085-94 (1 Aug. 1983).
Voyager 1 and 2 magnetic field and plasma data are presented which demonstrate the existence of large scale, corotating, nonlinear pressure waves between 2 AU and 4 AU that are not accompanied by fast streams. The pressure waves are presumed to be generated by the interaction between fast corotating streams and slower flows near the Sun. For two of the three pressure waves that are discussed, the absence of a relatively fast stream is probably a real, physical effect, viz. a consequence of deceleration of the stream and acceleration of the ambient flow by the associated compression wave. For the third pressure wave, the apparent absence of a stream may be a geometrical effect. It is suggested that the development of large-scale, nonlinear pressure waves at the expense of part of the kinetic energy of streams produces a qualitative change in the solar wind in the outer heliosphere. (39 refs.)

110838 Alfven solitons in the solar wind. C.R.Ovenden, H.A.Shah, S.J.Schwartz (Dept. of Appl. Math., Queen Mary Coll., London, England).
J. Geophys. Res. (USA), vol.88, no.A8, p.6095-101 (1 Aug. 1983).
The interaction of circularly polarized Alfven waves in the surrounding plasma in high speed solar wind streams is investigated. Alfven wave modulation instability is discussed and nonlinear envelope soliton solutions of the magnetohydrodynamic equations are introduced. The characteristics of these Alfven solitons are compared with observational results obtained from helios I and II. A model of the expected turbulent spectrum due to a collection of such solitons is constructed and its radial dependence is investigated, again along with comparison to Helios data. (28 refs.)

110839 Coupled hydromagnetic wave excitation and ion acceleration at interplanetary traveling shocks. M.A.Lee (Space Sci. Center, Univ. of New Hampshire, Durham, NH, USA).
J. Geophys. Res. (USA), vol.88, no.A8, p.6109-19 (1 Aug. 1983).
A self-consistent theory is presented for the excitation of hydromagnetic waves and the acceleration of ions upstream of interplanetary traveling shocks. The waves are excited by the ions by virtue of ion streaming relative to the solar wind; the ions are accelerated by being coupled to the compression of the shock via pitch angle scattering on the upstream waves and the downstream turbulence. Diffusion equations describing the ion transport and wave kinetic equations describing the hydromagnetic wave transport are solved self-consistently to yield analytical expressions for the differential wave intensity spectrum as a function of wave number k and distance z upstream of the shock and for the ion omnidirectional distribution functions and anisotropies as functions of energy E and z. This theory is in quantitative agreement with observations. (59 refs.)

110840 Solar cycle and long term changes in the solar wind. J.Feynman (Dept. of Phys., Boston Coll., Chestnut Hill, MA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.338-48 (March 1983).
During the last four years substantial progress has been made in the study of variations of the solar wind on time scales of decades to hundreds of years. Solar cycle changes in 3 dimensions have been described and the cyclic evolution of solar sources studied. Work on longer term changes has made a good start. Data sets and methods of scientific analysis are being developed. Estimates have been made of pre-space-age solar wind properties. The existence of the solar wind properties. The existence of the eleven year cycle for the last 1500 years was studied. The non-random nature of variations over many solar cycles was confirmed but there is still controversy concerning the periodic nature of the 80-100 year variation. There is evidence that variations of the Maunder and Sporer types may be periodic. (83 refs.)

110841 Heliospheric magnetic fields and plasmas. L.F.Burlaga (Lab. for Extraterrestrial Phys., NASA/Goddard Space Flight Center, Greenbelt, MD, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.363-75 (March 1983).
Surveys the literature on the subject of heliospheric physics for the period 1979-82. It consists of two distinct parts: a comprehensive bibliography of US efforts in heliospheric physics and a narrative description of the principal results. The bibliography includes relevant papers in English by European and Japanese scientists, but does not cover all the work in this field. The author focuses on observations and theories related to the study of the heliosphere as a large-scale astrophysical system which forms part of the Earth's environment. (242 refs.)

foF2 response to IMF sector-boundary crossings .... See Entry 110781

Analytic solution for the two-frequency mutual coherence function for spherical wave propagation .... See Entry 110783

Geomagnetic implications of a simple IMF model .... See Entry 110795

Evolution of ion distributions across the nearly perpendicular bow shock: specularly and nonspecularly reflected-gyrating ions .... See Entry 110798

An ISEE 3 high time resolution study of interplanetary parameter correlations with magnetospheric activity .... See Entry 110804

Variations of cosmic-ray energy in interplanetary space .... See Entry 110821

The association of energetic particles and shocks in the heliosphere .... See Entry 110822

The macroscopic magnetohydrodynamics of inhomogeneously turbulent cosmic plasmas .... See Entry 110893

Solar-planetary relationships: magnetospheric physics .... See Entry 110949

The magnetosphere of Saturn .... See Entry 110983

The effect of MHD instabilities on the flaring of cometary plasma tails .... See Entry 110985

Planck mean radiation-pressure cross sections for nonspherical grains. I .... See Entry 111179

94.80 AEROSPACE FACILITIES AND TECHNIQUES; SPACE RESEARCH

(see also 87.65 Aerospace biophysics and medical physics)

110842 4 probes to Comet Halley. J.Eichenlaub.
Astronomy (USA), vol.11, no.9, p.16-22 (Sept. 1983).
Discusses the nature of Comet Halley (1982i) in relation to the four proposed spacecraft missions Giotto, Planet A, (Vega 1 and Vega 2) and ISEE-3. Each mission is briefly described. (no refs.)

110843 Polar orbiting satellites. II. T.Weatherley.
Radio & Electron. World (GB), p.40-1 (Aug. 1983).
For pt.I see ibid., vol.2, no.6, p.17 (1983). To predict when a satellite can be heard from a given location, it is necessary to have certain reference parameters. The minimum requirements are the orbital period, and the time and point at which the satellite crosses the equator. Using data for the NOAA7 a worked example is included, and a utility program for the BBC micro is given. (no refs.)

110844 Weather satellite reception. II. W.Poel.
Radio & Electron. World (GB), p.52-7 (Aug. 1983).
For pt.I see ibid., vol.2, no.9, p.57 (1983). Examines the baseband requirements for Meteosat reception. There are two readily available converters for 1.8 GHz, one from Microwave Modules and the other from VHF Communications. The latter is described. The APT/WEFAX signal is firstly filtered in a bandpass filter and demodulated. The analogue video signal is sampled and converted in an 8-bit ADC. Only 6 bits are required for the grey levels, which are then converted into a serial format. Synchronization is obtained from the 2.4 kHz sub-carrier and all signals are obtained from a PLL. This is followed by a chain of dividers. (no refs.)

110845 The critical inclination problem with small eccentricity. II. Application to Earth satellites. A.H.Jupp (Dept. of Appl. Math. & Theoretical Phys., Univ. of Liverpool, Liverpool, England), A.Y.Abdulla.
Celestial Mech. (Netherlands), vol.30, no.3, p.297-308 (July 1983).
For pt.I see ibid., vol.21, no.4, p.361-93 (1980). The general theory described in an earlier paper is used to investigate the long-term behaviour of the eccentricity and argument of the perigee for Earth satellites which have nearly circular orbits and orbital inclinations in the neighbourhood of the critical value 63.4°. Taking into account the effect of all the zonal harmonics, it is shown that there are just two types of behaviour possible, compared with the six described in the earlier general theory and the four found by Aoki (1963). (5 refs.)

110846 A linear solution of the equations of motion of an Earth-orbiting satellite based on a Lie-series. D.J.Lelgemann (Inst. fur Angewandte Geodasie, Frankfurt, Germany).
Celestial Mech. (Netherlands), vol.30, no.3, p.309-21 (July 1983).
Using Hill's variables, an analytical solution of a canonical system of six differential equations describing the motion of a satellite in the gravitational field of the Earth is derived. The gravity field expanded into spherical harmonics, has to be expressed as a function of the Hill variables. The intermediary is chosen to include the main secular terms. The first order solution retains the highly practical formal structure of Kaula's (1966) linear solution, but is valid for circular orbits and provides a spectral decomposition of radius vector and radial velocity. The resulting eccentricity functions are much simpler than the Hansen functions, since a series evaluation of the Kepler equations is avoided. The solution obtained may be extended to higher order solutions by Hori's perturbation method. (8 refs.)

110847 Advanced low altitude infrared Earth sensors. T.K.Alex, Y.K.Jain, K.Kanakaraju, J.A.Kamalakar (ISRO Satellite Centre, Dept. of Space, Government of India, Bangalore, India).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.366, p.140-7 (1983). (Modern Utilization of Infrared Technology VIII, San Diego, CA, USA, 26-27 Aug. 1982).
Novel low altitude infrared Earth sensors are described. A static horizon sensor utilises the state of art technology in electronics to minimise the effect of radiance gradient by taking the ratio of the radiometric signals by a hard wired or microprocessor based system. A scanning sensor is also being developed which scans radially at four edges and which using a single scan assembly thus reducing errors caused by conventional techniques. (no refs.)

110848 The ISPM mission: science objectives and mission overview. K.-P.Wenzel, R.G.Marsden (Space Sci. Dept., ESA, ESTEC, Noordwijk, Netherlands), E.J.Smith.
ESA J. (Netherlands), vol.7, no.2, p.123-34 (1983).
The International Solar Polar Mission (ISPM) will, for the first time, allow exploration of the heliosphere within a few astronomical units of the Sun over the full range of heliographic latitudes. The prime mission objective is to study, as a function of solar latitude, the properties of the interplanetary medium and solar corona. The scientific instrumentation is designed to explore, in the third heliospheric dimension, the properties of the solar wind, the Sun/wind interface, the heliospheric magnetic field, solar radio bursts and plasma waves, solar X-rays, solar and galactic cosmic rays, and interplanetary/interstellar neutral gas and dust. ISPM will also detect cosmic gamma-ray bursts and search for gravitational waves. ISPM is a cooperative mission carried out jointly by ESA and NASA, to be launched in May 1986 and utilising a Jupiter gravity-assist to achieve a high-solar latitude trajectory. (7 refs.)

110849 Nodal period of a satellite perturbed by the Earth's oblateness. E.A.Roth (Mission Analysis Office, European Space Operations Centre, Darmstadt, Germany).
ESA J. (Netherlands), vol.7, no.2, p.189-93 (1983).
The first-order formula for the nodal period of a satellite orbit perturbed by the oblateness (J_2) of the central body is derived. The result is valid for all eccentricities $0 \leq e < 1$ and all inclinations $0 \leq i \leq \pi$, with an error of the order of $0(J_2^2)$. (5 refs.)

110850 Infrared astronomy: spy in space. R.A.J.Arthur.
Funkschau (Germany), no.14, p.52 (8 July 1983). In German.
Gives a brief report on the joint European IRAS satellite, equipped with a helium-cooled infrared telescope for operations in the 8 to 120 μm range from an orbiting height of 900 km. The terrestrial control station is at Chilton, South England. The 12 m parabolic antenna at Chilton is shown. (no refs.) *A.L.*

110851 Dynamics of momentum biased spacecraft in a near-polar orbit. R.G.Sellappan (Spacecraft Engng. Dept., RCA American Communications Inc., Princeton, NJ, USA).
IEEE Trans. Aerosp. & Electron. Syst. (USA), vol.19, no.3, p.360-8 (May 1983).
The equations of motion of a momentum biased spacecraft are derived in a general form. The spacecraft is assumed to be orbiting in a near-elliptical orbit. An aerodynamic torque model which accounts for the atmospheric superrotation is assumed. The equilibrium attitude angles are obtained in terms of modified Bessel functions. Analytic expressions for the long-term motion of the momentum biased axis are derived for special case. The analysis is applicable to the Magsat mission. (7 refs.)

110852 Meteorological satellite and its image processing techniques. M.Narui (Meteorological Satellite Centre, Tokyo, Japan).
J. Inst. Telev. Eng. Jpn. (Japan), vol.37, no.3, p.186-94 (March 1983). In Japanese.
This paper briefly describes the construction of the visual infrared spin scan radiometer (VISSR) on the HIMAWARI geostationary geological satellite (GMS) and outlines the image processing method of data sets issued from the VISSR. The VISSR is provided with the Ritchey-Chretien optical system and the scanning mirror servocontrolled by means of a torque motor and optical encoder. The data sampling rate is 437.5K samples per second for visual observation and 109.4K samples per second for infrared. The VISSR signals from the GMS are received and demodulated by a command and data acquisition system (CDAS) on ground. The stretched VISSR signals transmitted from the CDAS through a microwave line are fed to a computer system to provide images for transmission to news organisations. (no refs.) *K.B.*

110853 The Voyager mission to Uranus and beyond. S.J.Kerridge (Jet Propulsion Lab., Pasadena, CA, USA).
J. Br. Interplanet. Soc. (GB), vol.36, no.8, p.339-45 (Aug. 1983).
On 24 January 1986 the Voyager 2 probe will approach within 82000 km of the cloud tops of the planet Uranus, obtaining our first closeup pictures of this giant outer planet as well as amassing large quantities of data from the ten other onboard experiments. Closeups of the five presently known Uranian satellites will be transmitted back over a distance of 20 AU with a one-way light-time of two and three-quarter hours. The narrow, elliptical, inclined rings of Uranus will be probed both by the imaging subsystem and by the photopolarimeter detecting the light of stars shining through this diffuse necklace. (no refs.)

110854 Exosat—the new extrasolar X-ray observatory. H.A.Hoff.
J. Br. Interplanet. Soc. (GB), vol.36, no.8, p.363-7 (Aug. 1983).
A history of the Exosat mission is discussed. The equipment on board is described and the satellite's operation is considered. (2 refs.)

110855 Geosynchronous satellite list: 1983. W.L.Morgan (Communications Centre of Clarksburg, Clarksburg, MD, USA).
J. Br. Interplanet. Soc. (GB), vol.36, no.8, p.377-82 (Aug. 1983).
Presents an update to the list of Morgan (1979). The table lists satellites by their orbital location. For a given position, the satellites appear on an ascending frequency basis. Only those satellites in use or planned for in the near future are listed. The list does not include inactive or non-communicating pieces of debris. (2 refs.)

110856 ERS-1: an ice and ocean monitoring mission. P.R.C.Gillett (Dornier System GmbH, Friedrichshafen, Germany).
J. Br. Interplanet. Soc. (GB), vol.36, no.9, p.387-93 (Sept. 1983).
The detailed definition phase for the European Space Agency's Remote-Sensing Satellite System, ERS-1, has been carried out by an industrial consortium of European and Canadian companies led by Dornier System of Germany. The author presents a summary of the mission and the system that has evolved, highlighting the characteristics of the main elements. (3 refs.)

110857 A proposal to use an upper atmosphere satellite tethered to the Space Shuttle for the collection of micro-meteoric material. G.J.Corso (Dept. of Phys. & Astron., Indiana Univ. Northwest, Gary, IN, USA).
J. Br. Interplanet. Soc. (GB), vol.36, no.9, p.403-8 (Sept. 1983).
The use of a satellite tethered to the Space Shuttle by a long cable is proposed for the collection of intact cosmic dust particles smaller than 2 microns impacting the collector surfaces at a velocity less than about 3 km/sec; and the study of impact craters and impact debris resulting from impacts of all sized particles at velocities in excess of 3 km/sec. The tether facility, now being developed by the Marshall Space Flight Center for use on the Shuttle around 1987, is capable of deploying satellites at the end of a cable approximately 100 km long. Several advantages of this new approach for the collection of intact particles smaller than 2 microns over both stratospheric and on-board Shuttle mounted or Long Duration Exposure Facility type collectors are discussed. (35 refs.)

110858 Advances in orbit theory for an artificial satellite with drag. J.J.F.Liu (SPACECOM, Peterson AFB, Colorado Springs, CO, USA).
J. Astronaut. Sci. (USA), vol.31, no.2, p.165-88 (April-June 1983).
The general problem of the motion of an artificial satellite with atmospheric drag and the mathematical formulation of the variational equations for this problem are revisited. Relevant advances for the analytic and semianalytic solutions of the coupled problem with drag are outlined. The author discusses the complex nature of the dynamical system and presents some of the existing solutions and their numerical results when available. (101 refs.)

110859 Linear wide angle Sun sensor for spinning satellites. M.P.Philip, B.Kalakrishnan, Y.K.Jain (ISRO Satellite Centre, Bangalore, India).
Opt. Eng. (USA), vol.22, no.4, p.491-6 (July-Aug. 1983).
The V-slit, N-slit, and crossed slit Sun sensors that are normally used for Sun elevation angle measurement on spinning spacecraft suffer from two defects, namely, nonlinearity of response and limitation in range. The authors describe a concept which overcomes both of these defects. Two versions of sensors based on this concept which give a linear output and have a range of nearly ±90° of elevation angle are described. The first version has already been flown on three Indian spacecraft, and a flight model of the second improved version is under testing for another satellite to be flown shortly. (no refs.)

110860 Near-circular satellite orbits in an oblate, diurnally varying atmosphere. G.G.Swinerd, W.J.Boulton (Dept. of Math., Univ. of Aston, Birmingham, England).
Proc. R. Soc. London Ser. A (GB), vol.389, no.1796, p.153-70 (8 Sept. 1983).
The influence of air drag and the geopotential on near-circular satellite orbits, eccentricity $e < 0.01$, is considered. A model of the atmosphere is adopted that allows for oblateness, and in which the density behaviour approximates to the observed diurnal variation. Differential equations governing the variation in e and the argument of perigee ω are derived by combining the effects of air drag with those of the Earth's gravitational field. These are solved numerically using initial conditions obtained from a series of computed orbits of the satellite 1963-27 A. The behaviour of the orbital elements predicted by the numerical solution is compared with the observed elements to test the developed theory, and to obtain values of atmospheric parameters at heights near 400 km. (23 refs.)

110861 A BASIC program for calculating satellite orbits. C.A.Huertas.
Rev. Telegr. Electron. (Argentina), vol.71, no.839, p.293-5 (April 1983). In Spanish.
Presents a BASIC program for the calculation of times of passage over Buenos Aires of the following twelve satellites: OSCAR 7, 8 and 9, RS 1, 2, 3, 4, 5, 6, 7, and 8, and NOAA-7. It requires a 3K memory (1.7K if the REM is suppressed and only a single satellite at a time is dealt with). It is very rapid in operation; starting with the specification of the satellite in question and the date, it gives in a few minutes the time and direction of appearance over the horizon, the direction of closest approach, the direction of disappearance, the maximum elevation, the time of passage and the crossing with Equator. (no refs.) *C.J.O.G.*

110862 Return to Jupiter: project Galileo. T.V.Johnson, C.M.Yeates (Jet Propulsion Lab., Pasadena, CA, USA).
Sky & Telesc. (USA), vol.66, no.2, p.99-106 (Aug. 1983).
Discusses the Galileo mission planned for launch in 1986. A description is given of the instrumentation on the probe and the chronological sequence at Jupiter encounter. The objectives of the mission are summarised. (no refs.)

Solar escape .... See Entry 105074

Astronautical velocities .... See Entry 105075

Comparison of two methods for estimating the water vapor correction to altimeter readings from radiometric measurements .... See Entry 105360

Experimental study of stationary flame propagation in a tube under conditions of weightlessness .... See Entry 109744

Passive radiometry for vertical sounding from meteorological satellites .... See Entry 110675

Atmospheric sounding from a geostationary satellite .... See Entry 110678

Determination of sea surface temperatures and atmospheric correction values for infrared images on the base of data of the metrological satellite NOAA 5 .. .. See Entry 110682

Amplitude calibration of spaceborne Synthetic Aperture Radars .... See Entry 110688

A nontraditional means of determining the orbital elements of unknown cosmic objects from the data of computer processing of survey photographs .... See Entry 110876

Near-infrared mapping spectrometer for investigation of Jupiter and its satellites .... See Entry 110909

Adventure into space .... See Entry 110938

94.90 OTHER TOPICS IN SPACE PHYSICS

Proceedings of Symposium 5 of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 105087

Proceedings of Workshop VII and of the Topical Meeting of the COSPAR Interdisciplinary Scientific Commission F (Meetings F1 and F4) of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 110196

95.00 FUNDAMENTAL ASTRONOMY AND ASTROPHYSICS, INSTRUMENTATION AND TECHNIQUES AND ASTRONOMICAL OBSERVATIONS

95.10 FUNDAMENTAL ASTRONOMY

110863 DE 102: a numerically integrated ephemeris of the Moon and planets spanning forty-four centuries. X.X.Newhall, E.M.Standish,Jr., J.G.Williams (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.150-67 (Aug. 1983).
An ephemeris of the Moon and nine planets is numerically integrated from 1411 BC to 3002 AD. The initial conditions for the simultaneous integration are based on fits to modern position measurements of the eight major planets and the Moon. The data include optical meridian transits, radar ranges, planetary spacecraft positions, and lunar laser ranges. The acceleration model for the integration is described and it is shown that the stability of the lunar integration depends upon simultaneously integrating the physical librations. A long ephemeris has utility for comparison with both historical observations and analytical theories. Comparison with numerical representations permits the equinox and obliquity of the ephemeris to be recovered. (74 refs.)

110864 On the determination of absolute right ascensions and declinations of groups of stars using minor planets. W.Landgraf.
Astron. Nachr. (Germany), vol.304, no.3, p.137-8 (1983). In German.
Presents a method to obtain the absolute positions of stars from observations of a minor planet with small eccentricity distributed over a short time and possibly over a geocentric loop in the field traversed by the minor planet. (no refs.)

110865 Positions of stars in regions of 14 southern galactic clusters. T.B.Andersen, A.Reiz (Copenhagen Univ. Obs., Copenhagen, Denmark).
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.2, p.181-214 (Aug. 1983).
Positions for a total of 3487 stars, scattered over 14 regions, are determined using the Danish 1.5-m telescope at La Silla. The 14 regions are centred on the southern galactic clusters NGC 1981, 2287, 2437, 2451, 2516, 2546, 2547, 2548, 3114, 3532, IC 2391, 2395, 2602, and Trumpler 10. Combining the Ritchley-Chretien reflector optics with a single element Schmidt-type corrector, gives a considerably enlarged flat field (radius about 25 minutes of arc, or 95 mm) with stellar images of excellent definition. A frame of reference is established for each region using ESO Schmidt plates centred on the clusters, each plate containing from 20 to 35 measurable Perth 70 stars. These objects serve for determining positions of some 200 to 400 fainter stars within a central field of 25 minutes of arc radius, covering the corresponding 1.5-m plates. The fainter stars serve as a secondary standard. An internal mean error in one plate position in the range 0.030 to 0.048 seconds of arc is derived. (20 refs.)

110866 The solar eclipse of 26 Febrary 1979: introductory comments. W.W.Berning (Phys. Sci. Lab., New Mexico State Univ., Las Cruces, NM, USA).
J. Atmos. & Terr. Phys. (GB), vol.45, no.7, p.423-5 (July 1983). (Meeting of the American Geophysical Union on the Total Solar Eclipse of 26 February 1979, Toronto, Ont., Canada, May 1980).
On 26 February 1979 a total solar eclipse occurred over North America, the last to occur this century over this continent. The eclipse began at dawn, west of Puget Sound, and terminated at sunset over northern Greenland. The path of totality crossed the northwestern tier of the United States, the Canadian provinces of Saskatchewan, Manitoba, Ontario and northern Quebec, Baffin Island and Greenland. Most observations were made from Red Lake, Canada. (8 refs.)

Nonuniformity of the Earth's rotation within a day .... See Entry 110277

Eclipse-related measurements of middle-atmosphere electrical parameters .... See Entry 110572

Rocket-based investigations of O(^3P), O$_2$($a^1\Delta_g$) and OH* (ν=1, 2) during the solar eclipse of 26 February 1979 .... See Entry 110743

Meeting of the American Geophysical Union on the Total Solar Eclipse of 26 February 1979 .... See Entry 110771

Electron density and energetic particle precipitation observed during the eclipse of 26 February 1979 .... See Entry 110772

A model of the lower ionosphere above Red Lake, Canada, during the 26 February 1979 solar eclipse .... See Entry 110773

Satellite observations of energetic electron precipitation during the 1979 solar eclipse and comparisons with rocket measurements .... See Entry 110774

***E*-region nitric oxide concentrations inferred from the 26 February 1979 eclipse expedition** .... See Entry 110775

Steady-state model of the *D*-region during the February 1979 eclipse .... See Entry 110777

***D*-region positive and negative ion concentration and mobilities during the February 1979 eclipse** .... See Entry 110778

Differential Doppler measurements of the ionosphere during a solar eclipse ...... See Entry 110779

Meridian observations made with the Carlsberg Automatic Meridian Circle at Brorfelde (Copenhagen University Observatory) 1981-1982 .... See Entry 110928

On the reduction of the Carte du Ciel catalogues .... See Entry 110933

1983 RD .... See Entry 110956

1983 RD .... See Entry 110957

The microwave opacity of Saturn's rings at wavelengths of 3.6 and 13 cm from Voyager 1 radio occultation .... See Entry 110968

Particle size distributions in Saturn's rings from Voyager 1 radio occultation . ... See Entry 110969

W-shaped occultation signatures: inference of entwined particle orbits in charged planetary ringlets .... See Entry 110970

Internal gravity waves in Titan's atmosphere observed by Voyager radio occultation .... See Entry 110979

Comet Cernis 1983l .... See Entry 110986

Comet IRAS (1983k) .... See Entry 110989

Comet IRAS (1983o) .... See Entry 110993

Comet Shoemaker (1983p) .... See Entry 110994

Analysis of the polarization measurements during the occultations of the Crab Nebula by the plasma surrounding the Sun in 1977-1982 ...... See Entry 111018

Probable association of UX Piscium with a galaxy .... See Entry 111232

95.10C Celestial mechanics

(for dynamics and kinematics of stellar systems, see 98.10)

110867 Discrete mechanics: some remarks. E.Perozzi (Istituto di Astrofisica Spaziale, Rome, Italy).
Celestial Mech. (Netherlands), vol.30, no.3, p.249-61 (July 1983).
A detailed investigation of discrete mechanics (a numerical method developed by Greenspan and La Budde, 1973, 1974) in celestial mechanics applications is carried out. The method shows a remarkable precession of the argument of pericentre, whose value depends mainly on the time step scaling used and on the length of the integration step. It is found that this behaviour is due to the structure of discrete mechanics and that the precession, taken as a function of the length of the integration step, follows with good agreement an inverse square law. The existence of this relationship allows the development of a modified version of the method: its consistence with respect to the original one is discussed both from an analytical and a computational point of view. Furthermore the modified discrete mechanics allows the extension of the method to the case of the potential due to an oblate spheroid. (17 refs.)

110868 Special cases in the problem of two rigid bodies. G.N.Doubochine (Inst. Astronomique d'Etat, Moscow, USSR).
Celestial Mech. (Netherlands), vol.30, no.3, p.263-73 (July 1983). In French.
Two special cases in the problem of two rigid bodies are examined. In the first case two arbitrary bodies interact with a force, proportional to first degree of distance. In the second case, two spheres interact with a force proportional to some degree of distance. (1 ref.)

110869 Generalized f and g series and convergence of the power series solution of the n-body problem. D.N.Papadakos (Univ. Obs., St. Andrews, Scotland).
Celestial Mech. (Netherlands), vol.30, no.3, p.275-82 (July 1983).
The existence of power series, analogous to the familiar f and g-series of the two-body problem, is demonstrated in the case of the n-body problem, and recursive formulae are deduced for the derivation of the coefficients of these series. In addition a proof of the convergence of the power series solution of the n-body problem is given, based on the developed series. (16 refs.)

110870 A unified treatment of some expansion procedures in perturbation theory: Lie series, Faa di Bruno operators, and Arbogast's Rule. J.Murdock (Dept. of Math., Iowa State Univ., Ames, IA, USA).
Celestial Mech. (Netherlands), vol.30, no.3, p.283-95 (July 1983).
The problem of expanding the transform of a function under a near-identity change of coordinates is reviewed. A common derivation is given for Musen's (1965) Faa di Bruno operators and Kamel's (1970) Lie series, and both are related to Arbogast's Rule for composing power series. (6 refs.)

110871 Equations of motion of the restricted problem of three bodies with variable mass. A.K.Shrivastava, B.Ishwar (Dept. of Math., Indian Coll. of Engng., Motihari, Bihar, India).
Celestial Mech. (Netherlands), vol.30, no.3, p.323-8 (July 1983).
Deduces the differential equations of motion of the restricted problem of three bodies with decreasing mass, under the assumption of the mass of the satellite varies with respect to time. The authors apply Jeans law and the space time transformation contrast to the transformation of Meshcherskii. The space time transformation is applicable only in the special case $n=1$, $k=0$, $q={}^1/_2$. The equations of motion of the problem differ from the equations of motion of the restricted three body problem with constant mass only by small perturbing forces. (7 refs.)

110872 Necessary conditions for the existence of plane motions in the problem of translatory-rotary motion of two rigid bodies. II. V.V.Vidyakin.
Pis'ma v Astron. Zh. (USSR), vol.9, no.6, p.381-4 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
Conditions are found in which the centres of mass of absolute rigid bodies possessing arbitrary internal structure and external form can have motion in an invariable plane. Necessary and sufficient conditions have been found for plane motions in the problem under study. (3 refs.)

110873 On the collinear libration points of the photogravitational three-body problem. A.L.Kunitsyn, A.T.Tureshbaev.
Pis'ma v Astron. Zh. (USSR), vol.9, no.7, p.432-5 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
The existence of a three-parameter family of the collinear-libration points in photogravitational three-body problem is shown. It is shown that contrary to the classical problem, the region of stability of the equilibrium positions in parametric space exists. (9 refs.)

110874 On the motion of gravitating bodies with the radiation reaction force taken into account. L.P.Grishchuk, S.M.Kopeikin.
Pis'ma v Astron. Zh. (USSR), vol.9, no.7, p.436-40 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
Equations of motion for two spherically-symmetric nonrotating bodies are derived and solved in the $(v/c)^5$ approximation, where the radiation force first appears. An explicit expression for the force is given. The periodic and secular corrections to the Keplerian motion are found. It is shown that the invariant distance between the bodies diminishes secularly. (17 refs.)

110875 The averaged, hyperbolic, restricted three-body problem. A.B.Sorokovich (S. Lazo Polytech. Inst., Kishinev, USSR).
Sov. Astron. (USA), vol.26, no.6, p.721-6 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1200-11 (Nov.-Dec. 1982).
The plane, singly averaged, hyperbolic, restricted three-body problem in the case of small eccentricities of the perturbing body is analyzed in the article. The general solution of the linearized system of differential equations in the form of series in powers of the small parameter is found in the case when the first term is taken in the perturbation function. It is shown that stability of the unperturbed motion is retained when the orbital eccentricity of the perturbing body is relatively small and the perturbed body is sufficiently close to the central body. The exact and singly averaged problems are integrated numerically, and the linearized system is calculated on a computer from the equations of the general solution. The analytical and qualitative conclusions are confirmed by comparing the results obtained. (4 refs.)

110876 A nontraditional means of determining the orbital elements of unknown cosmic objects from the data of computer processing of survey photographs. V.IO.Kuryshev, N.I.Perov (State Pedagogical Inst., Ryazan, USSR).
Sov. Astron. (USA), vol.26, no.6, p.727-9 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1212-17 (Nov.-Dec. 1982).
A method of calculating the Keplerian elements of the orbits of artificial Earth satellites from five positions (α_k, δ_k, s_k, $k=0, 1, \ldots, 4$) is discussed. A distinctive feature of the proposed method is the absence from the working equations of series expanded in powers of time. (2 refs.)

110877 Some particular solutions of the restricted problem of three rigid bodies. E.N.Eremenko (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Astron. (USA), vol.26, no.6, p.730-3 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1218-24 (Nov.-Dec. 1982).
The problem of the translational-rotational motion of a triaxial rigid body is formulated in the restricted problem of three rigid bodies. The motion of the body is described by canonical osculating elements. The existence of particular regular solutions for the rigid body in a first approximation is established on the basis of the Gaussian averaging scheme. The question of the stability of these motions in the Lyapunov sense is investigated in a first approximation. (7 refs.)

Universal variables in the two-body problem .... See Entry 105067
Astronautical velocities .... See Entry 105075
The critical inclination problem with small eccentricity. II. Application to Earth satellites .... See Entry 110845
A linear solution of the equations of motion of an Earth-orbiting satellite based on a Lie-series .... See Entry 110846
Dynamics of momentum biased spacecraft in a near-polar orbit .... See Entry 110851
Advances in orbit theory for an artificial satellite with drag . See Entry 110858
Near-circular satellite orbits in an oblate, diurnally varying atmosphere .... See Entry 110860
A qualitative investigation of the motion of asteroids of the Hecuba type .... See Entry 110959
Secular orbit-orbit resonance between two satellites with nonzero mases .... See Entry 110967
W-shaped occultation signatures: inference of entwined particle orbits in charged planetary ringlets .... See Entry 110970
Hyperion: collisional disruption of a resonant satellite .... See Entry 110980
Perturbations in the movement of Saturn's satellites .... See Entry 110982
Local regularization of the magnetic-binary problem .... See Entry 111140

95.30 FUNDAMENTAL ASPECTS OF ASTROPHYSICS

110878 Focusing of high-Mach number jets by an ambient medium. D.Eichler (Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.48-53 (1 Sept. 1983).
It is argued that a precessing jet will, at some sufficiently large scale, be focused by an ambient plasma of finite pressure such that its angular spread on larger scales is much smaller than that of the precession cone at small scales. More generally, the collimation of a moderately wide jet can be sharpened by the ambient medium, and a smeared-out beam can be recollimated. Shapes of channels formed by such recollimated beams are calculated. The focal length along the precession axis is found to be nearly independent of the original opening angle if the other jet parameters are fixed. The results are compared with real sources where there is some observational evidence for jet focusing, such as SS 433. (20 refs.)

110879 Alfven wave collapse and the stability of a relativistic electron beam in a magnetized astrophysical plasma. S.R.Spangler, J.P.Sheerin (Dept. of Phys. & Astron., Univ. of Iowa, Iowa City, IA, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.273-8 (1 Sept. 1983).
The generation of Alfven waves by magnetic field-aligned electron streams, and the evolution of such streams under the action of the self-generated waves, remains an important question in theoretical radio astronomy. The authors present a simple derivation of a time scale on which a nonlinear Alfven wave packet collapses. This time scale is compared with the linear growth and quasi-linear relaxation time scales for conditions appropriate to an extragalactic radio source. The nonlinear time scale can be comparable to the linear and quasi-linear time scales, which suggests that nonlinear effects may stabilize this instability and permit the propagation of anisotropic electron streams. (17 refs.)

110880 Statistical mechanics of light elements at high pressure. V. Three-dimensional Thomas-Fermi-Dirac theory. J.J.MacFarlane, W.B.Hubbard (Dept. of Planetary Sci., Univ. of Arizona, Tucson, AZ, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.301-10 (1 Sept. 1983).
For pt.IV see ibid., vol.205, no.1, p.295-301 (1976). Presents a new numerical technique for solving the Thomas-Fermi-Dirac equation in three dimensions, for an array of ions obeying periodic boundary conditions. The technique is then used to calculate deviations from ideal mixing for an alloy of hydrogen and helium at zero temperature and high pressures. Results are compared with alternative models which apply perturbation theory to calculation of the electron distribution, based upon the assumption of weak response of the electron gas to the ions. The results indicate that predicted phase separation curves for hydrogen-helium alloys under conditions prevailing in the metallic zones of Jupiter and Saturn are very model dependent. (18 refs.)

110881 Comments on the Planck-Larkin partition function. C.A.Rouse (GA Technologies Inc., San Diego, CA, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.377-9 (1 Sept. 1983).
Several comments are presented regarding the Planck-Larkin partition function (PLPF) and scattering states. It is shown that the major physical problem with the temperature-dependent PLPF is that the effective maximum bound state for hydrogen predicted in this theory is considerably less than the maximum hydrogen lines observed in the solar photosphere and chromosphere. Regarding the partial compensation of bound states in an internal electron partition function by continuum states, it is noted that the time-averaged terms of a sum over states are all positive; hence, compensation is not possible. (26 refs.)

110882 Blast waves with cosmic-ray pressure. R.A.Chevalier (Dept. of Astron., Univ. of Virginia, Charlottesville, VA, USA).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.765-72 (15 Sept. 1983).
Investigates the effect of efficient cosmic-ray acceleration on the structure of blast waves and of driven waves created by supernova explosions. The solutions for the structures are used to predict the pion-decay γ-ray fluxes from supernovae and supernova remnants. (20 refs.)

110883 Effect of molecules and grains on Rosseland mean opacities. D.R.Alexander (Dept. of Phys., Wichita State Univ., Wichita, KS, USA), H.R.Johnson, R.L.Rypma.
Astrophys. J. (USA), vol.272, no.2, pt.1, p.773-80 (15 Sept. 1983).
Rosseland mean opacities, which include the effects of molecules and grains, have been computed down to 630K. Molecular effects have been computed with the opacity sampling method wherever possible. A detailed treatment of the condensation of and absorption due to grains has also been included for magnesium silicates and iron. The contributions of molecules (between 3000K and 1500K) and grains (below 1600K) are several orders of magnitude above the Rosseland mean opacity computed without them. The overall metal abundance and the C/O ratio can also dramatically affect the total opacity. (32 refs.)

110884 Viscous drag on an accretion disk due to an embedded stellar system. J.P.Ostriker (Princeton Univ. Obs., Princeton, NJ, USA).
Astrophys. J. (USA), vol.273, no.1, pt.1, p.99-104 (1 Oct. 1983).
If a gaseous disk, such as an accretion disk, is embedded in a more massive stellar system, then interactions between the stars and the gas produce a torque removing angular momentum from the disk. The drag time at any radius is always of the order of the relaxation time in the stellar system regardless of the disk properties. A specific calculation is carried out for two cases, the isotropic Bahcall-Wolf $E^{-1/4}$ distribution thought to form about a black hole and the isothermal Maxwellian distribution. The result has interesting implications for active galactic nuclei if these involve, as is sometimes thought, accretion of gas onto central black holes, for it provides a mechanism for removing angular momentum from the disk. A speculative scenario is also presented whereby a dense stellar system might simulate many of the properties of an active galactic nucleus without invoking a central black hole. (26 refs.)

110885 An approximate analytical solution for self-similar flow behind a radiation driven shockwave. J.B.Singh (Dept. of Maths., SGR Post-Graduate Coll., Dobhi, Jaunpur, India).
Astrophys. & Space Sci. (Netherlands), vol.94, no.1, p.123-6 (July 1983).
An approximate analytical solution for a self-similar flow behind a radiation driven shockwave is obtained using the Laumbach and Probstein's (1969) method in non-uniform atmosphere at rest. (6 refs.)

110886 A self-similar flow behind an exponential shock with radiative heat flux. II. J.B.Singh, P.R.Vishwakarma (Dept. of Math., SGR Postgraduate Coll., Dobhi, Jaunpur, India).
Astrophys. & Space Sci. (Netherlands), vol.94, no.1, p.127-32 (July 1983).
Self-similar solutions, for one-demensional unsteady flow of a perfect gas behind an exponential shock propagating into a uniform atmosphere, are obtained, taking radiation flux into consideration. The total energy of the wave is variable. (5 refs.)

110887 Exact solutions of the equation of radiative transfer in a line in the case of partial frequency redistribution. D.I.Nagirner (Leningrad State Univ., Leningrad, USSR).
Astrophysics (USA), vol.18, no.4, p.348-53 (Oct.-Dec. 1982). Translation of: *Astrofizika (USSR)*, vol.18, no.4, p.608-15 (Oct.-Dec. 1982).
A study is made of multiple scattering of radiation in a spectral line broadened solely by the motion of atoms in an infinite medium in the presence of homogeneous and isotropic sources. Continuum absorption is ignored. An exact expression is found for the radiation intensity for arbitrary frequency dependence of the power of the primary sources. This yields the intensity in the case of time-dependent sources radiating in the line center if the velocity of light is infinite. The asymptotic behavior of the intensity in the line wing and at large times is studied. (18 refs.)

110888 Gravitational lenses with angular momentum. J.Ibanez (Dept. de Fisica, Univ. del Pais Vasco, San Sebastian, Spain).
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.175-80 (Aug. 1983).
The bending angle of a photon passing near a rotating body is used to show the influence of angular momentum in a gravitational lens. The expressions are evaluated for spherical and spheroidal deflectors. (10 refs.)

110889 Hydrogen line broadening in the presence of a magnetic field with the unified classical path theory. G.Mathys (Inst. d'Astrophys., Cointe-Ougree, Belgium).
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.13-22 (Aug. 1983).
The expression of hydrogen line profiles in the presence of a magnetic field is derived by the unified classical straight line path theory. Lower state interactions are taken into account. Time ordering effects and ion-radiator motion are neglected. The simplifying cases of no lower state interacion and of the line wings are described. Results of preliminary calculations, dealing with Lyman-α (thus without lower state interaction), are presented and compared with results obtained previously with the impact theory and with the unified theory results in the absence of a magnetic field. (21 refs.)

110890 The gravitational potential due to uniform disks and rings. H.Lass (Jet Propulsion Lab., Pasadena, CA, USA), L.Blitzer.
Celestial Mech. (Netherlands), vol.30, no.3, p.225-8 (July 1983).
The gravitational potential due to thin uniform disks and rings is obtained in closed form in terms of complete elliptic integrals. (1 ref.)

110891 Constraints on light particles from stellar evolution. J.Ellis, K.A.Olive (CERN, Geneva, Switzerland).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B223, no.1, p.252-68 (15 Aug. 1983).
The authors examine the constraints imposed on the numbers and interactions of light particles by our understanding of the late stages of stellar evolution, including red giants, carbon-burning stars and cooling neutron stars. They show that these astrophysical considerations restrict the number of neutrino types to be less than $10^{+2\pm1}$. This result complements the standard constraint from cosmological nucleosynthesis, which was unable to exclude numbers of neutrinos between a few thousand and the best particle physics limit of order 10^5. They also investigate the constraints on supersymmetric theories with a light photino and gravitino, finding that the supersymmetry breaking scale parameter $f>O(100\ \mathrm{GeV})$ and the selectron masses are >20 to 40 GeV. Finally, they study energy-loss rates by majoron and invisible axion emission. (29 refs.)

110892 The propagation of torsion along flux tubes subject to dynamical nonequilibrium. E.N.Parker (Dept. of Astron. & Astrophys., Univ. of Chicago, Chicago, IL, USA).
Geophys. & Astrophys. Fluid Dyn. (GB), vol.24, no.4, p.245-72 (1983).
The dynamical nonequilibrium of close-packed flux tubes is driven by the torsion in the individual tubes so that, wherever tubes with the same sense of twisting come into contact, there is reconnection of their azimuthal field components. The reconnection consumes the local torsion, causing the propagation of torsional Alfven waves into the region from elsewhere along the tubes. Application of the Sun suggests that the propagation of torsion from below the visible surface up into the corona is an important energy supply to the corona. (38 refs.)

110893 The macroscopic magnetohydrodynamics of inhomogeneously turbulent cosmic plasmas. S.I.Vainshtein, L.L.Kichatinov (Siberian Inst. of Terrestrial Magnetism, Ionosphere & Radio Wave Propagation, Irkutsk, USSR).
Geophys. & Astrophys. Fluid Dyn. (GB), vol.24, no.4, p.273-98 (1983).
Magnetohydrodynamics turbulence at high magnetic Reynolds numbers is considered. The mean field magnetohydrodynamic equations for the rather general case of inhomogeneous turbulence are derived using the Orszag

(1970) scheme. Special attention is paid to nonlinear effects which are brought about by the back reaction of the magnetic field on the motion. The diamagnetic effect which is accompanied in the nonlinear regime by a paramagnetic effect is considered. The nonlinear transport of large-scale field due to density inhomogeneity is discussed. A physical interpretation is presented which clarifies the mechanism of field transport in an inhomogeneously turbulent medium. (19 refs.)

110894 Nonlinear convection in an imposed horizontal magnetic field. W.Arter (Dept. of Appl. Math. & Theoretical Phys., Univ. of Cambridge, Cambridge, England).
Geophys. & Astrophys. Fluid Dyn. (GB), vol.25, no.4, p.259-92 (1983).
Nonlinear two-dimensional magnetoconvection with a Boussinesq fluid driven across the field-lines, is taken as a model for giant-cell convection in the Sun and late-type stars. A series of numerical experiments shows the sensitivity on the horizontal scale of convection to the applied field and to the Rayleigh number R. Overstable oscillations occur in cells as broad as they are deep, but increasing R leads to steady motions of much greater wavelength. Purely geometrical effects can cause oscillation: this work implies that strong horizontal field will in general lead to time-dependent convection. (36 refs.)

110895 Asymptotic solution of the α^2-dynamo problem. D.Sokoloff (Moscow State Univ., Moscow, USSR), A.Shukurov, A.Ruzmaikin.
Geophys. & Astrophys. Fluid Dyn. (GB), vol.25, no.4, p.293-307 (1983).
The turbulent dynamo equation with non-uniform mean helicity is solved in an approximation, which is similar to the quasi-classical approximation of quantum mechanics. The rate of growth of the magnetic field is evaluated and a condition for dynamo action is obtained. The generated magnetic field is concentrated in the vicinity of an extremum of mean helicity, but in general vanishes at the point of extremum itself. The field is asymptotically force-free. The results obtained here clarify the fact, known from numerical calculations, that the threshold values of the dynamo-number for excitation of dipole and quadrupole modes are very close to each other. (11 refs.)

110896 Search for superheavy monopoles in 65 kg of iron magnetic sand with a SQUID fluxmeter. T.Ebisu, T.Watanabe (Dept. of Phys., Kobe Univ., Kobe, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.8, p.2617-19 (Aug. 1983).
A search was carried out for magnetically trapped monopoles in 65 kg of iron sand with a SQUID-search coil 80 mm in diameter, by heating the sample above its Curie point. The authors have found no candidate event compatible with the passage of a single Dirac charge. An upper limit of 1.5×10^{-5} monopoles/g is set for the density of monopoles heavier than 2.5×10^{15} GeV/c^2 in the iron sand of $(6\sim25)\times10^6$ years old. One can estimate the flux of cosmic monopole less than 1.3×10^{-11} cm^{-2} sec^{-1} sr^{-1} according to the age and the density of the sample examined. (12 refs.)

110897 Collective bifurcation of flux sheets in two-dimensional magnetoconvection. M.R.E.Proctor (Dept. of Appl. Maths. & Theoretical Phys., Cambridge, England).
Mon. Not. R. Astron. Soc. (GB), vol.204, no.3, p.935-43 (Sept. 1983).
A simple model of the dynamical effect of magnetic flux sheets on two-dimensional magnetoconvection, due to Galloway, Proctor and Weiss (1977, 1978) is used to show that if the flux is sufficiently strong steady states can be attained with the flux distributed unevenly between the cell boundaries. The model helps to elucidate the criterion for this bifurcation and makes possible a study of the interaction of several sheets. The relevance of the results to the solar convection zone is discussed. (8 refs.)

110898 Slow neutron capture origin for ^{180}Ta^m. K.Yokoi, K.Takahashi (Inst. fur Kernphys., Tech. Hochscule Darmstadt, Darmstadt, Germany).
Nature (GB), vol.305, no.5931, p.198-201 (15 Sept. 1983).
Most naturally-occurring heavy isotopes ($A\geq74$) are believed to be synthesized by the slow (s-) and rapid (r-) neutron capture processes, with the rest (some 30 neutron-deficient isotopes including ^{180}Ta) being conventionally classified as p-process elements. The very rare isotope ^{180}Ta (a nuclear isomeric state ^{180}Ta^m with a half-life $\geq3\times10^{13}$ yr) is of particular astrophysical interest because of its uncertain origin. It is shown that a significant amount of ^{180}Ta^m may be produced in the s-process. (36 refs.)

110899 An electron cyclotron maser instability for astrophysical plasmas. H.P.Freund, HH.K.Wong, C.S.Wu, M.J.Xu (Inst. for Phys. Sci. & Technol., Univ. of Maryland, College Park, MD, USA).
Phys. Fluids (USA), vol.26, no.8, p.2263-70 (Aug. 1983).
The electron cyclotron maser instability is analyzed for a plasma which consists of a suprathermal electron component characterized by velocity-space anisotropies in directions both parallel and perpendicular to the ambient magnetic field, as well as a high-density thermal plasma in which $\omega_e\sim\Omega_e$ (where ω_e and Ω_e are the electron plasma and cyclotron frequencies). The complete relativistic resonance condition is used and shown to result in a 'resonance ellipse' in momentum space. The instability is considered for both cold and warm suprathermal electron distributions, and for frequencies $\omega\sim\Omega_e$ in the ordinary mode and $\omega\sim2\Omega_e$ in the fast extraordinary mode. It is shown that the growth rates are comparable for these harmonics over a wide range of parameters which, since they are escape modes of the plasma, can lead to comparable radiation intensities. (21 refs.)

110900 Saving the invisible axion. P.J.Steinhardt (Dept. of Phys., Univ. of Pennsylvania, Philadelphia, PA, USA), M.S.Turner.
Phys. Lett. B (Netherlands), vol.129B, no.1-2, p.51-6 (15 Sept. 1983).
Recently it has been shown that the energy density contributed in the present Universe by coherent oscillations of the invisible axion field corresponds to $\Omega\simeq0.1\ (f_a/10^{12}\ \mathrm{GeV})^{11/9}$ (f_a is the scale of Peccei-Quinn SSB), apparently ruling out $f_a\gtrsim O(10^{13}$ GeV). The authors propose a simple way to avoid this bound: entropy production when the temperature of the Universe is between about 1 GeV and 1 MeV. The entropy might be produced by a first-order phase transition, or the out-of-equilibrium decays of a relic particle species. For $f_a\simeq10^{15}$ GeV, the entropy of the Universe must be increased by a factor of $O(10^2\text{-}10^3)$ to have $\Omega_a\simeq O(1)$. If inflation also occurs at a temperature $\simeq10^{15}$ GeV, then the de Sitter space produced fluctuations in the axion field lead to a Zel'dovich-like spectrum of (isothermal) perturbations in the axion energy density, with amplitude about 10^{-4}. It has recently been argued that in an axion-dominated Universe such a spectrum could lead to the formation of the structure observed in the Universe today. (31 refs.)

110901 Transfer of line radiation: comparison of various approximations. V.V.Ivanov.
Pis'ma v Astron. Zh. (USSR), vol.9, no.6, p.364-7 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
High-accuracy approximate solutions promising to revolutionize calculations of line radiation fields in non-LTE atmospheres are compared with the exact asymptotic solutions given by analytical methods. The standard problem of line formation is used as a working example. (5 refs.)

110902 Collisional-induced dissociation of the molecular hydrogen in rarefied gas. Yu.I.Izotov.
Pis'ma v Astron. Zh. (USSR), vol.9, no.7, p.441-4 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
For the temperatures $10^3\text{-}1.5\times10^4$K and number densities $1\text{-}10^7$ cm^{-3} the rate constant of the reaction $H_2+H\rightarrow H+H+H$ is calculated including all the H_2 vibrational states. It is shown that in a rarefied gas with a density $\leq10^4$ cm^{-3} the main contribution to the dissociation rate comes from the low vibrational states of the H_2 molecule. (15 refs.)

110903 On equilibrium figures for ideal fluids in the form of confocal spheroids rotating with common and different angular velocities. D.Montalvo, F.J.Martinez, J.Cisneros (Univ. Autonoma de San Luis Potosi, San Luis Potosi, Mexico).
Rev. Mex. Astron. & Astrofis. (Mexico), vol.5, no.4, p.293-300 (March 1983).
For a fluid mass consisting of two confocal spheroids each one with different density, the authors demonstrate, firstly, the non-existence of equilibrium figures if both spheroids rotate with a common angular velocity and, secondly, the existence of equilibrium figures if they rotate with different angular velocities. The fluid is considered incompressible, self-gravitating, free from any external pressure and also each spheroid of the model is homogeneous per se. (4 refs.)

110904 Turbulence in a self-gravitating gaseous disk. II. Turbulence spectra. S.M.Churilov, I.G.Shukhman (Inst. of Terrestrial Magnetism, Ionosphere, & Radio-Wave Propagation, Acad. of Sci., Irkutsk, USSR).
Sov. Astron. (USA), vol.26, no.6, p.660-5 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR),* vol.59, no.6, p.1093-102 (Nov.-Dec. 1982).
For pt.I see Astron. Zh., vol.58, no.2, p.260-72 (1981); (Sov. Astron., vol.25, no.2, p.147-53, 1981). Two-dimensional turbulence combining Jeans waves with vortical motion is investigated for the case of self-gravitating gaseous disk. Spectra of pure Jeans turbulence in the inertial interval are obtained which correspond to a constant energy flux. Statistical-equilibrium turbulence spectra are derived and analyzed in the general case, where both Jeans waves and vortices are excited. (13 refs.)

110905 Electron-ion and proton-ion collisions in astrophysics. A.Dalgarno (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA).
Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute, Baddeck, NS, Canada, 13-26 Sept. 1981 (New York, USA: Plenum 1983), p.1-36
Most of the diffuse material in the Universe exists in partly ionized plasmas. In the interstellar medium, the physical conditions range from the cold weakly-ionized dense molecular clouds for which the ionization source is provided by energetic cosmic rays to the hot highly-ionized dilute galactic corona for which the ionization source is provided by thermal electrons, heated by shocks driven by supernova explosions in the disc of the galaxy. Recombination radiation created; following the shock waves produces X-ray and ultraviolet photons whose absorption above the plane also contributes to the coronal heating. In planetary atmospheres, solar radiation is the primary ionization source supplemented at low altitudes by galactic cosmic rays which become relatively more important for the distant planets. (107 refs.)

Physics of Ion-Ion and Electron-Ion Collisions. Proceedings of a NATO Advanced Summer Institute .... See Entry 105031

Gravitational Radiation. NATO Advanced Study Institute, Les Houches Summer School .... See Entry 105034

General relativistic axisymmetric rotating systems: coordinates and equations .... See Entry 105181

The theory of gravitational radiation: an introductory review .... See Entry 105183

Gravitational radiation and the motion of compact bodies .... See Entry 105184

General relativistic collapse of rotating stars .... See Entry 105192

Spontaneous lepton-number violation and de-leptonization in stellar collapse .... See Entry 105497

Absence of Goldstino decoupling in hierarchical superunified models .... See Entry 105530

A theoretical investigation of the radiative properties of the CN red and violet systems .... See Entry 106308

Measurement of relative oscillator strengths for Ti I. III. Weak transitions from levels a^{3}F$_{3,4}$ (0.02 eV, 0.05 eV), a^{5}F$_{1-5}$ (0.81 eV-0.85 eV), a^{1}D$_2$ (0.90 eV), a^{3}P$_{0-3}$ (1.05 eV-1.07 eV) with solar analysis .... See Entry 106334

Radiative and thermal widths of Landau-excited hydrogen atoms in very strong magnetic fields .... See Entry 106352

Experimental studies of electron-ion recombination .... See Entry 106586

Theory of electron-atom collisions .... See Entry 106608

Electron impact excitation of ions .... See Entry 106609

Electron-impact ionization of ions .... See Entry 106610

The measurement of inelastic ion-ion and electron-ion collisions .... See Entry 106611

The generalized exponential-integral $V(x,y)=\int1\infty\ \exp(-xt)\ln(t+y)dt/t$ and computer algorithms for $y=0,1$ .... See Entry 106977

Relativistic hydrodynamics of a superfluid .... See Entry 108096

Association reactions of Na$^+$ and some implications for interstellar chemistry .... See Entry 109712

Boundary conditions for energetic particle transport at shocks .... See Entry 110817

An underground search for anomalous penetrating particles such as massive magnetic monopoles .... See Entry 110829

Neutrino energy production spectra in a relativistic plasma .... See Entry 110835

^{182}Hf chronometer for the early Solar System .... See Entry 110939

Towards an artificial comet .... See Entry 110988

Mass and energy balance in the 1973 August 9 flare .... See Entry 111010

On the effect of temperature fluctuations on line intensities .... See Entry 111032

On the radio pulse emission mechanism of PSR 1133+16: simultaneous dual-frequency high time resolution observations .... See Entry 111117

Analytic neutron stars in general relativity: exact solutions for the non-homogeneous charged model .... See Entry 111121

Normal and pion-condensed states in neutron star matter in a relativistic field theory constrained by bulk nuclear properties. I .... See Entry 111122

Normal and pion-condensed states in neutron star matter in a relativistic field theory constrained by nuclear bulk properties. II .... See Entry 111123

The dynamics of dissipatively heated spherical accretion .... See Entry 111125

Synthesis of chain molecules in regions with partially ionised carbon .... See Entry 111172

The heterogeneous condensation of interstellar ice grains ...... See Entry 111177

Planck mean radiation-pressure cross sections for nonspherical grains. I .... See Entry 111179

Interstellar C_2 in the Ophiuchus clouds .... See Entry 111180

3-D simulations of the collapse of nonspherical interstellar clouds .... See Entry 111182

A note on compressibility and energy cascade in turbulent molecular clouds .... See Entry 111184

On the calculation of ion-molecule reaction rates in interstellar space and planetary atmospheres .... See Entry 111187

Numerical investigation of the generation of global spiral structure in interacting galaxies .... See Entry 111219

Spiral structure and gas motion in M81 .... See Entry 111240

The Cherenkov effect and plasma turbulent reactors .... See Entry 111256

Dynamics of the radiating gas in the quasar PHL 5200 and in kindred objects .... See Entry 111272

Three-dimensional numerical model of the formation of large-scale structure in the Universe .... See Entry 111282

Where has the four dimensionality come from? .... See Entry 111285

Cluster analysis of the nonlinear evolution of large-scale structure in an axion/gravitino/photino-dominated Universe .... See Entry 111287

Problems with the new inflationary Universe .... See Entry 111288

On the possibility of a test of the cosmology of asymptotically free SU(5) theory .... See Entry 111289

Parameters of a neutrino-dominated Universe and GUT cosmology .... See Entry 111293

The dynamical role of a primordial electromagnetic field in spatially homogeneous, diagonal Bianchi type I-IX cosmologies .... See Entry 111294

95.55 ASTRONOMICAL INSTRUMENTS

110906 One-dimensional high time resolution solar observations with the Westerbork Synthesis Radio Telescope. A.Kattenberg (Sonnenborgh Obs., Astron. Inst. at Utrecht, Utrecht, Netherlands), F.Palagi.
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.1-5 (Aug. 1983).
During 1980, in cooperation with the Solar Maximum Mission program, the Westerbork Synthesis Radio Telescope has been used for solar observations with time resolution of 0.1 s. The authors describe the equipment and procedures that were used for these observations. Also, the authors present a summary of the data that were obtained and an overview of the results obtained in the analysis of these data. (8 refs.)

110907 A mercuric iodide detector system for X-ray astronomy I. Design considerations and predictions of background and sensitivity. G.R.Ricker, J.V.Vallerga, D.R.Wood (Dept. of Phys., MIT, Cambridge, USA).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.133-44 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
This is the first of two papers describing an extremely sensitive astronomical hard X-ray telescope design based on a mercuric iodide (HgI_2) detector shielded by a bismuth germanate ($Bi_4Ge_3O_{12}$) scintillator. In a version suitable for a Spacelab mission, this shielded detector is located at the focus of a pyrolytic graphite or lithium fluoride concentrator (the Hard X-ray Diffraction Telescope, or HXDT). The background counting rate of the mercuric iodide detector at balloon altitudes is calculated using a Monte Carlo simulation of the detector assembly in the radiation environment at 40 km above sea level. (22 refs.)

110908 A mercuric iodide detector system for X-ray astronomy. II. Results from flight tests of a balloon borne instrument. J.V.Vallerga, R.K.Vanderspek, G.R.Ricker (Dept. of Phys., MIT, Cambridge, MA, USA).
Nucl. Instrum. & Methods Phys. Res. (Netherlands), vol.213, no.1, p.145-54 (15 July 1983). (Proceedings of the Fifth International Workshop on Mercuric Iodide Nuclear Radiation Detectors, Jerusalem, Israel, 6-8 June 1982).
For pt.I see ibid., vol.213, no.1, p.133-44 (1983). To establish the expected sensitivity of a new hard X-ray telescope design, described by Ricker et al. (1983), an experiment was conducted to measure the background counting rate at balloon altitudes (40 km) of mercuric iodide, a room temperature solid state X-ray detector. The prototype detector consisted of two thin mercuric iodide (HgI_2) detectors surrounded by a large bismuth germanate ($Bi_4Ge_3O_{12}$) scintillator operated in anticoincidence. The bismuth germanate shield vetoed most of the background counting rate induced by atmospheric gamma-rays, neutrons and cosmic rays. A balloon-borne gondola containing a prototype detector assembly was designed, constructed and flown twice in the spring of 1982 from Palestine, Texas. The second flight of this instrument established a differential background counting rate of $4.2 \pm 0.7 \times 10^{-5}$ counts/s cm^2 keV over the energy range of 40-80 keV. This measurement was within 50% of the predicted value. The measured rate is ~ 5 times lower than previously achieved in shielded NaI/CsI or Ge systems operating in the same energy range. The prediction was based on a Monte Carlo simulation of the detector assembly in the radiation environment at float altitude. Details of the simulation can be found in paper I. (8 refs.)

110909 Near-infrared mapping spectrometer for investigation of Jupiter and its satellites. I.M.Aptaker (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Proc. SPIE Int. Soc. Opt. Eng. (USA), vol.366, p.96-111 (1983). (Modern Utilization of Infrared Technology VIII, San Diego, CA, USA, 26-27 Aug. 1982).
The Near-Infrared Mapping Spectrometer (NIMS) is one of the science instruments in the Galileo Mission, which will explore Jupiter and its satellites in the early-1990s. The NIMS experiment will map geological units on the surfaces of the Jovian satellites, characterize their mineral content; and for the atmosphere of Jupiter, investigate cloud properties and the spatial and temporal variability of molecular abundances. All the optics are gold-coated reflective and consist of a telescope and a grating spectrometer. The balance of the instrument includes a 17-detector (silicon and indium antimonide) focal plane array, a tuning fork chopper, microprocessor-controlled electronics, and a passive radiative cooler. A wobbling secondary mirror in the telescope provides 20 pixels in one dimension of spatial scanning in a pushbroom mode, with 0.5 mr×0.5 mr instantaneous field of view. The spectral range is 0.7-5.2 μ; resolution is 0.025 μ. NIMS is the first infrared experiment to combine both spatial and spectral mapping capability in one instrument. (no refs.)

110910 Covariance analysis of a charge carrier device processing algorithm for stellar sensors. B.Boxenhorn (Charles Stark Draper Lab. Inc., Cambridge, MA, USA).
J. Guid. Control & Dyn. (USA), vol.6, no.4, p.239-45 (July-Aug. 1983).
This paper addresses the problem of modeling a charge carrier device imager array, develops equations for propagating the signal, and develops equations to propagate the noise. Equations are used for a window processor with a comparator for stellar detection. Finally, a numerical example is presented that shows how the probability of detection varies as a function of the signal-to-noise ratio and charge-transfer inefficiency. Some surprising results are explained. (3 refs.)

110911 Three-element very-long baseline radiointerferometer. L.I.Matveenko, R.Z.Sagdeev, V.I.Kostenko, L.R.Kogan, E.P.Molotov, S.P.Ignatov, A.B.Severnyi, I.G.Moiseev, V.A.Efanov, R.L.Sorochenko, R.M.Martirosyan, A.M.Aslanyan.
Pis'ma v Astron. Zh. (USSR), vol.9, no.7, p.415-20 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
The three-element radiointerferometer Pushchino-Evpatoriya-Simeiz with the 22, 70, and 22 m antennas respectively was put into operation in July 1982. First observations were carried out at the 1.35 cm wavelength. The interferometer enables one to study angular structures with sizes of 2.5 to 85 msec of arc. The maximum sensitivity is 20 mJy at the 250 kHz recording bandwidth and 100 sec integration time. The visibility functions of the Orion-KL and W51M maser sources in a water vapor line are presented. Their angular sizes and brightness temperatures are estimated. (6 refs.)

110912 Diffraction on a segmented telescope mirror. A.V.Lenskii (Kiev State Univ., Kiev Ukrainian SSR).
Sov. Astron. (USA), vol.26, no.6, p.734-5 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1225-8 (Nov.-Dec. 1982).
The possibility of using a composite telescope mirror as a reflection echelon is demonstrated. (4 refs.)

Proceedings of Symposium 2 of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 105015

Photography and the long-focus visual refractor: three American case studies, 1885-1914 .... See Entry 105084

Infrared astronomy: spy in space .... See Entry 110850

Exosat—the new extrasolar X-ray observatory .... See Entry 110854

Linear wide angle Sun sensor for spinning satellites .... See Entry 110859

Speckle interferometry degraded by irregular motion of a scanning telescope mirror .... See Entry 110919

On the performance of video band complex correlators .... See Entry 110924

95.65 AUXILIARY AND RECORDING INSTRUMENTS

110913 A microprocessor-controlled multichannel counter for a digital autocorrelator [radioastronomical application]. G.Comoretto (Univ. di Firenze, Firenze, Italy).
J. Phys. E (GB), vol.16, no.9, p.836-9 (Sept. 1983).
A multichannel general purpose counter, composed of 1024×32-bit counters, is presented. The circuit is based on a random access memory, and is microprocessor controlled. The microprocessor structure is also described. This circuit has been developed for a digital autocorrelator for radioastronomical observations. (8 refs.)

110914 Pickering-racine prisms revisited. C.A.Christian, R.Racine (Canada-France-Hawaii Telescope Corp., Kamuela, HI, USA).
Publ. Astron. Soc. Pac. (USA), vol.95, no.569, p.457-60 (July 1983).
Rediscusses the use of Pickering-Racine prisms for extension of photometric calibration sequences to faint magnitudes. The design philosophy and practical implementation techniques are reviewed. The authors emphasize the specific procedures to be followed during the preparation and execution of an observing program, as well as in the data reduction. Finally, a test of the use of such a device, based on data for the globular cluster NGC 2419, is reviewed. No correlation is found between Δm and magnitude, when photographic magnitudes are compared to those determined from a linear, electronic detector. (12 refs.)

Multi-object spectroscopy with optical fibres .... See Entry 110925

95.70 OTHER INSTRUMENTATION AND TECHNIQUES

(inc. clocks, frequency standards)

110915 A clear-sky detector using reflected artificial light. H.E.Mostert.
J. Br. Astron. Assoc. (GB), vol.93, no.5, p.205-9 (Aug. 1983).
A clear-sky detector is described, based upon the principle of determining when frequency-modulated artificial light is reflected back to the detector by the sky. The operating threshold may be varied to allow for local conditions and the sensitivity required. (3 refs.)

110916 Counting the stars by computer. E.Kibblewhite.
New Sci. (GB), vol.99, no.1371, p.478-82 (18 Aug. 1983).
Lasers and computer control have led to a machine which dramatically speeds up astronomers' analyses of photographs—and has led to new kinds of astronomical objects being identified. Its inventor explains how. (no refs.)

Proceedings of Workshops III and IV and of the Topical Meeting of the COSPAR Interdisciplinary Scientific Commission F (Meeting F2) of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 110195

Inelasticity of nucleus-nucleus collisions and composition of high-energy cosmic rays .... See Entry 110834

95.75 TECHNIQUES OF OBSERVATION AND REDUCTION

110917 On searches for periodic pulsed emission: the Rayleigh test compared to epoch folding. D.A.Leahy, R.F.Elsner, M.C.Weisskopf (Space Sci. Lab., NASA Marshall Space Flight Center, AL, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.256-8 (1 Sept. 1983).
The Rayleigh test has been recently invoked as a method of searching a time series for periodic pulsations. The authors discuss and compare this technique to epoch folding, a technique which has had widespread use in X-ray astronomy. The authors find that the Rayleigh test provides a more sensitive approach to the search for periodic pulsations when the pulses are sinusoidal or of broad duty cycle, such as those typical of the pulsing X-ray sources.

Epoch folding, on the other hand, is more sensitive to the narrow pulses typical of radio pulsars. (5 refs.)

110918 Analysis methods for results in gamma-ray astronomy. Ti-pei Li, Yu-qian Ma (Inst. of High Energy Phys., Acad. Sinica, Beijing, China).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.317-24 (1 Sept. 1983).
The current procedures for analyzing results of γ-ray astronomy experiments are examined critically. The authors propose two formulae to estimate the significance of positive observations in searching γ-ray sources or lines. The correctness of the formulae are tested by Monte Carlo simulations. (7 refs.)

110919 Speckle interferometry degraded by irregular motion of a scanning telescope mirror. C.Leinert, H.M.Dyck (Max-Planck-Inst. fur Astron., Heidelberg-Konigstuhl, Germany).
Appl. Opt. (USA), vol.22, no.16, p.2403-4 (15 Aug. 1983).
A common feature of IR telescopes is a chopping secondary mirror used to remove thermal background effects. With the secondary operated in a slow-scanning mode, 2-D images of infrared-bright sources can be constructed by incrementing the telescope position in a direction perpendicular to the scan. Not all secondary systems work well enough, however, to produce the desired results and the authors report the results of numerical calculations which confirm that small erratic motions of the secondary result in degraded double-star visibilities of the observed kind. (6 refs.)

110920 Remote sensing by IR heterodyne spectroscopy. T.Kostiuk, M.J.Mumma (NASA Goddard Space Flight Center, Greenbelt, MD, USA).
Appl. Opt. (USA), vol.22, no.17, p.2644-54 (1983). (Topical Meeting on Optical Techniques for Remote Probing of the Atmosphere, Incline Village, NV, USA, 10-12 Jan. 1983).
The use of IR heterodyne spectroscopy for the study of planetary atmospheres is discussed. Infrared heterodyne spectroscopy provides a convenient and sensitive method for measuring the true intensity profiles of atmospheric spectral lines. Application of radiative transfer theory to measured line shapes can then permit the study of molecular abundances, temperatures, total pressures, excitation conditions, and dynamics of the regions of line formation. The theory of formation of atmospheric spectral lines and the retrieval of the information contained in these molecular lines are illustrated. Notable successes of such retrievals from IR heterodyne measurements on Venus, Mars, Jupiter, and Earth are given. A discussion of new developments in IR heterodyne technology is also presented. (62 refs.)

110921 A new method of determining nebular radial velocities from Fabry-Perot interferograms. M.Thonnat (Lab. d'Astron. Spatiale, CNRS, Marseille, France), B.Ruffini, J.Caplan, A.Llebaria.
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.236-40 (Aug. 1983).
Interferograms are digitised with a PDS microphotometer and then analysed automatically to give radial velocity fields. It is concluded that this new method, which works at constant dispersion and which is much more rapid and convenient, is a very satisfactory alternative to the former procedures. (20 refs.)

110922 A method to improve the visibility of time-variable gamma-ray sources in structured background. M.E.Ozel, H.A.Mayer-Hasselwander (Max-Planck-Inst. fur Extraterrestrische Phys., Garching, Munchen, Germany).
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.130-5 (Aug. 1983).
For the investigation of time variable gamma-ray sources embedded in a spatially structured background emission, the spatial selection of those gamma-ray events which are probable to increase the observed signal is not a trivial task. A method is presented which allows for the optimum event selection without introducing any statistical trials which could reduce the significance of the result. The method is applied to simulated and observed data to demonstrate its feasibility and merits. (14 refs.)

110923 Determination of effective temperatures for hot stars from integrated fluxes. W.Tobin (Lab. d'Astron. Spatiale, CNRS, Marseille, France).
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.168-71 (Aug. 1983).
An analysis is made of the method of determination of effective temperatures for early-type stars from monochromatic and integrated fluxes. The essence of the method is a comparison of model predictions with the de-reddened ratio (observed monochromatic flux in the visual or infrared)/(observed integrated flux), and solutions may be found graphically without iteration. Likely errors in effective temperature are discussed. (14 refs.)

110924 On the performance of video band complex correlators. P.C.Egau (Dept. of Electrical Engng., Univ. of Nairobi, Nairobi, Kenya).
IEEE Trans. Aerosp. & Electron. Syst. (USA), vol.19, no.3, p.462-6 (May 1983).
The performance data for various correlation schemes for Gaussian signals converted from the intermediate frequency band to the video band are derived and discussed. The folded-band conversion scheme is shown to have significant advantages for continuum observations in radioastronomy. (8 refs.)

110925 Multi-object spectroscopy with optical fibres. F.G.Watson (UK Schmidt Telescope, Coonabarabran, Australia).
J. Br. Astron. Assoc. (GB), vol.93, no.5, p.193-9 (Aug. 1983).
An informal review of fibre-optics spectroscopy is presented. This simple new technique permits a conventional spectrograph to be used in a highly efficient, two-dimensional mode. Details of some existing systems are given, and future plans are outlined. (16 refs.)

Proceedings of Symposium 2 of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 105015

Photography and the long-focus visual refractor: three American case studies, 1885-1914 .... See Entry 105084

Hypersensitization of Kodak IIIa-J plates by baking in forming gas in a sealed tube .... See Entry 105390

An investigation into latent image and hypersensitization decay of Kodak IIIa-J and IIIa-F photographic plates .... See Entry 105391

The variation with wavelength of the response of Kodak emulsion, IIIa-J .... See Entry 105392

A BASIC program for calculating satellite orbits .... See Entry 110861

On the determination of absolute right ascensions and declinations of groups of stars using minor planets .... See Entry 110864

A nontraditional means of determining the orbital elements of unknown cosmic objects from the data of computer processing of survey photographs .... See Entry 110876

One-dimensional high time resolution solar observations with the Westerbork Synthesis Radio Telescope .... See Entry 110906

Three-element very-long baseline radiointerferometer .... See Entry 110911

Diffraction on a segmented telescope mirror .... See Entry 110912

A microprocessor-controlled multichannel counter for a digital autocorrelator [radioastronomical application] .... See Entry 110913

Pickering-racine prisms revisited .... See Entry 110914

On the statistical stability of solar cyclicity .... See Entry 111021

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Hα observations of four novae in M31 .... See Entry 111057

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95.80M Space ultraviolet

Observations of high-energy jets in the corona above the quiet Sun, the heating of the corona, and the acceleration of the solar wind ... See Entry 111004

Mass and energy balance in the 1973 August 9 flare ... See Entry 111010

Outer atmospheres of late stars ... See Entry 111035

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AG Draconis ... See Entry 111082

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Detection of a stellar prominence of the K supergiant 32 Cyg ... See Entry 111134

A study of UV spectra of ζ Aur/VV Cep stars. IV. System parameters and mass-loss of δ Sge ... See Entry 111135

A 0538−66 .... See Entry 111143

A study of the binary system 58 Persei .... See Entry 111144

Ultraviolet observations of the transient X-ray sources A 0535+26 and A 0620−00 .... See Entry 111150

High dispersion *IUE* observations of the planetary nebula NGC 3918 .... See Entry 111195

X-ray and UV observations of the BL Lacertae object 3C 66A .... See Entry 111207

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95.80N X-ray

Mass and energy balance in the 1973 August 9 flare .... See Entry 111010

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HEAO 1 high-energy X-ray observations of Centaurus X-3 ... See Entry 111130

4U 1543−45 .... See Entry 111142

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The X-ray emitting gas in poor clusters with central dominant galaxies .... See Entry 111246

95.80Q gamma-ray and elementary particle

Pulsations of cosmic rays before solar proton bursts from ground-based observational data .... See Entry 110827

Gamma-ray observational constraints on the origin of the optical continuum emission from the white-light flare of 1980 July 1 .... See Entry 111011

γ-ray line emission from SS 433 .... See Entry 111093

95.85 CATALOGUES, ATLASES ETC

110926 New galaxies with ultraviolet excess. IV. M.A.Kazaryan, E.S.Kazaryan (Erevan State Univ., Erevan, USSR).
Astrophysics (USA), vol.18, no.4, p.285-96 (Oct.-Dec. 1982). Translation of: *Astrofizika (USSR)*, vol.18, no.4, p.512-22 (Oct.-Dec. 1982).
For pt.III see Astrofizika, vol.16, no.1, p.17-23 (1980) or Astrophysics, vol.16, no.1, p.7-20 (1980). A fourth list containing 114 new galaxies with ultraviolet excess found by means of the 40″ Schmidt telescope of the Byurakan Observatory with α 1.5° objective prism is given. It is concluded that a stage with an ultraviolet excess is a frequent and long lasting phenomenon in galaxies. (4 refs.)

110927 A catalogue of extragalactic radio source identifications. M.P.Veron-Cetty, P.Veron (European Southern Obs., Garching, Munchen, Germany).
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.2, p.219-21 (Aug. 1983).
Presents a compilation of all published identifications of extragalactic radio sources and of all radio quiet quasars with known redshift. The catalogue contains 14585 entries for 10173 different sources published in 917 papers. (no refs.)

110928 Meridian observations made with the Carlsberg Automatic Meridian Circle at Brorfelde (Copenhagen University Observatory) 1981-1982. L.Helmer, C.Fabricius, O.H.Einicke (Copenhagen Univ. Obs., Copenhagen, Denmark), C.Thoburn.
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.2, p.223-45 (Aug. 1983).
The catalogue contains positions and magnitudes for 1577 stars with visual magnitudes brighter than 11.0. The observations were made with the 7-inch circle at Copenhagen University Observatory during the period July 1981 to May 1982. The instrument has been equipped with a photoelectric moving-slit micrometer and a minicomputer to control the entire observing process, making it a fully automated transit circle. The internal mean errors of a single observation are $\epsilon_\alpha \cos\delta=0.0138^s$, $\epsilon_\delta=0.216''$, $\epsilon_m=0.132^m$. The positions are reduced relative to the FK4 system for each night and over the whole meridian, instead of the usual narrow zones. The positions of the FK4 stars used in the least squares solution are also given in the catalogue. (19 refs.)

110929 A catalogue of late-type supergiant stars in the Small Magellanic Cloud. L.Prevot, N.Martin (Obs. de Marseille, Marseille, France), E.Maurice, E.Rebeirot, J.Rousseau.
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.2, p.255-69 (Aug. 1983).
An objective-prism survey of the Small Magellanic Cloud has been made on IIIaJ plates taken with the 1 m ESO Schmidt telescope. This results in the detection of nearly 200 late K and M supergiant stars. Most of these are new probable members of the SMC which do not appear in previous catalogues. The mean visual absolute magnitude $M_v=-6.0$ agrees with the visual absolute magnitude of Iab-Ib galactic supergiants of spectral types M0 to M4. The fraction of known variable stars found in the catalogue is barely 10%; this is 2.5 times less than the value found for the corresponding stars in the LMC. The catalogue provides accurate 1975 coordinates, finding charts, spectral types, *V*-magnitudes, indications concerning radial velocities when available and designations of the stars in other catalogues. (20 refs.)

110930 An atlas of QSO spectra. B.J.Wilkes (Inst. of Astron., Univ. of Cambridge, Cambridge, England), A.E.Wright, D.L.Jauncey, B.A.Peterson.
Proc. Astron. Soc. Aust. (Australia), vol.5, no.1, p.2-83 (1983).
Presents low-dispersion optical spectra of 295 QSO candidates. (36 refs.)

110931 A catalogue of major metre-wavelength solar events recorded by the Dapto and Culgoora solar radio observatories (1961-1981). R.D.Robinson, J.M.Tuxford, K.V.Sheridan, R.T.Stewart (Div. of Radiophys., CSIRO, Sydney, Australia).
Proc. Astron. Soc. Aust. (Australia), vol.5, no.1, p.84-113 (1983).
Presents a catalogue of 668 metre-wavelength radio events, based on dynamic spectra obtained by a radio spectrograph. The data are presented in two tables which list respectively the radio spectral data and flare data, and the morphological properties of the radio events. In addition a third table gives supplementary information for all moving Type IV events observed by the Culgoora radioheliograph or the 158 MHz interferometer. (80 refs.)

110932 Radio data on clusters of galaxies from the Culgoora circular array. O.B.Slee, B.C.Siegman (Div. of Radiophys., CSIRO, Sydney, Australia).
Proc. Astron. Soc. Aust. (Australia), vol.5, no.1, p.114-29 (1983).
The authors reports observations at 80 and 160 MHz of radio sources associated with clusters of galaxies. These low-frequency intensity measurements were combined with published higher-frequency flux data to obtain accurate radio spectra. In addition the 160 MHz contour maps for many of the cluster fields were used to find positions and angular sizes for the associated radio sources. (18 refs.)

110933 On the reduction of the Carte du Ciel catalogues. J.Stock, J.Cova S. (Centro de Investigacion de Astron., Merida, Venezuela).
Rev. Mex. Astron. & Astrofis. (Mexico), vol.5, no.4, p.233-60 (March 1983).
In the hope of retrieving useful positions for proper motion determinations from the Carte du Ciel (CdC) using recently developed block adjustment methods, an area from the Oxford Zone I of the CdC consisting of 24 overlapping plates of relatively homogeneous epoch is reanalized using the original measurements contained in the catalogue. Positions for equinox 1950.0 and epoch 1901.1 are obtained for 2911 stars down to the limiting magnitude of the catalogue using independently both the AGK3 and the FK4 catalogues as reference systems. The results show that positions accurate to 0.3″ may be obtained and that the block adjustment method used is capable of absorbing distortion terms which are a linear function of the coordinates. (10 refs.)

Faint early-type stars in the neighbourhood of the H II region RCW 99 .... See Entry 111194

95.90 OTHER TOPICS IN ASTRONOMY AND ASTROPHYSICS

110934 A reassessment of the high precision megalithic lunar sightlines. II. Foresights and the problem of selection. C.L.N.Ruggles (Univ. Coll. Cardiff, Cardiff, Wales).
Archaeoastronomy (GB), no.5, p.S1-36 (1983).
For pt.I see ibid., no.4, p.S21-S40 (1982). The author presents foresight declinations for 44 putative high precision lunar sightlines. The inherent uncertainties in these declinations due to uncertainties in the exact observing position are discussed. The problem of the selection of foresights from among other possible horizon features is examined, and the analysis of measured declinations within the 'lunar bands' around the mean standstills is reviewed. Finally a statistical reappraisal of the 44 sightlines is presented. (164 refs.)

110935 The 'Torreon' of Machu Picchu as an observatory. D.S.P.Dearborn, R.E.White (Steward Obs., Univ. of Arizona, Tucson, AZ, USA).
Archaeoastronomy (GB), no.5, p.S37-49 (1983).
The authors report the results of field work during 1980 at Machu Picchu and during 1982 at Pisac. The report concentrates on measurements of the Torreon ('Sentry Tower' or 'Semicircular Temple') and on its possible use as an observatory. It is shown that the structure was designed as a precise instrument for fixing the date of the winter (June) solstice and the date of the passage of the Sun through the zenith, and for observing certain constellations. (23 refs.)

110936 Revised surveys of Cork-Kerry stone circles. J.Patrick (Deakin Univ., Geelong, Australia), P.R.Freeman.
Archaeoastronomy (GB), no.5, p.S50-6 (1983).
The authors report new measurements of the orientations of 31 recumbent stone circles in Cork and Kerry. Some discrepancies between these measurements and those of Barber (1973) are discussed. Some evidence is found for astronomical alignments in the direction from the portal stones of the circle to the recumbent stone: of the 31 sites, sixteen point to within 1° of declination of some astronomical event. (10 refs.)

110937 Observation of the Moon in megalithic times. A.Thom, A.S.Thom.
Archaeoastronomy (GB), no.5, p.S57-66 (1983).
The authors determine the declinations for forty megalithic lunar lines, using refined methods of calculation. Histograms of the observed declinations are presented; and it is concluded that the declinations are correlated with six lunar standstills. Correction of the observations for refraction is discussed; there is some evidence from these corrections that temperatures in megalithic times were about 4 F° higher than those at the present day. (no refs.)

110938 Adventure into space. E.M.Burbridge (Center for Astrophys. & Space Sci., Univ. of California, San Diego, CA, USA).
Science (USA), vol.221, no.4609, p.421-7 (29 July 1983).
Gives a very general discussion of the exploration of the Solar System with space vehicles. The author also discusses observations of extraSolar System objects. (35 refs.)

162nd Meeting of the American Astronomical Society (papers in summary form only received) .... See Entry 105012

Proceedings of Symposium 2 of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 105015

Highlights of Astronomy as Presented at the XVIII General Assembly of the IAU. Vol.6 .... See Entry 105030

Proceedings of Workshops III and IV and of the Topical Meeting of the COSPAR Interdisciplinary Scientific Commission F (Meeting F2) of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 110195

Proceedings of Workshop VII and of the Topical Meeting of the COSPAR Interdisciplinary Scientific Commission F (Meetings F1 and F4) of the COSPAR Twenty-Fourth Plenary Meeting .... See Entry 110196

Maya observations of very long periods of Venus .... See Entry 110952

BMS meteor observer's handbook. Vol.II. Telescopic meteor work. 6th edition .... See Entry 110998

96.00 SOLAR SYSTEM

96.10 GENERAL, SOLAR NEBULA, AND COSMOGONY

110939 **^{182}Hf chronometer for the early Solar System.** E.B.Norman (Nuclear Phys. Lab., Univ. of Washington, Seattle, WA, USA), D.N.Schramm.
Nature (GB), vol.304, no.5926, p.515-17 (11 Aug. 1983).
Proposes here that ^{182}Hf ($t_{1/2}=9\times10^6$ yr) can resolve the question of whether heavy-element non-actinide nucleosynthesis occurred during a ^{26}Al-producing event. The answer to this question will help to clarify the chronology of the formation of the Solar System and will help to determine the astrophysical sites of heavy-element nucleosynthesis. (27 refs.)

110940 **Cosmogonical implications of elemental and isotopic abundances in atmospheres of the giant planets.** D.Gautier (Lab. d'Astron. Infrarouge, Obs. de Paris, Meudon, France), T.Owen.
Nature (GB), vol.304, no.5928, p.691-4 (25 Aug. 1983).
Current knowledge of element abundances and isotope ratios in the atmospheres of the major planets is reviewed. The observed enhancement of C/H compared with the solar value favours models for the origin of these bodies that invoke the accretion and degassing of an ice-rock core followed by the accumulation of a solar composition envelope. Titan may represent an example of a core-forming planetesimal. Observations of D/H and other isotope ratios must be accommodated by these models in ways that are not yet completely clear. Some additional tests are suggested. (46 refs.)

110941 **Progress toward the origin of the solar system.** S.J.Weidenschilling (Planetary Sci. Inst., Tucson, AZ, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.206-13 (March 1983).
Reviews research published from 1979 through mid-1982. Its emphasis is on physical/dynamical processes that produced the various bodies in the solar system in approximately their present numbers, orbits, compositions and masses. Chemical evidence concerning the state of the solar nebula and planetary accretion is included. (188 refs.)

The Adhi Kot breccia and implications for the origin of chondrules and silica-rich clasts in enstatite chondrites ....See Entry 111000

96.20 MOON

110942 **Petrology and chemistry of two 'large' granite clasts from the Moon.** P.H.Warren, G.J.Taylor, K.Keil (Dept. of Geology, Univ. of New Mexico, Albuquerque, NM, USA), D.N.Shirley, J.T.Wasson.
Earth & Planet. Sci. Lett. (Netherlands), vol.64, no.2, p.175-85 (Aug. 1983).
Reports the discovery and analysis of Apollo-14 breccias 14321 and 14303, two pristine lunar granite clasts, 10-100 times larger than any previously described. The origin of this rare but important rock type is also discussed. (46 refs.)

110943 **Paleomagnetism of the Moon and meteorites.** L.L.Hood (Lunar & Planetary Lab., Univ. of Arizona, Tucson, AZ, USA), S.M.Cisowski.
Rev. Geophys. & Space Phys. (USA), vol.21, no.3, p.676-84 (April 1983).
Discusses chondrites, achondrites, lunar palaeomagnetism, returned samples and discusses orbital analyses. (60 refs.)

DE 102: a numerically integrated ephemeris of the Moon and planets spanning forty-four centuries ....See Entry 110863

96.30 PLANETS AND SATELLITES

(exc. the Moon; for celestial mechanics, see 95.10; for Earth as an astronomical body, see 91. Geophysics)

110944 **Planetary science: 1979-1982.** S.W.Squyres (NASA Ames Res. Center, Moffett Field, CA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.139-42 (March 1983).
Reviews studies of the global topography of Venus, and the analysis of data on Jupiter, Amalthea, Io, Europa, Ganymede, Callisto, Saturn, Mimas, Enceladus, Tethys, Dione, Rhea, Titan, Hyperion, Iapetus, and Phoebe. Among the discoveries are continent-sized landforms on Venus, a ring encircling Jupiter, the most volcanically active surface in the solar system on Io, hitherto unknown forms of global tectonism on icy Europa, Ganymede, and Enceladus, and intricate structure within Saturn's rings. Along with the spectacular growth in knowledge stemming from spacecraft exploration, major advances have also been made in telescopic observations of bodies not yet visited by spacecraft, radar observations of a variety of objects, and theoretical studies of the evolution of both individual bodies and the solar system as a whole. (33 refs.)

110945 **Planetary atmospheres.** R.Beebe (Dept. of Astron., New Mexico State Univ., Las Cruces,NM, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.143-51 (March 1983).
The period from 1979 to 1982 has been characterized by extensive exploration of the Solar System. Pioneer and Voyager missions to Venus, Jupiter, and Saturn combined with ongoing analysis and data collection from the Viking-Mars mission have contributed greatly to the understanding of planetary atmospheres. The review considers bodies in order of increasing distance from the Sun: Venus, Mars, Jupiter, Saturn, Titan, Uranus, Neptune, and Pluto. (254 refs.)

110946 **The geology of the terrestrial planets.** M.H.Carr (US Geological Survey, Menlo Park, CA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.160-72 (March 1983).
Reviews photogeology of Mercury, Venus, the Moon, and Mars during the 1979-82 period. (282 refs.)

110947 **Planetary ring systems.** J.Cuzzi (NASA Ames Res. Center, Moffett Field, CA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.173-86 (March 1983).
Review studies of the rings of Saturn, Jupiter and Uranus and theoretical developments during the period 1979-82. (304 refs.)

110948 **Planetary radar astronomy.** S.J.Ostro (Dept. of Astron., Cornell Univ., Ithaca, NY, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.186-96 (March 1983).
This review of the 1979-82 period begins with a brief synopsis of radar definitions and technical terminology, and then summarizes results for individual targets. (104 refs.)

110949 **Solar-planetary relationships: magnetospheric physics.** D.P.Stern (Planetary Magnetospheres Branch, Goddard Space Flight Center, Greenbelt, MD, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.361-2 (March 1983).
The quadrennium 1979-82 witnessed notable advances in magnetospheric and interplanetary physics, and demonstrated some major trends. Examples of both are listed, followed by an evaluation of the state of the discipline and of its future. (5 refs.)

110950 **Plasma waves in planetary magnetospheres.** R.R.Anderson (Dept. of Phys. & Astron., Univ. of Iowa, Iowa City, IA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.474-94 (March 1983).
Concentrates on US research on plasma waves above the ULF-ELF range within planetary magnetospheres during the 1979-82 quadrennium. (514 refs.)

Basaltic volcanism on the terrestrial planets ....See Entry 105038

The measurement of inelastic ion-ion and electron-ion collisions ....See Entry 106611

Modeling planetary magnetospheres ....See Entry 110812

Approximation solutions of the equations of motion of a charged particle in the field of a magnetic dipole ....See Entry 110813

The association of energetic particles and shocks in the heliosphere ....See Entry 110822

DE 102: a numerically integrated ephemeris of the Moon and planets spanning forty-four centuries ....See Entry 110863

Asymptotic solution of the α^2-dynamo problem ....See Entry 110895

Electron-ion and proton-ion collisions in astrophysics ....See Entry 110905

Remote sensing by IR heterodyne spectroscopy ....See Entry 110920

On the calculation of ion-molecule reaction rates in interstellar space and planetary atmospheres ....See Entry 111187

96.30E Venus

110951 **Solar related waves in the Venusian atmosphere from the cloud tops to 100 km.** L.S.Elson (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
J. Atmos. Sci. (USA), vol.40, no.6, p.1535-51 (June 1983).
A diagnostic, quasi-linear model has been developed which uses observed solar-related temperatures and a specified zonal mean circulation and thermal structure to find the solar-related circulation above the clouds of Venus. Because there are no observations of the mean circulation above the clouds, it has been calculated using an independent model. Although the model-derived, solar-related circulation depends on the mean flow to a much greater degree than is the case for terrestrial tides, and although there is uncertainty in this mean flow, several important conclusions have been drawn concerning the solar-related circulation and thermal structure. (24 refs.)

110952 **Maya observations of very long periods of Venus.** S.C.McCluskey (West Virginia Univ., Morgantown, WV, USA).
J. Hist. Astron. (GB), vol.14, pt.2, p.92-101 (June 1983).
Points out some heretofore unnoticed periods in the Venus Almanac of Codex Dresden and other sources that suggest a connection between Maya observational practices and the precision and predictive techniques found in the Venus Almanac. (18 refs.)

110953 **Rotation of Venus's polar dipole.** J.T.Schofield (Dept. of Atmospheric Phys., Univ. of Oxford, Oxford, England), D.J.Diner.
Nature (GB), vol.305, no.5930, p.116-19 (8 Sept. 1983).
The Venusian polar dipoles are long-lived, elongated, warm features seen in images of thermal esmission from the polar cloud tops of the planet. They are almost 4000 km across, are centred close to the pole, and appear to rotate with a period of ~3 days retrograde. The northern hemisphere dipole was first identified as such by the Orbiter Infrared Radiometer (OIR) on the Pioneer Venus Orbiter (PVO). In this study the authors use OIR images at 11.5 μm to investigate its detailed rotation. Its rotation rate is observed to change steadily over the 72-day data set, and there is some evidence for oscillatory variations superimposed on this trend. (24 refs.)

110954 **Aeronomy of the inner planets.** T.E.Cravens, A.F.Nagy (Space Phys. Res. Lab., Univ. of Michigan, Ann Arbor, MI, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.263-73 (March 1983).
Progress concerning the thermospheres of Venus and Mars is reviewed. A dramatic advance in the understanding of the upper atmosphere and ionosphere of Venus was primarily due to the large amount of data generated by the Pioneer Venus mission. Progress on Mars has been rather modest and has stemmed from theoretical modeling efforts related to the 1976 Viking observations. This report covers the following topics: the thermosphere and ionosphere of Mars, the thermosphere of Venus, some aspects of the solar wind-ionosphere interaction of Venus, the dayside ionosphere of Venus including both composition and energetics, and the nightside ionosphere of Venus. (159 refs.)

Planetary lightning: Earth, Jupiter, and Venus ....See Entry 110595

96.30G Mars

110955 **A theoretical study of small amplitude waves in the Martian lower atmosphere and a comparison made with those on Earth.** A.M.Gadian (Dept. of Maths., Teesside Polytech., Middlesbrough, England), J.S.A.Green.
Ann. Geophys. (France), vol.1, no.3, p.239-43 (May-June 1983).
A linearised study of waves in the Martian atmosphere reveals much similarity with those on Earth. For motion independent of the meridional direction, approximations can be made from the exact solutions and these can be regarded as a useful guide to the relevance and importance of the waves in the Martian atmosphere. The authors distinguish between acoustic waves, including Lamb Waves, inertial gravity, baroclinic and Rossby waves. The beta effect and Newtonian radiative damping will be included for these longer perturbations. (3 refs.)

Aeronomy of the inner planets ....See Entry 110954

96.30H Asteroids

110956 **1983 RD.** C.Shoemaker, E.Shoemaker, R.S.Dunbar, E.Helin, A.C.Gilmore, B.G.Marsden.
I.A.U. Circ. (USA), no.3865, 1 pp. (16 Sept. 1983).
Precise positions are reported for the period 1983 September 7 to 15. Improved orbital elements are given, together with an ephemeris for the period 1983 September 13 to 17, at one-day intervals. (no refs.)

110957 1983 RD. B.G.Marsden, A.W.Harris, R.L.Millis.
I.A.U. Circ. (USA), no.3866, 1 pp. (16 Sept. 1983).
Presents an ephemeris for the period 1983 September 17 to October 3 at one-day intervals, and for October 8 to December 2 at five-day intervals. In addition UBV photometry is reported for 1983 September 13 and 14; these observations are consistent with a rotation period of about 2.5 or about 5 hours. (1 ref.)

110958 Asteroids and comets. C.R.Chapman (Planetary Sci. Inst., Tucson, AZ, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.196-206 (March 1983).
Reviews progress in the study of asteroids, Earth-approaching objects, and comets in the 1979-82 period. (127 refs.)

110959 A qualitative investigation of the motion of asteroids of the Hecuba type. I.A.Gerasimov (P.K. Shternberg State Astron. Inst., Moscow, USSR).
Sov. Astron. (USA), vol.26, no.6, p.715-20 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1190-9 (Nov.-Dec. 1982).
The Delaunay-Hill averaging scheme is applied to the plane, circular, restricted three-body problem with 2:1 commensurability of mean motions. A qualitative investigation is made for the case when the first four terms are retained in the perturbation function. Five types of phase trajectories are found. The stability of singular solutions is analyzed. (14 refs.)

On the determination of absolute right ascensions and declinations of groups of stars using minor planets ....See Entry 110864

96.30K Jupiter

110960 Magnetic drifts at Io: depletion of 10-MeV electrons at Voyager 1 encounter due to a forbidden zone. B.E.Goldstein (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA), W.-H.Ip.
J. Geophys. Res. (USA), vol.88, no.A8, p.6137-42 (1 Aug. 1983).
The possibility that the partial dropout of the 10-MeV electrons observed at Voyager 1 encounter with Io might be explained by a forbidden zone is investigated. Because the convection velocity in the vicinity of Io decreases, grad B drifts of energetic electrons opposing the convection result in a forbidden region around Io. It is found that the location and magnitude of the 10-MeV electron depletion calculated on this basis agrees well with the location found by mapping along draped field lines from the Voyager trajectory to the location of Io. The depletion of 10-MeV electrons thus should not be construed as evidence for a local dipole magnetic field at Io. If the forbidden zone explanation for the 10-MeV dropout observed by Voyager is correct, then no electrons in this energy range would be lost to the surface of Io and there should not be a wake extending behind Io in which electrons of energies 10 MeV are depleted. (19 refs.)

110961 Electron precipitation and related aeronomy of the Jovian thermosphere and ionosphere. J.H.Waite,Jr. (Space Sci. Lab., NASA Marshall Space Flight Center, Huntsville, AL, USA), T.E.Cravens, J.Kozyra, A.F.Nagy, S.K.Atreya, R.H.Chen.
J. Geophys. Res. (USA), vol.88, no.A8, p.6143-63 (1 Aug. 1983).
Voyager ultraviolet spectrometer (UVS) measurements provided the first unassailable evidence for particle precipitation in the Jovian atmosphere. Strong emissions at high latitudes indicate particle precipitation energy fluxes of about 10 ergs cm^{-2} s^{-1}. Dayglow emissions at mid and low latitudes may indicate additional particle precipitation fluxes on the order of 0.3 ergs cm^{-2} s^{-1} at all latitudes. Such particle precipitation can have significant aeronomical effects on the Jovian thermosphere and ionosphere. A one-dimensional theoretical model is used to study these effects for the case of electron precipitation. Diffusion equations are solved for all the major neutral species and for H^+, and photochemical solutions are given for the short lived ions. Calculations of the energy deposition rate and neutral temperature are performed. (80 refs.)

110962 The source location of certain Jovian decametric radio emissions. W.Calvert (Dept. of Phys. & Astron., Univ. of Iowa, Iowa City, IA, USA).
J. Geophys. Res. (USA), vol.88, no.A8, p.6165-70 (1 Aug. 1983).
New evidence supporting the widely accepted concept that certain of the Jovian decametric radio waves originate as northern hemisphere extraordinary mode cyclotron emissions (possibly from the Io flux tube) has been found in the Voyager radio observations. Shortly after the closest approach to Jupiter, the wave signals received by Voyager 1 near 10 MHz exhibited cusps in the fringe pattern which is attributed to Faraday rotation in the Io plasma torus. The diminished Faraday rotation indicated by these cusps implies that the wave path had become perpendicular to the magnetic field in the torus. At nearly the same time, the wave polarization near 1 MHz (where Faraday rotation is absent) exhibited a sudden reversal of its rotation sense, indicating that the wave path for those frequencies had also become perpendicular to the magnetic field at the spacecraft. For these two events it was possible to project the wave paths back toward Jupiter and determine to some extent where the waves originated. (24 refs.)

110963 Terrestrial versus Jovian VLF chorus; a comparative study. U.S.Inan, R.A.Helliwell (Space, Telecommunications & Radiosci. Lab., Stanford Univ., CA, USA), W.S.Kurth.
J. Geophys. Res. (USA), vol.88, no.A8, p.6171-80 (1 Aug. 1983).
The relevant parameters of the magnetospheres of Jupiter and Earth are studied from the point of view of wave-particle resonant interactions that are believed to be responsible for the generation of VLF chorus emissions observed on Voyager-1. Using existing models of the cold and energetic plasma distributions in the Jovian magnetosphere, expressions for the wave-particle interaction length (L_I) and the nonlinearity parameter (ρ) are derived. Values of these parameters are compared with those computed for the Earth's magnetosphere. It is found that the typical interaction lengths are at least 2-5 times larger in the Jovian than in the terrestrial magnetosphere. Also, the wave intensity necessary to reach the threshold of nonlinearity in the Jovian magnetosphere was found to be up to 5-100 times lower. (32 refs.)

110964 A two-stage mechanism for escape of Na and K from Io. M.E.Summers, Y.L.Yung (Div. of Geological & Planetary Sci., California Inst. of Technol., Pasadena, CA, USA), P.K.Haff.
Nature (GB), vol.304, no.5928, p.710-12 (25 Aug. 1983).
It is generally accepted that Io is the source of S, O, Na and K which, after ionization, form the constituents of the Io plasma torus. The authors propose that Na and K escape from Io in two stages. Atoms of Na and K are first sputtered into the atmosphere from the surface by high-energy magnetospheric ions. Atmospheric sputtering by low-energy co-rotating ions then removes these constituents (along with others present) out of Io's gravitational field. It is suggested that the observed Na and K ejection asymmetry is due to preferential sputtering of atmospheric particles on the hemisphere of Io facing Jupiter. (20 refs.)

110965 Outer planets satellites. D.Morrison (Inst. for Astron., Univ. of Hawaii, Honolulu, HI, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.151-9 (March 1983).
Reviews the published literature on the outer planet satellites for 1979-1982. For the Jovian and Saturnian systems it focuses on the Voyager data and their interpretation. Astronomical observations are the source of such data as exist on the satelites of Uranus, Neptune, and Pluto. Because of the large volume of literature published on the satellites it is not possible to assemble a complete bibliography. (111 refs.)

110966 The Jovian magnetosphere. T.J.Birmingham (Lab. for Extraterrestrial Phys., NASA/Goddard Space Flight Center, Greenbelt, MD, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.375-89 (March 1983).
Discusses Jovian fields and plasmas. The author considers the various regions of the Jovian magnetosphere roughly in the order of their distance from the planet. The author first considers briefly the region <4.9 R_J Jovicentric ($R_J=71372$ km is the Jovian radius). Next comes the 4.9-$\sim$8 R_J region, which is dominated by a low energy, heavy ion plasma originating from volcanic activity on the moon Io (5.9 R_J). Next the author considers the large region from 8 R_J to the Jovian magnetopause. Finally the author examines the unique structure of the Jovian magnetosheath and Voyager excursions into the magnetotail at Saturnian distances. (263 refs.)

Planetary lightning: Earth, Jupiter, and Venus ....See Entry 110595

Return to Jupiter: project Galileo ....See Entry 110862

Statistical mechanics of light elements at high pressure. V. Three-dimensional Thomas-Fermi-Dirac theory .... See Entry 110880

Cosmogonical implications of elemental and isotopic abundances in atmospheres of the giant planets .... See Entry 110940

96.30M Saturn

110967 Secular orbit-orbit resonance between two satellites with nonzero masses. T.Pauwels (Sterrenkundig Obs., Rijksuniv. Gent, Gent, Belgium).
Celestial Mech. (Netherlands), vol.30, no.3, p.229-47 (July 1983).
The Rhea-Titan resonance is studied as a special case of secular orbit-orbit resonances. In earlier studies Rhea's mass has always been neglected. In order to investigate whether this approximation is valid, both masses are taken into account. It is shown that in the Rhea-Titan case the resonance is dominated by the effect of the large difference between the natural precession rates of the lines of apsides of both satellites, leading to approximations containing only one of the masses. For libration about 0 it happens to be Titan's mass, so that neglecting Rhea's mass is valid. Next, the influence of the difference between the natural precession rates on the resonance is examined, and finally it is shown that the libration period is independent of the libration amplitude. (7 refs.)

110968 The microwave opacity of Saturn's rings at wavelengths of 3.6 and 13 cm from Voyager 1 radio occultation. G.L.Tyler, E.A.Marouf, R.A.Simpson, H.A.Zebker, Von R. Eshleman (Center for Radar Astron., Stanford Univ., Stanford, CA, USA).
Icarus (USA), vol.54, no.2, p.160-88 (May 1983). (Saturn Conference, Tucson, AZ, USA, 11-15 May 1982).
Radio occultation observations of Saturn's rings with Voyager 1 provide independent measurements of the complex (amplitude and phase) microwave extinction and the near-forward scattering cross section of the rings at wavelengths of 3.6 and 13 cm. The ring opening was 5.9°. The normal microwave opacities, $\tau[3.6]$ and $\tau[13]$, provide a measure of the total cross-sectional area of particles larger than about 1 and 4 cm radius, respectively. The data for various rings and the Cassini Division are discussed. (26 refs.)

110969 Particle size distributions in Saturn's rings from Voyager 1 radio occultation. E.A.Marouf, G.L.Tyler, H.A.Zebker, R.A.Simpson, Von R. Eshleman (Center for Radar Astron., Stanford Univ., Stanford, CA, USA).
Icarus (USA), vol.54, no.2, p.189-211 (May 1983). (Saturn Conference, Tucson, AZ, USA, 11-15 May 1982).
Observations of microwave opacity $\tau[\lambda]$ and near forward scatter from Saturn's rings at wavelengths λ of 3.6 and 13 cm from the Voyager 1 ring occultation experiment contain information regarding ring particle sizes in the range of about $a=0.01$ to 15 m radius. The opacity measurements $\tau[3.6]$ and $\tau[13]$ are sufficient to constrain the scale factor $n(a_0)$ and index q of a power law incremental size distribution $n(a)=n(a_0)[a_0/a]^q$, assuming known minimum and maximum sizes and a many-particle-thick model. Forward scatter at 3.6 cm is used to solve for a general distribution over the radius range $1\lesssim a\lesssim 15$ m. Distributions $n(a)$ valid over $0.01\lesssim a\lesssim 15$ m are obtained. Mass distributions are computed directly from $n(a)$. Such distributions are obtained for four features in the ring system centered at 1.35, 1.51, 2.01, and 2.12 Saturn radii (R_s). (51 refs.)

110970 W-shaped occultation signatures: inference of entwined particle orbits in charged planetary ringlets. Von R. Eshleman, J.V.Breakwell, G.L.Tyler, E.A.Marouf (Stanford Univ., Stanford, CA, USA).
Icarus (USA), vol.54, no.2, p.212-26 (May 1983).
Observed W-shaped occultation signatures of certain narrow ringlets in the ring systems of Saturn and Uranus imply a concentration of material near their inner and outer radial edges. A model is proposed where edge bunching is a natural consequence of particles in entwined elliptical orbits, with the same particles alternately defining both edges. While such orbits cross over in radius, collisions would not occur if they have small inclinations, the same fixed argument of periapse, and other parameters whereby the particles would 'fly in formation' along compressed helical paths relative to the core of the ringlet, which is taken to be a circle in the equatorial plane. For this model to match to observed ring thickness and ringlet widths, orbit inclinations must be much smaller than their eccentricities, which themselves would be very small compared to unity. Stabilization against collapse due to gravitational perturbations is discussed. (16 refs.)

110971 The evolution of spokes in Saturn's B ring. E.Grun, G.E.Morfill, R.J.Terrile, T.V.Johnson, G.Schwehm (Lunar & Planetary Inst., Houston, TX, USA).
Icarus (USA), vol.54, no.2, p.227-52 (May 1983). (Saturn Conference, Tucson, AZ, USA, 11-15 May 1982).
The optical appearance of spokes is studied in high resolution ($\lesssim$200 km/lp) images obtained by Voyager 2. Spokes are classified into three categories. Several narrow spokes were observed during formation along radial lines in the sunlit portion of the B-ring. The formation time is discussed. The rate of spoke formation is highest at the morning ansa outside Saturn's shadow. Several spokes are found where one edge revolves with Keplerian speed whereas the other edge stays radial. Recurrent spoke patterns are observed at the period of Saturn's rotation. From edge-on views of the ring system, an upper limit for the height of spokes is derived. (24 refs.)

110972 Collisional interactions of ring particles: the ballistic transport process. W.-H.Ip (Max-Planck-Inst. fur Aeronomie, Katlenburg-Lindau, Germany).
Icarus (USA), vol.54, no.2, p.253-62 (May 1983). (Saturn Conference, Tucson, AZ, USA, 11-15 May 1982).
As the erosion rate of the Saturnian rings resulting from meteroid bombardment can be quite significant in the evolutionary history of the ring system, a simple model is constructed to study the relevant dynamics of ballistic transport of the impact ejecta. The combined process of collision with the ring plane particles, with the impact probability related to the optical depth and inelastic rebound from the ring plane until the random motion of the particle is effectively damped, is traced by using the Monte Carlo method. The numerical results indicate that the final distribution of the ejecta depends very much on the initial ejection velocity. (20 refs.)

110973 Formation of fine dust on Saturn's rings as suggested by the presence of spokes. R.Smoluchowski (Dept. of Astron. & Phys., Univ. of Texas, Austin, TX, USA).
Icarus (USA), vol.54, no.2, p.263-6 (May 1983). (Saturn Conference, Tucson, AZ, USA, 11-15 May 1982).
The common interpretation of spokes on the B ring of Saturn is that they are the result of light scattered by electrostatically levitated micrometer- and submicrometer-size dust particles. The origin of this dust in terms of radiation-induced thermal fatigue and collisions between the particles of the ring as well as meteoritic bombardment is investigated. (22 refs.)

110974 Saturn's electrostatic discharges: properties and theoretical considerations. D.R.Evans, J.H.Romig, J.W.Warwick (Radiophys. Inc., Boulder, CO, USA).
Icarus (USA), vol.54, no.2, p.267-79 (May 1983). (Saturn Conference, Tucson, AZ, USA, 11-15 May 1982).
The properties of Saturn's electrostatic discharges (SED) as observed by the Voyager Planetary Radio Astronomy experiment during the two Voyager encounters with Saturn are summarized. Several models for the formation of SED are discussed in light of these observations. The most likely source regions appear to be either the equatorial zone of the planet or the dense part of the B-ring near 1.80 R_s. The strengths and weaknesses of each of these possibilities are examined. A search for an anomaly near 1.80 R_s in the data of other experiments aboard Voyager is carried out. (17 refs.)

110975 Saturn's electrostatic discharges: could lightning be the cause?. J.A.Burns, M.R.Showalter (Cornell Univ., Ithaca, NY, USA), J.N.Cuzzi, R.H.Durisen.
Icarus (USA), vol.54, no.2, p.280-95 (May 1983). (Saturn Conference, Tucson, AZ, USA, 11-15 May 1982).
It is proposed that Saturn's electrostatic discharges (SED) might be generated in the planet's equatorial atmosphere, perhaps as lightning from a storm system. The 10^h10^m periodicity of the signal envelope duplicates that of Saturn's equatorial jet. The rings shield the atmosphere from solar EUV photons, and thereby substantially reduce the local ionospheric cutoff frequency to allow low-frequency SED to leak out. Many of the unusual properties of SED could be explained in terms of changes in the storm system, the relative spacecraft position in the beaming pattern of the source, local refraction of the signal by the highly disturbed ionosphere, the influence of the ring particles on the highest frequency component of SED. A comparison of SED with planetary lightning on other planets is presented. (52 refs.)

110976 Saturn meteorology: a diagnostic assessment of thin-layer configurations for the zonal flow. M.Allison (NASA Goddard Space Flight Center, Inst. for Space Studies, New York, NY, USA), P.H.Stone.
Icarus (USA), vol.54, no.2, p.296-308 (May 1983).
Voyager imaging, infrared, and radio observations for Saturn have been interpreted by Smith et al. (1982) as an indication that the jet streams observed at the cloud tops extend to depths greater than the 10^4-bar level. This analysis assumes a maximum latitudinal temperature contrast of a few percent, a mean atmospheric rotation rate at depth given by Saturn's ratio period, and no variation with latitude of the bottom pressure level for the zonal flow system. These assumptions are not, however, firmly constrained by observation. The diagnostic analysis of plausible alternative configurations for Saturn's atmospheric structure demonstrates that a thin weather layer system cannot be excluded by any of the available observations. A quantitative estimate of the effects of moisture condensation suggests that these might provide the buoyancy contrasts necessary to support a thin-layer flow. (32 refs.)

110977 A determination of the composition of the Saturnian stratosphere using the IUE. P.Winkelstein, J.Caldwell, S.J.Kim (Dept. of Earth & Space Sci., State Univ. of New York, Stony Brook, NY, USA), M.Combes, G.E.Hunt, V.Moore.
Icarus (USA), vol.54, no.2, p.309-18 (May 1983). (Saturn Conference, Tucson, AZ, USA, 11-15 May 1982).
Reduces ultraviolet spectra of Saturn from the IUE satellite to produce a geometric albedo of the planet from 1500 to 3000 Å. By matching computer models to the albedo the authors determine a chemical composition consistent with the data. This model includes C_2H_2 and C_2H_6 with mixing ratios and distributions of $(9 \pm 3) \times 10^{-8}$ in the top 20 mbar of the atmosphere with none below for C_2H_2 and $(6 \pm 1) \times 10^{-6}$ also in the top 20 mbar with none below for C_2H_2 and C_2H_6 distributions and the C_2H_6 mixing ratio are taken directly from the Voyager IRIS model (Courtin et al. 1981). The Voyager IRIS model also includes PH_3, which is not consistent with the UV albedo from 1800 to 2400 Å. The model requires a previously unidentified absorber to explain the albedo near 1600 Å. (35 refs.)

110978 Investigations of the optical properties of Saturn's atmosphere carried out at the Main Astronomical Observatory of the Ukrainian Academy of Sciences. J.M.Dlugach, A.V.Morozhenko, A.P.Vid'Machenko, E.G.Yanovitskij (Main Astron. Obs., Acad. of Sci., Kiev, Ukrainian SSR).
Icarus (USA), vol.54, no.2, p.319-36 (May 1983).
The results of polarimetric, photometric, and spectroscopic investigations of Saturn are given. Polarimetric and photometric investigations shown that in the long wavelength spectral range ($\lambda > 0.5$ μm) spherical particles play the dominant role in the reflected radiation. But for $\lambda < 0.5$ μm, oriented nonspherical particles are revealed in the equatorial region within planetocentric latitudes ±30°. It is suggested that Saturn's rings may be the source of these particles. The brightness coefficient variations are discussed. A number of weak methane absorption bands are measured for the first time, and the ammonia absorption band at $\lambda = 0.648$ μm is present in the low-resolution photoelectric spectrophotometry. The reduction of high-resolution spectrograms confirms the presence of 20 ammonia lines belonging to the band at 0.648 μm. (30 refs.)

110979 Internal gravity waves in Titan's atmosphere observed by Voyager radio occultation. D.P.Hinson, G.L.Tyler (Center for Radar Astron., Stanford Univ., Stanford, CA, USA).
Icarus (USA), vol.54, no.2, p.337-52 (May 1983). (Saturn Conference, Tucson, AZ, USA, 11-15 May 1982).
Dual-wavelength radio observations during the nearly diametric occultation of Voyager 1 by Titan provided 3.6- and 13-cm data on the equatorial neutral atmosphere. Intensity and frequency fluctuations occurred on time scales from about 0.1 to 1.0 sec at both wavelengths whenever the radio path passed within 90 km of the surface, indicating the presence of variations in refractivity on length scales from a few hundred meters to a few kilometers. Strong intensity scintillations were observed for ray periapsis between about 5 and 25 km altitude, while weak scintillations occurred with ray periapsis between the surface and 5 km, and between 25 and 90 km. The observations support a hypothesis of stratospheric gravity waves, possibly driven by a cloud-free convective region in the lowest few kilometers of the atmosphere. (59 refs.)

110980 Hyperion: collisional disruption of a resonant satellite. P.Farinella, A.Milani, A.M.Nobili (Dipartimento di Matematica, Univ. di Pisa, Pisa, Italy), P.Paolicchi, V.Zappala.
Icarus (USA), vol.54, no.2, p.353-60 (May 1983). (Saturn Conference, Tucson, AZ, USA, 11-15 May 1982).
Hyperion is an irregularly shaped object which appears as the likely remnant of a catastrophic collisional evolution. The present Hyperion is probably the 'core' of a disrupted precursor. The numerical experiments performed to explore the region of the phase space surrounding the present orbit show that most fragments ejected with a relative velocity $\gtrsim 0.1$ km/sec rapidly attain chaotic-type orbits, having repeated close encounters with Titan. Ejection velocities of this order of magnitude are expected for a collision at a velocity of ~ 10 km/sec with a projectile-to-target mass ratio of the order of 10^{-3}, similar effects could be produced by less energetic but nearly grazing collisions. (18 refs.)

110981 The inner edge of Saturn's B ring. T.G.Northrop (Lab. for High Energy Astrophys., NASA Goddard Space Flight Center, Greenbelt, MD, USA), J.R.Hill.
J. Geophys. Res. (USA), vol.88, no.A8, p.6102-8 (1 Aug. 1983).
The sharp, 90-km wide transition from an optical depth of 0.2 in the C ring to 1 in the B ring begins at 91970 km from Saturn's center. This radius is found to be almost exactly at the inward stability limit of charged particles launched in the ring plane at the local Kepler velocity, provided these particles have large charge to mass ratio. The zonal harmonic models of Saturn's magnetic field from the Voyager data and the gravitational field model from Pioneer data are essential to get the very close agreement between theory and observation. The theoretical stability limits are 91973 ± 145 km from Voyager 1 magnetic field data and 91991 ± 145 km from Voyager 2 magnetic data. In addition to the magnetic mirror, gravitational, and centrifugal forces, an unknown force must be postulated to produce equilibrium in the ring plane and make the stability calculation meaningful. (12 refs.)

110982 Perturbations in the movement of Saturn's satellites. I.G.Chugunov.
Pis'ma v Astron. Zh. (USSR), vol.9, no.6, p.368-75 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
Perturbations in the movement of satellites I-VI due to the influence of Saturn's dynamic oblateness, its rings, the Sun and the mutual influence of satellites on each other are investigated. (9 refs.)

110983 The magnetosphere of Saturn. A.W.Schardt (Lab. of High Energy Astrophys., NASA Goddard Space Flight Center, Greenbelt, MD, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.390-402 (March 1983).
Discusses the magnetic field, solar wind-magnetosphere interactions, Titan-magnetosphere interactions, outer magnetosphere, slot region, inner magnetosphere and the ring region. (98 refs.)

Statistical mechanics of light elements at high pressure. V. Three-dimensional Thomas-Fermi-Dirac theory .... See Entry 110880

Cosmogonical implications of elemental and isotopic abundances in atmospheres of the giant planets .... See Entry 110940

Outer planets satellites .... See Entry 110965

96.30T Other planets

110984 Uranus: variability of the microwave spectrum. G.Gulkis, E.T.Olsen, M.J.Klein (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA), T.J.Thompson.
Science (USA), vol.221, no.4609, p.453-5 (29 July 1983).
Radio astronomical observations of Uranus show that the radio emission spectrum is evolving in time. Ammonia vapor must be depleted in the Uranian atmosphere as Gulkis and his co-workers (1978) previously suggested. Since 1965, ammonia either has been decreasing in time or is a decreasing function of latitude, or both, provided that the radio emission is atmospheric in origin. If Uranus has an observable low-emissivity 'surface', these trends may be reversed. The microwave observations made in 1965, at the time when the spin axis of Uranus was nearly perpendicular to the Sun-Uranus line, are consistent with an atmospheric opacity profile that would be produced by saturated ammonia vapor in a predominantly hydrogen atmosphere. At the present time, when the spin axis of Uranus is nearly aligned with the Sun-Uranus line, the measurements require an opacity that would be produced by saturated water vapor. A large thermal gradient between the pole and equator is ruled out. (13 refs.)

The Voyager mission to Uranus and beyond .... See Entry 110853

Cosmogonical implications of elemental and isotopic abundances in atmospheres of the giant planets .... See Entry 110940

Outer planets satellites .... See Entry 110965

W-shaped occultation signatures: inference of entwined particle orbits in charged planetary ringlets .... See Entry 110970

96.50 OTHER OBJECTS IN THE PLANETARY SYSTEM

96.50D Interplanetary matter, magnetic and electric fields

(inc. gegenschein and zodiacal light; see also 94.60 Interplanetary space)

Laboratory measurements of D/H ratios in interplanetary dust .... See Entry 111003

Planck mean radiation-pressure cross sections for nonspherical grains. I .... See Entry 111179

96.50G Comets

110985 The effect of MHD instabilities on the flaring of cometary plasma tails. M.B.Niedner,Jr., A.I.Ershkovich, J.C.Brandt (Lab. for Astron. & Solar Phys., NASA Goddard Space Flight Center, Greenbelt, MD, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.362-4 (1 Sept. 1983).
The earlier hypersonic pressure balance model of flaring in cometary plasma tails (Ershkovich, Niedner, and Brandt, 1982), is modified to include the effects of magnetohydrodynamic instabilities occurring along the ionopause in the outer-tail regions. The effect of instability is to mix the solar-wind and comet-tail plasmas, increasing the tail magnetic field strength above that calculated from magnetic flux conservation. The earlier model assumed the ionopause to be a tangential discontinuity surface (flux conserving) at all distances, with the result that the magnetic field approached zero in the outer regions of strongly flaring tails. The present model is more realistic. (8 refs.)

110986 Comet Cernis 1983l. S.W.Milbourn.
Br. Astron. Assoc. Circ. (GB), no.637, 1 pp. (12 Sept. 1983).
Reports improved parabolic orbital elements and an ephemeris for the period 1983 September 13 to December 22. (no refs.)

110987 The fleeting comet of mid-May: Comet 1983d (IRAS-Araki-Alcock). J.Sauval.
Ciel & Terre (Belgium), vol.99, no.3, p.85-93 (May-June 1983). In French.
Comments on the May comet (1983d) and shows some photographs obtained especially in Belgium. (no refs.)

110988 Towards an artificial comet. G.Haerendel (Max-Planck-Inst. fur Phys. und Astrophys., Garching, Germany).
ESA J. (Netherlands), vol.7, no.2, p.135-44 (1983).
The AMPTE mission will provide the opportunity to make a large barium release outside the magnetosphere, on its morning flank. The interaction of the barium plasma with the solar-wind flow will resemble in many respects the processes occurring in the ionised coma of a comet. Initially, a diamagnetic cavity about 80 km in radius will be formed, with a compressed magnetic field on the outside in the direction facing the Sun. The downstream side may develop a turbulent wake and be slowly filled with rays emerging from the 'head' of the artificial comet. The rays form as a consequence of a fast trapping of the solar-wind magnetic field in the plasma cloud a few minutes after maximum expansion, due to anomalous transport effects and aided by flute-type macro-instabilities. Heating and acceleration of the ions causes brightening because of the Doppler shifting of the Ba resonance lines out of the bottom of the solar Fraunhofer lines. The visual phenomena may last for several minutes only, with peak magnitudes $m_v \sim +2.5$, but low-light-level TV systems will be able to track the phenomena for 30-60 minutes. (29 refs.)

110989 Comet IRAS (1983k). P.M.Kilmartin, B.G.Marsden.
I.A.U. Circ. (USA), no.3855, 1 pp. (29 Aug. 1983).
Two precise positions are reported for the epoch 1983 August 10. Parabolic orbital elements are given, together with an ephemeris for the period 1983 August 14 to September 23, at ten-day intervals. (no refs.)

110990 Comet Cernis (1983l). M.Hanner, C.E.Spratt.
I.A.U. Circ. (USA), no.3856, 1 pp. (29 Aug. 1983).
Reports the detection during the period 1983 August 9 to 11 of an absorption feature at 2.9 to 3.0 μm. In addition total visual magnitude estimates are reported for the period 1983 August 17 to 21. (no refs.)

110991 Comet Sugano-Saigusa-Fujikawa (1983e). D.Seargent.
I.A.U. Circ. (USA), no.3857, 1 pp. (29 Aug. 1983).
Reports total visual magnitude estimates and coma diameters for the period 1983 June 8 to 16. (no refs.)

110992 Comet IRAS-Araki-Alcock (1983d). V.F.de Assis Neto.
I.A.U. Circ. (USA), no.3857, 1 pp. (29 Aug. 1983).
Reports total visual magnitude estimates and coma diameters for the period 1983 June 7 to 12. (no refs.)

110993 Comet IRAS (1983o). J.Davies, S.F.Green, C.M.Bardwell, A.C.Gilmore, B.G.Marsden.
I.A.U. Circ. (USA), no.3860, 1 pp. (14 Sept. 1983).
Reports the discovery on 1983 July 27 of an 18th-magnitude comet in Carina. Five approximate positions measured by IRAS on 1983 July 27 and September 1 are reported, together with two precise positions for the epoch 1983 September 11. Parabolic orbital elements are given, together with an ephemeris for the period 1983 September 13 to October 13, at five-day intervals. (no refs.)

110994 Comet Shoemaker (1983p). B.Skiff, E.Bowell, R.S.Dunbar, R.E.McCrosky, C.S.Morris, B.G.Marsden.
I.A.U. Circ. (USA), no.3864, 1 pp. (16 Sept. 1983).
Precise positions are reported for the period 1983 September 14 to 16. A total visual magnitude and coma diameter estimate are given for 1983 September 15. Parabolic orbital elements are given, together with an ephemeris for the period 1983 September 3 to November 2, at five-day intervals. (no refs.)

110995 Visual comet photometry. G.S.Keitch.
J. Br. Astron. Assoc. (GB), vol.93, no.5, p.200-4 (Aug. 1983).
Theoretical and practical aspects of visual photometry of the cometary coma are reviewed. Careful analyses of magnitude data are useful for statistical purposes and for future attempts to correlate visual brightness with the production rates and abundances of various cometary species. The photometric parameters are discussed and the practical aspects of obtaining useful m_v estimates are considered with a view to improving and standardizing the data. (18 refs.)

4 probes to Comet Halley .... See Entry 110842

Electron-ion and proton-ion collisions in astrophysics .... See Entry 110905

Asteroids and comets .... See Entry 110958

96.50K Meteors, showers and meteoroids

110996 Survey of meteor signal rates observed over a VHF forward-scatter link between Waltair and Dehra Dun. M.Srirama Rao, S.R.Ratnam, D.A.V.Krishna Rao (Dept. of Phys., Andhra Univ., Waltair, India), E.Bhagiratha Rao.
Indian J. Radio & Space Phys., vol.12, no.2, p.50-2 (April 1983).
Diurnal and day-to-day variation in meteor signal rates observed for a period of one year over a VHF forward-scatter link between Waltair and Dehra Dun (a distance of 1533 km) at 48.2 MHz are presented. The diurnal variations of meteor rates are discussed and the results are compared with the meteor wind radar observations at Waltair. (15 refs.)

110997 The effect of the geomagnetic field on the diffusion of meteor trails. S.M.Levitskii, N.Abdrakhmanov, V.P.Timchenko (Kiev State Univ., Kiev, Ukrainian SSR).
Radiophys. & Quantum Electron. (USA), vol.25, no.11, p.883-6 (Nov. 1982). Translation of: *Izv. VUZ Radiofiz. (USSR)*, vol.25, no.11, p.1240-3 (Nov. 1982). [received: Sept. 1983]
It is shown that the nature of the diffusion of meteor trails should depend on the state of the ionosphere. Under nighttime conditions diffusion of underdense trails is mainly of an ambipolar nature, and during the day it is determined by the effect of brief containment within the surrounding ionospheric plasma. Radar observations of the Geminids made under conditions in which the diffusion was ambipolar have shown that when the line of sight coincides with the direction of the minor axis of the ellipsoid formed by the meteor trail in the geomagnetic field, the time constant of attenuation of the radar echo turns out to be greater than for an observation from the direction of the major axis. (16 refs.)

110998 BMS meteor observer's handbook. Vol.II. Telescopic meteor work. 6th edition. R.A.Mackenzie.
London, England: Mackenzie (1983), 10 pp.
Discusses telescopic meteors, observation methods, equipment, radiant positions, magnitude distribution, sporadic meteors and shower meteors.

Attenuation of radio waves by atmospheric wet ice and mixed phase hydrometeors .... See Entry 110638

Collisional interactions of ring particles: the ballistic transport process .... See Entry 110972

96.50M Meteorites, micrometeorites

110999 Isotopic composition of carbonaceous-chondrite kerogen: evidence for an interstellar origin of organic matter in meteorites. J.F.Kerridge (Inst. of Geophys., Univ. of California, Los Angeles, CA, USA).
Earth & Planet. Sci. Lett. (Netherlands), vol.64, no.2, p.186-200 (Aug. 1983).
Stepwise combustion has revealed systematic patterns of isotopic heterogeneity for C, H and N in the insoluble organic fraction (m-kerogen) from the Orgueil and Murray carbonaceous chondrites indicating a common source. The data cannot be reconciled with a single mass-fractionation process acting upon a single precursor composition. An interstellar, rather than solar nebular, origin for at least some of the meteoritic organic matter is indicated. This has interesting implications for the origin of prebiotic molecules, temperatures in the early solar system, and the isotopic compositions of volatiles accreted by the terrestrial planets. (55 refs.)

111000 The Adhi Kot breccia and implications for the origin of chondrules and silica-rich clasts in enstatite chondrites. A.E.Rubin (Dept. of Mineral Sci., Nat. Museum of Natural History, Smithsonian Instn., Washington, DC, USA).
Earth & Planet. Sci. Lett. (Netherlands), vol.64, no.2, p.201-12 (Aug. 1983).
The Adhi Kot EH4 enstatite chondrite breccia consists of silica-rich clasts, chondrule-rich clasts and matrix. The silica-rich clasts are a new kind of enstatite chondritic material, which contains more cristobalite than enstatite, as well as abundant niningerite and troilite. The bulk atomic Mg/Si ratios of the clasts (0.22-0.40) are much lower than the average for enstatite chondrites (0.79). Kamacite and martensite occur in all three breccia components. The clasts have kamacite-rich rims, and kamacite-rich aggregates occur in the matrix. A unidirectional change in the ambient pS_2/pO_2 ratio in the region of the solar nebula where Adhi Kot agglomerated can explain many of the breccia's petrologic features. (35 refs.)

111001 Experimental investigations of trace element fractionation in iron meteorites. II. The influence of sulfur. J.H.Jones, M.J.Drake (Lunar & Planetary Lab., Univ. of Arizona, Tucson, AZ, USA).
Geochim. & Cosmochim. Acta (GB), vol.47, no.7, p.1199-209 (July 1983).
For pt.I see 9th. Proc. Lunar Planet. Sci. Conf., p.1407-21 (1978). The authors have investigated the partitioning of Ir, Ge, Ga, W, Cr, Au, P, and Ni between solid metal and metallic liquid as a function of temperature and S-concentration of the metallic liquid. Experimentally-determined partition coefficients have been used in conjunction with a fractional crystallization model to reproduce the geochemical behavior of Ni, P, Au and Ir during the magmatic evolution of groups IIAB, IIIAB, IVA and IVB iron meteorites. However, the geochemical behavior of Ge, Ga, W and Cr cannot be reproduced in an internally consistent way. (26 refs.)

111002 Petrogenesis of the Elephant Moraine A79001 meteorite: multiple magma pulses on the shergottite parent body. H.Y.McSween,Jr. (Dept. of Geological Sci., Univ. of Tennessee, Knoxville, TN, USA), E.Jarosewich.
Geochim. & Cosmochim. Acta (GB), vol.47, no.8, p.1501-13 (Aug. 1983).
The EETA 79001 achondrite consists of two distinct igneous lithologies joined along a planar, non-brecciated contact. Both are basaltic rocks composed primarily of pigeonite, augite, and maskelynite, but one contains zoned megacrysts of olivine, orthopyroxene, and chromite that represent disaggregated xenoliths of harzburzite. Both lithologies probably formed from successive volcanic flows or multiple injections of magma into a small, shallow chamber. Many similarities between the two virtually synchronous magmas suggest that they are related. Possible mechanisms to explain their differences are considered. (55 refs.)

111003 Laboratory measurements of D/H ratios in interplanetary dust. E.Zinner, K.D.McKeegan, R.M.Walker (McDonnell Center for Space Sci., Washington Univ., St. Louis, MO, USA).
Nature (GB), vol.305, no.5930, p.119-21 (8 Sept. 1983).
Measurements of noble gas elemental and isotopic abundance patterns have provided evidence that a subset of the particles collected in the upper atmosphere by aircraft are micrometeorites. This 'chondritic' subset is characterized by major and trace element contents within a factor of 2 of cosmic abundances. The authors have found that the deuterium in two such particles is enriched relative to hydrogen by $500\text{-}1100\,^0/_{00}$ when compared with the terrestrial SMOW standard. This result confirms the extraterrestrial origin of the 'chondritic' dust particles and demonstrates that the material preserves an interesting, and potentially unique, isotopic record which may reflect a

memory of processes occurring during (or before) the formation of the solar system. (26 refs.)

Multiple microtektite horizons in Upper Eocene marine sediments: no evidence for mass extinctions ....See Entry 110383

Paleomagnetism of the Moon and meteorites ....See Entry 110943

96.60 SOLAR PHYSICS

111004 **Observations of high-energy jets in the corona above the quiet Sun, the heating of the corona, and the acceleration of the solar wind.** G.E.Brueckner, J.-D.F.Bartoe (E.O. Hulburt Center for Space Res., Naval Res. Lab., Washington, DC, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.329-48 (1 Sept. 1983).
High spatial resolution observations of the ultraviolet solar spectrum reveal high-energy events in the quiet Sun. They can be classified as turbulent events and jets. The turbulent events show high turbulence confined in small areas while the jets show upward moving material with velocities exceeding the sound velocity in the corona. A single jet carries an energy of 2.5×10^{26} ergs and a mass of 3×10^{11} g at 400 km s^{-1} into the corona at an altitude of 4000-16000 km. Strong shock waves accompanying the jets can heat the corona. A cloud model of the solar wind is proposed where all the kinetic energy of the wind is provided at the solar surface by the high-energy jets. With a birthrate of 24 events per second over the whole Sun, which is within the uncertainties of the observations, the power and mass flux requirements of the corona and the solar wind can be satisfied. (44 refs.)

111005 **Associations between coronal mass ejections and soft X-ray events.** N.R.Sheeley,Jr., R.A.Howard, M.J.Koomen, D.J.Michels (E.O. Hulburt Center for Space Res., Naval Res. Lab., Washington, DC, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.349-54 (1 Sept. 1983).
Studies the association between white light coronal mass ejections (CMEs) and full-disk X-ray events as a function of X-ray duration during the recent years of high sunspot activity (1979-1981). On a time scale of hours, the authors find no duration that separates X-ray events into two distinct classes depending on whether or not they have associated CMEs. Rather, the tendency for long-duration X-ray events to have associated CMEs reflects the fact that, as X-ray duration increases, the differential distribution of events without CMEs falls off faster than the distribution of X-ray events with CMEs. (18 refs.)

111006 **High spatial and temporal resolution observations of the solar Ca II H line.** L.E.Cram (CSIRO Div. of Appl. Phys., Sydney, Australia), L.Dame.
Astrophys. J. (USA), vol.272, no.1, pt.1, p.355-61 (1 Sept. 1983).
A 24 minute time series of photographic Ca II H line spectra made with high spatial and spectral resolution is analyzed to provide data on the range of line profile variations in the quiet Sun. Distribution functions of the line-core intensity and the ratio of emission peak intensities are exhibited and are used to classify the associated line profiles. It is shown that the range of profile variation is significantly larger than that covered by the models A-F of Vernazza, Avrett, and Loeser (1981), especially in relation to the darkest profiles in which no core emission can be detected. Time-resolved spectra are used to show that the 3-minute chromospheric oscillation involves upward-propagating excitation which leads to intense heating in the cell points. (32 refs.)

111007 **A dynamical model of coronal loops.** S.Hinata (Phys. Dept., Auburn Univ., Auburn, AL, USA).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.715-22 (15 Sept. 1983).
It is shown that, for MHD equilibrium configurations in the corona, the plasma transport across the magnetic field drives the plasma motion when the plasma resistivity is taken into account, provided that the equilibrium configurations are not force-free ($J\times B\neq0$), and that the pressure and/or density changes radially from the center of the loop column. (15 refs.)

111008 **H I Lyman-alpha in the Sun: the effects of partial redistribution in the line wings.** D.Roussel-Dupre (Inst. for Astron., Univ. of Hawaii, Honolulu, HI, USA).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.723-38 (15 Sept. 1983).
Presents a form for the Lyman-α redistribution function that is modified to include effects of collisional coupling between different energy states and that can be used in a radiative transfer equation. By separating the source function into its primary components at all heights, the formation of Lyman-α radiation is investigated in detail. Frequencies in the line wing can be mapped back such that the heights of formation for $\Delta\lambda=\pm0.5$-6 Å span the entire solar chromosphere. The usefulness of the Lyman-α wing as an atmospheric probe, however, is limited by long thermalization lengths, a result of almost coherent scattering outside of the Doppler core. (36 refs.)

111009 **A static model of chromospheric heating in solar flares.** P.J.Ricchiazzi, R.C.Canfield (Center for Astrophys. & Space Sci., Univ. of California, San Diego, CA, USA).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.739-55 (15 Sept. 1983).
Models the response of the solar chromosphere to several flare processes: nonthermal electrons, thermal conduction, and coronal pressure. The equations of steady state energy balance, hydrostatic equilibrium, radiative transfer, and atomic statistical equilibrium are solved simultaneously by finite difference methods, using linearization and iteration. It is assumed that the atmospheric response is confined to one dimension by a strong vertical magnetic field. The radiative transfer equation is solved for the most important optically thick transitions of hydrogen, magnesium, and calcium. Radiative loss due to H^-, the EUV and X-ray lines of heavier ions, and free-free bremsstrahlung is included in an optically thin manner. The theoretical atmospheres elucidate the role of various physical processes in establishing the structure of flare chromospheres. (49 refs.)

111010 **Mass and energy balance in the 1973 August 9 flare.** K.P.Dere, J.W.Cook (E.O. Hulburt Center for Space Res., Naval Res. Lab., Washington, DC, USA).
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.181-7 (Aug. 1983).
The mass and energy balance of the thermal plasma during the decay phase of the 1973 August 9 solar flare are studied. The analysis is based on observationally determined values for the differential emission measure, density, turbulent and bulk velocities, and physical dimensions. The total particle content and total thermal energy content of the flare plasmas with temperatures above 10^5K and their variation with time are calculated. The particle loss and the energy losses through radiation, conduction, and convection are evaluated. (26 refs.)

111011 **Gamma-ray observational constraints on the origin of the optical continuum emission from the white-light flare of 1980 July 1.** J.M.Ryan, E.L.Chupp, D.J.Forrest, S.M.Matz (Dept. of Phys., Univ. of New Hampshire, Durham, NH, USA), E.Rieger, C.Reppin, G.Kanbach, G.H.Share.
Astrophys. J. Lett. Ed. (USA), vol.272, no.2, pt.1, p.L61-5 (15 Sept. 1983).
Reports the results of γ-ray observations of the white-light flare of 1980 July 1 which started at approximately 1627 UT. The authors conclude that the major white-light emission which occurs in the late phase of the flare could not have been due to heating by electron or ion precipitation. This conclusion is based on the fact that the X-ray and γ-ray flux as measured by the Gamma-Ray Spectrometer on the Solar Maximum Mission (SMM) satellite peaks approximately 1 minute before the maximum of the optical continuum emission. Approximately 73% of the optical continuum emission, representing a spatially and temporally distinct bright point, follows this maximum with little or no X-ray or γ-ray emission in the same period. (20 refs.)

111012 **Influence of turbulent pressure on solar convective modes.** H.M.Antia, S.M.Chitre, D.Narasimha (Tata Inst. of Fundamental Res., Bombay, India).
Mon. Not. R. Astron. Soc. (GB), vol.204, no.3, p.865-81 (Sept. 1983).
The stability of linear convective modes in the solar envelope model is investigated by incorporating in a very crude manner the effects of turbulent pressure and eddy transport coefficients calculated in the mixing length approximation. It is demonstrated that for a reasonable choice of the parameters there occur two peaks in the growth rate versus horizontal wavenumber plot which correspond to the observed features associated with granulation and supergranulation. (29 refs.)

111013 **Solar oscillations with 13-day period.** T.L.Duvall,Jr., H.P.Jones, J.W.Harvey (Kitt Peak Nat. Obs., Tucson, AZ, USA).
Nature (GB), vol.304, no.5926, p.517-18 (11 Aug. 1983).
Examines photoelectric drift-scan measurements of the solar diameter and full-disk magnetograms taken at Kitt Peak National Observatory for evidence of variations corresponding to the velocity oscillations of the 13.1-day period. An upper limit on radius variations is reported which is a factor of six below the amplitude needed to explain the velocity observations as a radial oscillation and the possible role of the rotation of large-scale surface magnetic features is considered. (8 refs.)

111014 **New measurements of the solar diameter.** J.H.Parkinson (Mullard Space Sci. Lab., Univ. Coll. London, Dorking, England).
Nature (GB), vol.304, no.5926, p.518-20 (11 Aug. 1983).
Measurements made during the 31 July 1981 total eclipse together with a reanalysis of previous eclipse and Mercury transit measurements confirm that there is no evidence for any secular change in the solar diameter, with a reduced upper limit. However, there is increased support for an ~80-yr cyclic variation. (14 refs.)

111015 **Internal rotation of the Sun.** H.C.Spruit (Max-Planck-Inst. fur Phys. und Astrophys., Garching, Germany), E.Knobloch, I.W.Roxburgh.
Nature (GB), vol.304, no.5926, p.520-2 (11 Aug. 1983).
The conditions for the occurrence of hydrodynamic instabilities in a radiative stellar interior are reviewed assuming that the rotation is constant on spheres. The instability with the lowest threshold is a double diffusive one, the axisymmetric baroclinic diffusive instability. A minimum rotation curve for the present Sun is calculated using the assumption that the efficiency of this instability is sufficiently high that the rotation of the Sun is close to marginal stability. This lower limit to the internal rotation rate is roughly consistent with present observations of the rotational splitting of solar oscillations. (19 refs.)

111016 **Solar radius change between 1925 and 1979.** S.Sofia (Lab. for Planetary Atmospheres, Goddard Space Flight Center, NASA, Greenbelt, MD, USA), D.W.Dunham, J.B.Dunham, A.D.Fiala.
Nature (GB), vol.304, no.5926, p.522-6 (11 Aug. 1983).
By analysing numerous reports, from different locations, on the duration of totality of the solar eclipses on 24 January 1925, and on 26 February 1979, it is found that the solar radius at the earlier date was 0.5 arc s, or 375 km larger than at the later date. The correction to the standard solar radius found for each eclipse was different when different subsets of the observations were used (for example, edge of path of totality timings compared with central timings), suggesting the existence of systematic inaccuracies in the lunar figure. However, the differences between the corrections for both eclipses were very similar for all subsets considered, indicating that changes of the solar size may be reliably inferred despite the existence of the lunar figure errors, as long as the proper consideration is made of the distribution of the observations. These results are considered strong evidence in support of the occurrence of solar radius changes on shorter than evolutionary time scales. (13 refs.)

111017 **Limits on the Sun's core magnetism from solar oscillations.** W.Dziembowski (N. Copernicus Astron. Centre, Polish Acad. of Sci., Warsaw, Poland), P.R.Goode.
Nature (GB), vol.305, no.5929, p.39-42 (1 Sept. 1983).
The authors perform an analysis of oscillation data due to Hill et al. (1982) to show that limits of a few megagauss can be placed on poloidal and toroidal magnetic fields inside the Sun. A limit can also be placed on the part of the quadrupole moment of the Sun due to magnetism. These fields are too weak to induce a quadrupole moment much larger than that which would result if the Sun rotated rigidly at the observed surface equatorial rate. (10 refs.)

111018 **Analysis of the polarization measurements during the occultations of the Crab Nebula by the plasma surrounding the Sun in 1977-1982.** N.S.Soboleva, G.M.Timofeeva.
Pis'ma v Astron. Zh. (USSR), vol.9, no.7, p.409-14 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
Measurements of the Faraday rotation in the solar corona in the course of occultations of the Crab Nebula in 1977-1982 are reported. During this period the nebulae moved southward of the Sun and approached the Sun at a distance of about $5R_\odot$. It is found that during the whole 11-year solar cycle (1971-82) the negative rotation measure dominated (magnetic field being directed from the observer). This effect can be explained neither by radial, nor dipole, nor spiral solar magnetic field models. (8 refs.)

111019 **Solar activity.** D.M.Rust (American Sci. & Engng. Inc., Cambridge, MA, USA).
Rev. Geophys. & Space Phys. (USA), vol.21, no.2, p.349-60 (March 1983).
Reviews magnetic field emergence, active regions, flare buildup, eruptive prominences, coronal transients, impulsive phenomena and atmosphere flare effects. (186 refs.)

111020 **Sizes of turbulence elements in the solar atmosphere.** R.I.Kostyk (Main Astron. Obs., Acad. of Sci., Ukrainian SSR).
Sov. Astron. (USA), vol.26, no.6, p.703-5 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1167-70 (Nov.-Dec. 1982).
The average size of turbulent vortices (the correlation length) in the solar atmosphere decrease with height from 670 ($h=160$ km) to 440 km (h-250

km), while their root-mean-square velocity is constant and equal to 1.7 km.sec^{-1}. (22 refs.)

111021 On the statistical stability of solar cyclicity. K.S.Voichishin, M.I.Stodilka (Physicomech. Inst., Acad. of Sci., Ukrainian SSR).
Sov. Astron. (USA), vol.26, no.6, p.705-11 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1171-83 (Nov.-Dec. 1982).
A form function for the 11-year solar-activity cycles is introduced for an interval equal to the duration of the cycles, with allowance for the asymmetry of the latter. A mathematical model is proposed to describe the time structure of solar cyclicity. A method and algorithm for optimal estimation (in the sense of the minimum of the root-mean-square deviation) of its parameters are described. The statistical correlation of parameters of 11 year cycles is discussed and the stability of their fine structure is illustrated. The residual dispersion is calculated with allowance for all 20 cycles of the Zurich numbering (after subtracting from the initial data their approximated values). Attention is drawn to the uniformity of its variation from cycle to cycle as a test of the statistical stability of the shape of the latter. The sources of disruption of the indicated uniformity for monthly average observed Wolf numbers are calculated and ways of eliminating them are indicated. It is concluded that the statistical stability of the shape of the 11-year solar-activity cycles is real to within the variation of their asymmetry. (24 refs.)

Annual Meeting of the Division on Solar Physics of the American Astronomical Society .... See Entry 105013

The rate of the ^{3}He(p,$e^+\nu$)^{4}He reaction .... See Entry 105839

Measurement of relative oscillator strengths for Ti I. III. Weak transitions from levels a^{3}F$_{3,4}$ (0.02 eV, 0.05 eV), a^{5}F$_{1-5}$ (0.81 eV-0.85 eV), a^{1}D$_2$ (0.90 eV), a^{3}P$_{0-3}$ (1.05 eV-1.07 eV) with solar analysis .... See Entry 106334

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Solar cycle and long term changes in the solar wind .... See Entry 110840

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Comments on the Planck-Larkin partition function .... See Entry 110881

An approximate analytical solution for self-similar flow behind a radiation driven shockwave .... See Entry 110885

A self-similar flow behind an exponential shock with radiative heat flux. II .... See Entry 110886

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The macroscopic magnetohydrodynamics of inhomogeneously turbulent cosmic plasmas .... See Entry 110893

Nonlinear convection in an imposed horizontal magnetic field .... See Entry 110894

Collective bifurcation of flux sheets in two-dimensional magnetoconvection .... See Entry 110897

One-dimensional high time resolution solar observations with the Westerbork Synthesis Radio Telescope .... See Entry 110906

A catalogue of major metre-wavelength solar events recorded by the Dapto and Culgoora solar radio observatories (1961-1981) .... See Entry 110931

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On the effect of temperature fluctuations on line intensities .. See Entry 111032

On the excitation of oscillations of stars at their encounters .... See Entry 111033

97.00 STARS

97.10 STELLAR CHARACTERISTICS

111022 Long-period variables in the Magellanic Clouds: supergiants, AGB stars, supernova precursors, planetary nebula precursors, and enrichment of the interstellar medium. P.R.Wood, M.S.Bessell, M.W.Fox (Mount Stromlo & Siding Spring Obs., Res. School of Phys. Sci., Australian Nat. Univ., Canberra, Australia).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.99-115 (1 Sept. 1983).
Infrared *JHK* magnitudes and low-dispersion red spectra have been obtained for 90 long-period variables (LPVs) in the Small and Large Magellanic Clouds. The LPVs fall into two distinct groups, core helium (or carbon) burning supergiants and stars on the asymptotic giant branch (AGB). The AGB stars extend in luminosity right up to the AGB limit ($M_{\rm bol}\approx-7.1$). The existence of stars at the AGB limit provides direct evidence that the more massive AGB stars produce supernovae. Carbon star LPVs are confined to luminosities fainter than $M_{\rm bol}\sim-6$, in agreement with other studies of carbon stars in the Magellanic Clouds. Many of the oxygen-rich AGB stars show enhanced oxide bands of the *s*-process element Zr, indicating that dredge-up of material at helium shell flashes is occurring in these stars as well as in the carbon stars. The authors interpret the absence of carbon stars among the upper AGB stars. The authors deduce that stars with initial masses $\gtrsim 5\ M_\odot$ produce supernovae while less massive stars produce planetary nebulae with nebula masses from $\sim$0.1-2.1 $M_\odot$. (61 refs.)

111023 Stellar winds driven by multiline scattering. D.B.Friend, J.I.Castor (Joint Inst. for Lab. Astrophys., Univ. of Colorado, Boulder, CO, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.259-72 (1 Sept. 1983).
Presents a model of a radiation-driven stellar wind with overlapping spectral lines. It is based on the Castor, Abbott, and Klein (1975) (CAK) theory. The presence of overlapping lines allows a photon to be scattered many times in different lines. The authors assume a random separation between strong lines, which makes it possible to find the angular distribution of the wavelength-averaged intensity of radiation from the star. The properties of the wind at any point depend on this intensity, which in turn depends on the structure of the wind. A self-consistent wind model is found. (23 refs.)

111024 A new instability during nuclear shell burning. R.Kippenhahn, H.-C.Thomas (Max-Planck-Inst. fur Phys. & Astrophys., Inst fur Astrophys., Garching, Munchen, Germany).
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.206-10 (Aug. 1983).
Shell burning can be vibrationally unstable. If a mass element in a region with nuclear burning is lifted the nuclear energy generation is reduced due to the decrease of the temperature in the element. It is therefore pushed back to its original position more violently than in the case without nuclear burning. This effect can sometimes overcome the damping and cause an overstability. With a linear stability analysis it is shown that the overstability in a helium burning shell of a 5 $M_\odot$ star can produce oscillations with a period of 0.1 s and a characteristic time of growth of 6 yr. (5 refs.)

111025 Stability of thermal relaxation oscillations. M.Barranco (Dept. de Optica, Univ. de Barcelona, Barcelona, Spain), J.R.Buchler, J.Perdang.
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.6-12 (Aug. 1983).
Demonstrates that a two-zone model for thermal relaxation oscillations (limit cycles), in, for example, thin He burning shells or in X-rays bursters, is vulnerable against an increase in the complication of the model structure, a property which is termed morphological instability. The inclusion of a third zone can completely destroy the limit cycle or else it can deform it. As a by-product of the analysis the authors find that a slight alteration of the structure of the model is inefficient in transforming the thermal pulses into 'chaotic' fluctuations. The result is indicative that the stochastic time behaviour, observed for the majority of X-ray bursters, if intrinsic, cannot be accounted for by a mere slight perturbational effect around the energy generating shell source. (14 refs.)

111026 The molecular weight barrier and angular momentum transport in radiative stellar interiors. E.Knobloch, H.C.Spruit (Max-Planck-Inst. fur Phys. und Astrophys., Inst. fur Astrophys., Garching, Munchen, Germany).
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.59-68 (Aug. 1983).
The stability of a differentially rotating fluid with respect to axisymmetric instabilities is investigated in the presence of finite viscosity, thermal diffusion and a gradient of chemical composition, of diffusivity. The results confirm that the Goldreich-Schubert-Fricke instability is suppressed already at very small stabilizing composition gradients of the order $N_{\rm S}\approx\Omega$, where $N_{\rm S}$ is the buoyancy frequency due to the chemical gradient and Ω the rotation rate. This excludes the GSF instability as a mixing agent in chemically inhomogeneous stellar interiors. However, two other modes of instability exist, one of which is stabilized only by much stronger composition gradients of the order $N_{\rm S}\approx N_{\rm T}$ where $N_{\rm T}$ is the thermal buoyancy frequency. The other instability is triply diffusive in nature and is probably not very important since like the GSF instability it is limited to composition gradients with $N_{\rm S}\lesssim\Omega$. (31 refs.)

111027 Relaxation oscillations and double temperature structures in stellar coronae. A.G.Hearn, N.P.M.Kuin, P.C.H.Martens (Sterrenkundig Inst., Utrecht, Netherlands).
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.69-74 (Aug. 1983).
Further work using the iterative method of Hearn and Vardavas (1981) for calculating stationary models for stellar coronae has shown that the coronae of small extent obtained with large fluxes of mechanical energy are not stable. It is suggested that the corona undergoes a relaxation oscillation in which a single extended corona collapses to a double corona which in turn builds up to a single extended corona again. An order of magnitude estimate of the period of the relaxation oscillation is more than 70d. Such a coronal relaxation oscillation may be an explanation for the observed variations of mass loss from late B and early A type supergiants and perhaps from Be stars. The inclusion of radiative forces resulting from the absorption of photospheric radiation by resonance lines is discussed. (32 refs.)

111028 Studies of the Carina Nebula. V. The near infrared excess of O-type stars and the anomalous extinction law in their environment. P.S.The, M.Groot (Astron. Inst., Univ. of Amsterdam, Amsterdam, Netherlands).
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.75-82 (Aug. 1983).
For pt.IV see Astron. & Astrophys. Suppl. Ser. vol.41, no.1, p.93-107 (1980). From a photometric study of a sample of O, B and A-type stars located in the Carina Nebula, through 14 broad passbands between 0.3 to 4.0 μm, it is shown that the extinction law of the matter in the direction of the O-type stars is anomalous; this is not the case for most of the B and later type stars. The ratio of total to selective extinction of the O-type stars generally differs from star to star. (36 refs.)

111029 Transport properties of neutrinos in stellar collapse. I. Bulk viscosity of collapsing stellar cores. L.J.van den Horn (Astron. Inst., Univ. of Amsterdam, Amsterdam, Netherlands), C.G.van Weert.
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.93-100 (Aug. 1983).
Presents a detailed kinetic theory calculation of the bulk viscosity due to neutrinos in interaction with a material medium representative of a collapsing stellar core. The general theory of bulk viscous dissipation in a relativistic imperfect fluid is outlined. In stellar collapse the bulk viscosity arises primarily from neutrino absorption by neutrons and electron capture on protons. Assuming these reactions to be in local chemical equilibrium, the authors solve the linearized relativistic neutrino transport equation for the case of bulk viscous dissipation. Owing to the equilibrium constraint, the solution is determined by a single absorption parameter. (32 refs.)

111030 X-rays from stars. L.Golub (Harvard-Smithsonian Center of Astrophys., Cambridge, MA, USA).
Astronomy (USA), vol.11, no.9, p.66-70 (Sept. 1983).
Discusses solar X-ray emission and flares. The role of magnetic fields is discussed. Implications of these results for stellar emission are considered. Coronal emission is discussed. (no refs.)

111031 Radial velocities of bright southern stars. III. Late-type standard stars at 12 Å mm^{-1}. J.Andersen, B.Nordstrom (Copenhagen Univ. Obs., Copenhagen, Denmark).
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.2, p.287-90 (Aug. 1983).
For pt.II see ibid., vol.52, no.3, p.479-82 (1983). Radial velocities have been measured on 51 spectrograms of 14 late-type standard stars, taken with the ESO 1.5 m telescope and coude spectrograph at a dispersion of 12.4 Å mm^{-1} (IIa-O emulsion). A list of 15 suitable lines and wavelengths for radial velocity determination in late-type spectra is established. Using these lines, the internal and external standard errors for a single plate are discussed. (15 refs.)

111032 On the effect of temperature fluctuations on line intensities. P.Gouttebroze (Lab. de Phys. Stellaire et Planetaire, Verrieres-le-Buisson, France).
J. Quant. Spectrosc. & Radiat. Transfer (GB), vol.30, no.3, p.193-211 (Sept. 1983).
Investigates the effects of temperature fluctuations in a stellar atmosphere on the intensities of the lines emitted by a multilevel atom, by differentiating the coupled set of radiative transfer and statistical equilibrium equations. The authors propose a numerical method for the fast computation of large sequences of line profiles when the atmospheric temperatures are fluctuating about a mean curve $T(z)$ (oscillations, waves, turbulence, etc...). This method is applied to a three-level atom simulating the formation of Ca(II) lines in the solar atmosphere and the results are compared with those of direct computations. The authors show how the variations of atomic level populations, line source functions, and emergent intensities, may be related to temperature variations by a sum of several terms corresponding to each atomic transition and arising from the variations of collisional excitation rates. Finally, the

authors discuss the possibility of extending the method to compute profile variations when temperatures, densities and velocities are changing simultaneously within the atmosphere. (13 refs.)

111033 On the excitation of oscillations of stars at their encounters. A.G.Kosovichev, A.B.Severnyi.
Pis'ma v Astron. Zh. (USSR), vol.9, no.7, p.424-31 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
The oscillations arising at close encounters of stars is considered with the aid of numerical methods in linear adiabatic approximations. It is shown that two types of oscillatory motions appear due to the action of tidal force. It is suggested that the 160-min oscillation of the Sun can be a relict phenomenon of encounter of the Sun with a low-mass star, or a cloud. It is also pointed out that the oscillations arising at close encounters are very similar to those of β Cephei stars. (29 refs.)

111034 The wave turbulence spectra in a polytropic atmosphere. E.N.Pelinovskii, N.S.Petrukhin.
Pis'ma v Astron. Zh. (USSR), vol.9, no.7, p.445-8 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
In the weak turbulence approximation, the energy spectrum of acoustic-gravity waves in a polytropic atmosphere is shown to be of the form: $E(k) \propto k^{-9/4}$, $E(\omega) \propto \omega^{-7/2}$. (9 refs.)

111035 Outer atmospheres of late stars. M.M.Katsova (P.K. Shternberg State Astron. Inst., Moscow, USSR).
Sov. Astron. (USA), vol.26, no.6, p.678-83 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1124-33 (Nov.-Dec. 1982).
The short-wavelength spectra of the stars UX Ari during flare activity and in the quiet state and RW Aur are analyzed. An independent determination of the electron density made it possible to draw the reliable conclusion from the line intensities that the extent of the transition region between chromosphere and corona is considerably greater for these stars and Capella than for the Sun. Two groups of stars are distinguished: (1) rotating red dwarfs; (2) subgiants belonging to systems of the RS CVn-type and T Tau-type stars. The former are characterized by coronal loops emitting in the X-ray region. The appearance of considerble fluxes in lines of ions with $T_i \approx 10^5$K in stars of the latter group without X-ray enhancement is connected with direct heating with $T=10^4$-10^5K and with the development of upward-intensifying motions. Such a dynamical model of the outer atmosphere differs considerably from the usually considered outflow of the solar-wind type, efficiently cooling the coronas of stars with low gravity. (24 refs.)

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97.20 NORMAL STARS (BY CLASS): GENERAL OR INDIVIDUAL

111036 Infrared observations of R136, the central object of the 30 Doradus Nebula. N.Panagia (Istituto di Radioastron., CNR, Bologna, Italy), E.G.Tanzi, M.Tarenghi.
Astrophys. J. (USA), vol.272, no.1, pt.1, p.123-30 (1 Sept. 1983).
Photometric observations of R136 in the *J*, *H*, *K*, and *L* infrared filters, reveal the presence of strong excess radiation produced by stellar wind. From model fitting of the infrared continuum determine (*a*) the slope of the velocity variation with radius, (*b*) the mass loss rate, and (*c*) the stellar radius, which is determined in an implicit form as a function of the temperature. Adding information derived from the ionization of the 30 Doradus Nebula, the authors determine an ultraviolet brightness temperature and a total luminosity. This confirms that the stellar mass must exceed 2000 $M_\odot$. The comparable amounts of momentum carried by the wind and the radiation field indicate that the mass loss characteristics of R136 are closer to those of O-type stars rather than W-R stars. Combining the mass loss and luminosity values of R136 with those of galactic supergiants, the authors derive a *M-L* relationship. (36 refs.)

111037 X-rays and rotation among post-T Tauri G stars in Orion Ic. M.A.Smith (Sacramento Peak Obs., Sunspot, NM, USA), S.H.Pravdo, W.H.-M.Ku.
Astrophys. J. (USA), vol.272, no.1, pt.1, p.163-6 (1 Sept. 1983).
V_R sin *i* values and X-ray luminosities are combined for a number of post-T Tauri G stars in the Orion Ic cluster. The results show that rapidly rotating, 1-2 $M_\odot$ G stars actually exhibit stronger X-ray emission than do T Tauri stars. There appears to be a general correlation between L_x/L_{bol} and V_R sin *i*; the indicated exponent of the relation, ~0.5, appears to be slightly smaller than that found for a similar relation for moderately rotating *G-K*, class II-V stars. The shallowness in slope with increasing rotational velocity could indicate that the average surface magnetic flux saturates with increasing magnetic activity and rotational velocity. The existence of circumstellar disks around the X-ray emitters implies that the site of X-ray emission is close to the stellar surface. There is evidence that these disks partially absorb the X-rays in some or all cases. The authors suggest that any coronas in these stars cannot extend more than ~one-half R^* near the equatorial plane. (24 refs.)

111038 A search for X-rays from runaway stars. C.K.Kumar, T.R.Kallman, R.J.Thomas (Howard Univ., Washington, DC, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.219-22 (1 Sept. 1983).
Enhanced X-ray emission from an early-type runaway star would be direct evidence for the presence of a collapsed companion, and thus for its origin as the result of a supernova explosion in a massive binary. To test this idea, measurements of X-ray fluxes in the 0.5-3 keV energy range from nine O and B type runaway stars were made with the Einstein Observatory. In each case, the X-ray luminosity observed does not exceed that expected from a normal OB star. Therefore the authors conclude that, if the runaway stars have collapsed companions, the separations of the components must be much greater than those in normal OB binaries. (15 refs.)

111039 Outer atmospheres of cool stars. XIII. Capella at critical phases. T.R.Ayres (Lab. for Atmospheric & Space Phys., Univ. of Colorado, Boulder, CO, USA), F.H.Schiffer, J.L.Linsky.
Astrophys. J. (USA), vol.272, no.1, pt.1, p.223-33 (1 Sept. 1983).
For pt.XII see ibid., vol.260, no.2, p.670-94 (1982). Presents a high-dispersion ultraviolet study of the late-type spectroscopic binary Capella covering critical phases−three quadratures and one conjunction−in the orbit, as observed with the International Ultraviolet Explorer. The authors' work supports the conclusion reached by Ayres and Linsky (1980), that the rapidly rotating F9 III secondary star in the system is considerably brighter than the more slowly rotating G6 III primary in ultraviolet emission lines. The enhanced ultraviolet emission of the Capella giants compared to other yellow giants in recent *IUE* low-dispersion surveys suggests that the primary and secondary both are crossing the Hertzsprung gap for the first time. If the Capella giants indeed are both first crossers, then the spin-down of stars evolving through the Hertzsprung gap may be quite rapid. The authors conclude that the extraordinary brightness of the Capella secondary in the far-ultraviolet is a transitory, dynamic magnetic phase in the post-main-sequence evolution of moderately massive (~3 $M_\odot$) stars. (44 refs.)

111040 Some constraints on the color-magnitude diagram of giants in the galactic spheroid. J.N.Bahcall, R.M.Soneira (Inst. for Advanced Study, Princeton, NJ, USA), D.C.Morton, K.P.Tritton.
Astrophys. J. (USA), vol.272, no.2, pt.1, p.627-34 (15 Sept. 1983).
The color-magnitude diagram of giants in the galactic spheroid is shown to be important in determining the number-color histogram of stars brighter than $B=19$ mag. This result is demonstrated by comparing a standard Galaxy model with observations of 391 stars in a field in the direction of Aquarius ($l=36.5°$, $b=-51.1°$). (39 refs.)

111041 The Al I-cyanogen correlation in the spectra of globular cluster red giants and the origin of intracluster heavy element variations. J.Norris, G.H.Smith (Mount Stromlo & Siding Spring Observatories, Woden, Australia).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.635-45 (15 Sept. 1983).
A spectroscopic survey of CN-strong/CN-weak pairs or groupings of stars in seven globular clusters has been made to ascertain if there is a positive correlation between the behavior of the resonance lines of Al I at 3944 and 3965 Å and that of the CN bands, as has been reported in NGC 6752. It is found that in five of the clusters such a correlation exists, but that in M4 and 47 Tucanae the Al I lines appear not to vary between the CN-strong and CN-weak groups. The implications of the results and the other abundance patterns of these systems for the origin of intracluster C, N, Na, Al, and heavy *s*-process element variations are considered. (51 refs.)

111042 G74−7: a true DA,F (DAZ) white dwarf. P.Lacombe (Dept. de Phys. & Observatoire du Mont Megantic, Univ. de Montreal, Montreal, Quebec, Canada), J.Liebert, F.Wesemael, G.Fontaine.
Astrophys. J. (USA), vol.272, no.2, pt.1, p.660-4 (15 Sept. 1983).
Reports the first results of an observational attempt to confirm the existence of DA,F white dwarfs (cool, hydrogen-rich with calcium lines) using precision digital spectrophotometry. High-resolution observations of 16 cool white dwarfs ($T_e \lesssim 9500$K), variously classified as DA, DA,F, or DF stars have been carried out. This survey has yielded only one object, G74−7, with a sharp and narrow Ca II K-line of equivalent width 0.7 Å. The corresponding photospheric calcium abundance in G74-7 is Ca/H$\sim 1.2\times 10^{-9}$, and the line profile is consistent with theoretical predictions. The origin of the observed calcium is discussed and it is shown that the heavy element diffusion time scale in the envelope is short compared to the evolutionary time scale of the white dwarf suggesting a recent encounter with an interstellar cloud. (27 refs.)

111043 Outer atmospheres of cool stars. XIV. A model for the chromosphere and transition region of beta Ceti (G9.5 III). K.Eriksson (Joint Inst. for Lab. Astrophys., Univ. of Colorado, Boulder, CO, USA), J.L.Linsky, T.Simon.
Astrophys. J. (USA), vol.272, no.2, pt.1, p.665-77 (15 Sept. 1983).
For pt.XIII see ibid., vol.272, no.1, pt.1, p.223-33 (1983). Computes a model for the chromosphere and transition region of β Ceti (G9.5 III) consistent with *IUE* spectra of the resonance lines of Mg II, C II and C IV. The authors treat the Mg II *h* and *k* lines in partial redistribution and the C II and C IV lines in complete redistribution. A good match to the observed line profile fluxes and to the Mg II *k* line profile is achieved for a hydrostatic equilibrium one-component model with temperature plateaus at 5500K and 22500K, but this model is not unique. Computed line fluxes are presented for a range of models to show the range of permitted temperature structures. (61 refs.)

111044 Late stages of stellar evolution. II. Mass loss and the transition of asymptotic giant branch stars into hot remnants. D.Schonberner (Louisiana State Univ. Obs., Baton Rouge, LA, USA).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.708-14 (15 Sept. 1983).
Computes the transition of asymptotic branch giants of 0.8 and 1.0 $M_\odot$ into remnants of 0.565, 0.553, and 0.546 $M_\odot$ by means of mass loss which removes the stellar envelopes in about 10^3 yr. The remnants then evolve across the H-R diagram to the white dwarf configuration and their relevance for central stars of planetary nebulae is studied. From the temporal evolution of these models lower limits for mass and luminosity of central stars of ~0.55 $M_\odot$ and ~2500 $L_\odot$ are determined. (26 refs.)

111045 The atmosphere of Canopus. II. Chemical composition. Determination of the mass, radius, luminosity, and age. L.S.Lyubimkov, A.A.Boyarchuk (Crimean Astrophys. Obs., USSR).
Astrophysics (USA), vol.18, no.4, p.341-8 (Oct.-Dec. 1982). Translation of: *Astrofizika (USSR)*, vol.18, no.4, p.596-607 (Oct.-Dec. 1982).
For pt.I see Astrofizika, vol.18, no.3, p.375-85 (1982) or Astrophysics, vol.18, no.3, p.228-34 (1983). The model found earlier (Boyarchuk and Lyubimkov, 1982) is used to determine the abundances of 21 elements in the atmosphere of Canopus. The analysis is based on relatively weak lines in order to reduce the influence of inaccuracies in the microturbulence and in the damping. The chemical composition of the atmosphere of Canopus is found to be similar to the solar composition. By comparison with evolution calculations, the mass, radius, luminosity, and age are found for the supergiants α Car, α UMi, and

γ Cyg. It is shown that the extension of the atmospheres of these stars is small compared with their radii. (24 refs.)

111046 Stellar deuterium abundance: a new upper limit in Canopus. R.Ferlet (European Southern Obs., Garching, Munchen, Germany), M.Dennefeld, M.Spite.
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.172-4 (Aug. 1983).
Canopus is a supergiant star, with a mass near 10 $M_{\odot}$, which could have retained its original deuterium during contraction to the main sequence. From high resolution, high signal to noise ratio observations of Hα, a new upper limit for the D/H ratio of 5×10^{-7} by number has been obtained. This upper limit is below the lowest observed ratio in the interstellar medium showing the depletion effect on the initial deuterium abundance by stellar evolution. (17 refs.)

111047 Notes on the heavily reddened and variable A-type supergiant CD$-33°12119$. A.M.van Genderen (Leiden Obs., Leiden, Netherlands), G.Hammerschlag-Hensberge, P.S.The.
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.197-205 (Aug. 1983).
The results of photometric measurements (0.3 to 5 μm) and a spectroscopic study of the variable A2 Ia-type star CD$-33°12119$ are presented. The visual brightness variation of the star shows a peak-to-peak amplitude of $\sim$0.2 and a characteristic period of $\sim$35 d. The most striking phenomena of the visual spectrum are the extremely strong P Cygni profiles of Hα and Hβ. The extinction-free spectral energy distribution fits a theoretical Kurucz LTE model-atmosphere of $T_{\rm eff}=10000$K and log $g=1.5$. These physical parameters fit the *P-L-C* relation for variable supergiants reasonably well. (29 refs.)

111048 A search for rapid spectroscopic variability in the early type supergiants γ and θ Ara. D.Baade (European Southern Obs., Garching, Munchen, Germany).
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.211-15 (Aug. 1983).
Twenty high-dispersion Reticon spectra of the Si III $\lambda\lambda$ 4552-74 triplet and Hα show variable line profiles of γ Ara (B1 Ib) and θ Ara (B2 Ib). The Si III lines of γ Ara are asymmetric, and changes even occur within one hour. There are indications of multiple absorption components. There are reasons to believe that this variability can be explained by pulsation. θ Ara, being 2500K cooler, did not show a similar behaviour. It was instead found in two different states lasting at least 8 and 6 nights, respectively. The change from one state to the other was not directly observed, but it took place within one day. (16 refs.)

111049 Spectroscopy and infrared photometry of southern T Tauri stars. I.Appenzeller, I.Jankovics (Landessternwarte Konigstuhl, Heidelberg, Germany), J.Krautter.
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.2, p.291-309 (Aug. 1983).
Obtains flux calibrated low resolution ($\Delta\lambda\approx7$ Å FWHM, $4200<\lambda<6800$ Å) IDS spectrograms, medium resolution image tube spectrograms ($\Delta\lambda=1.4$ Å, $3650<\lambda<4600$ Å or $\Delta\lambda=1.8$ Å, $3800<\lambda<5000$ Å) and infrared photometry of southern T Tauri stars. The results are presented in a format similar to that of the corresponding northern hemisphere data of Cohen and Kuhi (1979). (25 refs.)

111050 An investigation of short timescale variability in 6 early B stars. C.Stagg (Dept. of Astron., Univ. of Toronto, Toronto, Canada).
Inf. Bull. Variable Stars (Hungary), no.2376, p.1-6 (1 Aug. 1983).
Reports photometric observations during September 1982 of six early B-type stars which have been suspected of short period variability. Light variations were observed in V358 Persei, 2 Vulpeculae and V819 Cygni; however, these variations could not be fitted to previously reported periods. No variations were observed in 1 Camelopardalis (HR 1417), HR 8105 or V568 Cygni. In addition two of the check stars, HD 13970 (B5 Ib) and HR 7577 (F2 V) showed light variations on a time-scale of hours. (12 refs.)

111051 UBV observations and a photometric sequence for the highly active T Tauri star VY Tau. R.P.S.Stone (Lick Obs., Mt. Hamilton, CA, USA).
Inf. Bull. Variable Stars (Hungary), no.2380, p.1-4 (8 Aug. 1983).
The author presents photoelectric UBV photometry and a finding chart for a sequence of 15 stars in the field of the violently variable T Tauri star VY Tauri. In addition six photoelectric observations of VY Tauri itself, covering the period September 1972 to November 1981, are reported. It is found that these measurements were obtained within a period of relative inactivity of the variable star. (4 refs.)

111052 Abundance sensitive parameters for red giants in globular clusters. T.L.Evans (South African Astron. Obs., Cape Town, S Africa).
Mon. Not. R. Astron. Soc. (GB), vol.204, no.3, p.945-59 (Sept. 1983).
Photoeletric VI_{KC} photometry yields structural parameters for the giant branch in nine clusters. Three features are studied spectroscopically in the 5000-6200 Å region. The TiO bands are closely correlated with V-I colour and do not provide an independent abundance criterion. The Mg b lines depend on abundance but lose sensitivity at high metal content, apparently because of the strengthening of the overlapping MgH bands. The NaD lines are adversely affected by interstellar absorption and atmospheric emission. They show a wide scatter at a given colour in 47 Tuc, similar to that found among hotter stars, as well as a strong positive correlation with metal abundance. These and other parameters obtained from photometry and low-resolution spectroscopy order the clusters in a similar way which is at variance with the results of abundance analyses based on high-dispersion spectroscopy. (69 refs.)

111053 A color-selected magnetic white dwarf. R.A.Downes (Dept. of Astron., Univ. of California, Los Angeles, CA, USA), B.Margon.
Publ. Astron. Soc. Pac. (USA), vol.95, no.568, p.358-60 (June 1983).
During a survey for ultraviolet-excess objects in the plane of the Galaxy, the authors have discovered at 15th-magnitude white dwarf with an unusual absorption spectrum. The features are shown to be resolved Zeeman components of hydrogen in a magnetic field of $\sim13\times10^{6}$ gauss. Thus, this is one of the rare magnetic white dwarfs found via color selection. (10 refs.)

111054 Null results from a survey for pulsating DB white dwarfs. E.L.Robinson, D.E.Winget (Dept. of Astron., Univ. of Texas, Austin, TX, USA).
Publ. Astron. Soc. Pac. (USA), vol.95, no.568, p.386-7 (June 1983).
The authors describe the survey in which the pulsating DB white dwarf GD 358 was found, and present a list of the DB white dwarfs observed in the survey that did not have detectable pulsations. It is shown that there are probably no pulsational instability strips for the DB white dwarfs at temperatures less than 20000K. (10 refs.)

111055 On the origin of coronae, stellar winds and microturbulence in early-type stars. A.Z.Dolginov, V.A.Urpin.
Pis'ma v Astron. Zh. (USSR), vol.9, no.6, p.360-3 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
The meridional circulation in early-type stars is considered. It is shown that turbulent velocities generated by meridional flows are of the order of 1-10 km/s in A-B-O stars and are in good agreement with the observed velocities of microturbulence. Acoustic waves generated by turbulence are the sources of energy to heat the coronae. Coronae of O and B stars can emit 10^{34} erg/s in UV and X-rays and can be hot enough to be the sources of strong stellar winds. (12 refs.)

111056 Polarization of stars in R-associations: observational data. N.V.Voshchinnikov, P.E.Marchenko (Leningrad Univ., Leningrad, USSR).
Sov. Astron. (USA), vol.26, no.6, p.673-7 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1115-23 (Nov.-Dec. 1982).
Polarimetric data are assembled for 95 stars that are illuminating reflection nebulae. Most of these belong to 18 standard R-associations. The observed dependence of the percentage polarization P on wavelength and color excess E_{B-V} suggest that the unpolarized light of R-association members may become polarized as it traverses an ensemble of dust grains aligned by a magnetic field which in some cases (Tau R2, Ori R1/R2, Sco R1, Cep R2) is intrinsic to the association. In certain R-associations the grain size is variable and the stochastic magnetic field component fluctuates on a scale of 10-30 pc. (33 refs.)

Planetary Nebulae. International Astronomical Union Symposium No.103 .... See Entry 105027

Nonlinear convection in an imposed horizontal magnetic field .... See Entry 110894

A catalogue of late-type supergiant stars in the Small Magellanic Cloud .... See Entry 110929

Long-period variables in the Magellanic Clouds: supergiants, AGB stars, supernova precursors, planetary nebula precursors, and enrichment of the interstellar medium .... See Entry 111022

On the excitation of oscillations of stars at their encounters .... See Entry 111033

Outer atmospheres of late stars .... See Entry 111035

A comment on red supergiant variables in the SMC .... See Entry 111058

The evolutionary state and pulsation characteristics of red variables in globular clusters .... See Entry 111059

The circumstellar dust of mu Cephei .... See Entry 111060

HD 164615: a probable spotted single F type star .... See Entry 111063

On the nature of dwarf novae .... See Entry 111065

AB Aurigae and its variable hydrogen lines .... See Entry 111071

The intrinsic properties of 29 Cepheids in the Magellanic Clouds .... See Entry 111072

The old-nova GK Per (1901). III. Accretion disc models .... See Entry 111076

R CrB .... See Entry 111080

AG Draconis .... See Entry 111082

SU Tauri .... See Entry 111085

R Coronae Borealis .... See Entry 111087

U Aquarii .... See Entry 111088

Observations of red variable stars in globular clusters .... See Entry 111089

M and S stars in the Magellanic Clouds .... See Entry 111090

Symbiotic stars: spectrophotometry at 3-4 and 8-13 μm .... See Entry 111091

HR 4912: a variable of the old-disk population .... See Entry 111096

New observations of six RV Tauri and SRd variable stars .... See Entry 111098

A photometric and spectrographic study of YZ Bootis .... See Entry 111099

The photometric behavior of FK Comae Berenicis .... See Entry 111102

Spectrophotometric observations of CH Cygni in 1980-1982 .... See Entry 111103

A photometric study of dwarf novae .... See Entry 111106

A new look at BE Ursae Majoris .... See Entry 111128

RW Tauri as a weak W Serpentis star .... See Entry 111129

Detection of a stellar prominence of the K supergiant 32 Cyg .... See Entry 111134

A study of UV spectra of ζ Aur/VV Cep stars. IV. System parameters and mass-loss of δ Sge .... See Entry 111135

Preliminary 1983 photometry of HD 174429 (PZ tel.) .... See Entry 111138

Some observations of the central star of the bipolar planetary nebula NGC 2346 .... See Entry 111139

ϵ Aurigae .... See Entry 111141

A study of the binary system 58 Persei .... See Entry 111144

CPD $-62°$ 1837: a K0 III+Mira binary system? .... See Entry 111145

A photometric orbit for the eclipsing binary AG Phoenicis .... See Entry 111147

Narrow- and intermediate-band Hα and O I λ7774 photometry and Reticon spectroscopy of SX Cassiopeiae .... See Entry 111148

Identification of the soft X-ray source H 1011$-$47 (=E 1013$-$477): a new magnetic variable? .... See Entry 111149

Ultraviolet observations of the transient X-ray sources A 0535+26 and A 0620$-$00 .... See Entry 111150

S stars in ω Centauri .... See Entry 111158

The spectroscopic parallax of Stock 14 .... See Entry 111161

Radio images of the bipolar H II region S106 .... See Entry 111167

Herbig-Haro objects in the dust globule ESO 210-6A .... See Entry 111175

Spectrophotometry of low excitation Herbig-Haro objects .... See Entry 111181

X-ray emission from pre-main-sequence stars, molecular clouds, and star formation .... See Entry 111185

Bipolar gas jets in star-forming regions .... See Entry 111197

97.30 VARIABLE AND PECULIAR STARS

(inc. novae)

111057 Hα observations of four novae in M31. R.Ciardullo, H.Ford (Univ. of California, Los Angeles, CA, USA), G.Jacoby.
Astrophys. J. (USA), vol.272, no.1, pt.1, p.92-8 (1 Sept. 1983).
On-line off-line Hα plates of M31's nucleus revealed four bright stellar objects ($m_R\approx14.9$, 15.0, 15.8, 16.4) within 1.2 kpc of the galaxy center. Spectrophotometric observations made 10 days later showed the stars were novae in the stage of early decline. In the 10 day interval, the Hα emission from these novae faded less than a magnitude, despite the fact that their continua had long since faded from view. The high luminosity and long decay time of the Hα emission suggest it might take an excellent standard candle for extragalactic distance measurements. (27 refs.)

111058 A comment on red supergiant variables in the SMC. J.A.Frogel (Cerro Tololo Inter-American Obs., Casilla, La Serena, Chile).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.116-17 (1 Sept. 1983).
Infrared photometric observations of two suspected supergiant carbon stars in the Small Magellanic Cloud (SMC) show that these stars have mean luminosities no greater than those of known C stars in the Clouds and hence are not candidates for the 'missing' bright C stars. Some suspected supergiant counterparts to oxygen rich Mira-type variables are also shown to be quite distinct from supergiants and are more likely luminous asymptotic giant branch stars. (13 refs.)

111059 The evolutionary state and pulsation characteristics of red variables in globular clusters. J.A.Frogel (Cerro Tololo Inter-American Obs., Casilla, La Serena, Chile).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.167-74 (1 Sept. 1983).
Infrared photometry, effective temperatures, and bolometric magnitudes for more than 50 red giant variables in globular clusters are assembled and discussed. All of the long-period variables (LPVs) in the clusters have luminosities greater than that corresponding to core helium flash, so they must be asymptotic giant branch (AGB) stars. Why luminous AGB stars (the LPVs) are only in metal-rich clusters is not understood. Part of the explanation probably lies in higher red giant masses in clusters of higher metallicity. Red *K-L* colors for the LPVs are probably indicative of relatively high mass loss rates compared to the non-LPV variables. Those red variables which lie at considerably warmer temperatures than the giant branches of their clusters could be AGB stars, and some may have circumstellar shells. (46 refs.)

111060 The circumstellar dust of mu Cephei. C.Rogers, P.G.Martin, D.R.Crabtree (Scarborough Coll., Univ. of Toronto, Toronto, Ontario, Canada).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.175-81 (1 Sept. 1983).
An accurate solution to the equation of transfer in spherical geometry (including an anisotropic phase function) is used to model *IUE* observations of the circumstellar extinction of μ Cep. Some grain materials can thus be eliminated from consideration while others can be restricted in grain size (and envelope optical depth). Further discrimination of candidate grain models is achieved through analysis of the thermal infrared emission. It is found that circumstellar dust similar to basaltic glass with enhanced near-infrared absorptivity would satisfy observations in both wavelength regimes. (17 refs.)

111061 Confirmation among visual multiples of an increase of Ap stars with age. H.A.Abt (Kitt Peak Nat. Obs., Tucson, AZ, USA), O.Cardona.
Astrophys. J. (USA), vol.272, no.1, pt.1, p.182-9 (1 Sept. 1983).
Open clusters with ages below certain threshold values contain no Ap stars and those with greater ages contain numbers of Ap stars that apparently increase with age. But in view of the few young clusters studied, the data could also be interpreted in terms of random differences in the frequencies of Ap stars between individual clusters, rather than an age effect. The authors therefore obtained data on 77 field visual multiple systems (that originated from many different clusters and associations) in which the primaries are O5-A1 stars and the secondaries occur in the absolute magnitude range of the Ap stars. Again spectral classification shows no Ap stars in systems with ages $\leq 10^6$ yr and a steady increase in Ap stars thereafter. The numerical agreement with the cluster data is good, confirming that the cluster data are exhibiting a real age effect. (21 refs.)

111062 The massive WC6+O6-8 spectroscopic binary HD 94305. V.S.Niemela, R.H.Mendez (Inst. de Astron. y Fisica del Espacio, Buenos Aires, Argentina), A.F.J.Moffat.
Astrophys. J. (USA), vol.272, no.1, pt.1, p.190-5 (1 Sept. 1983).
HD 94305 is found to be a double-lined WC6+O6-8 spectroscopic binary. The minimum masses of the components of this binary are 15 $M_\odot$ and 32 $M_\odot$ for the Wolf-Rayet and the O type components, respectively. The relatively high minimum mass for the WC6 component adds further evidence to the notion presented by Niemela (1981) that the more massive WC6-8 stars cannot be descendants of the less massive WN3-5 stars. (16 refs.)

111063 HD 164615: a probable spotted single F type star. H.A.Abt (Kitt Peak Nat. Obs., Tucson, AZ, USA), G.Bollinger, E.W.Burke,Jr..
Astrophys. J. (USA), vol.272, no.1, pt.1, p.196-201 (1 Sept. 1983).
This star shows light variations by 0.05 mag in a period of about 0.815^d, but there are substantial differences from cycle to cycle. The authors explore various possible explanations for the variations. First, the star is not an Ap variable because its spectrum is normal (F2 IV) and it does not have the color variations that are typical of an Ap star. It is not an ellipsoidal primary because the radial velocity does not change; a lack of change in line widths excludes the possibility of its being a double-lined binary with unresolved lines. It is probably not a pulsating star because of the lack of color and velocity changes. However, the hypothesis of a single rotating spotted star fits because the rotational period (1.7^d sin *i*) is compatible with the light period (0.815^d) and it offers a natural explanation for changes from cycle to cycle in terms of changes in spot activity. (22 refs.)

111064 A search for light-time effects in binary Cepheids: AW Persei. N.R.Evans (Erindale Coll., Univ. of Toronto, Toronto, Ontario, Canada).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.214-18 (1 Sept. 1983).
Phase residuals in *O-C* diagrams for the classical Cepheid AW Persei are examined to see whether they produce periodic variations associated with binary orbital motion (the light-time effect). Variations of several standard deviations in the *O-C* diagram are consistent with a light-time interpretation. The available radial velocity information is in agreement with the size and timing of the light curve shifts. An orbital period of 20 years is derived from recent radial velocities. Mass estimates from the orbit are discussed. (23 refs.)

111065 On the nature of dwarf novae. J.Smak (Joint Inst. for Lab. Astrophys., NBS, Washington, DC, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.234-7 (1 Sept. 1983).
Observational data on mass transfer rates and radii of disks indicate that the outer parts of disks in novae and nova-like binaries are sufficiently hot for stationary accretion; those in dwarf novae are too cool to avoid an accretion instability; while those in Z Cam systems are the borderline cases. The mass ratios of novae and nova-like binaries with main-sequence secondaries appear—at a given orbital period—to be systematically larger than those of dwarf novae, implying that higher mass ratios are responsible for higher mass transfer rates. (28 refs.)

111066 Photoionization models for the winds from cataclysmic variables. T.R.Kallman (Center for Space Res., MIT, Cambridge, MA, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.238-44 (1 Sept. 1983).
Photoionization models are presented for the relative abundances of Si IV, C IV, and N V as a function of the ionization parameter and shape of the ionizing continuum spectrum in the EUV and X-ray energy range. These models are applied to the interpretation of the UV resonance lines observed from the cataclysmic variable TW Virginis by Cordova and Mason (1982). The observed lines are assumed to be formed in gas flowing supersonically out from the continuum source in the form of a stellar wind. It is shown that the shape of the ionizing spectrum can be determined without assuming that the outflow is spherical by fitting to ratios of the line strengths. Under the added assumption of spherical outflow the derived ionization parameter for the X-ray component can be used to constrain the total mass flux in the wind. (23 refs.)

111067 Element identifications in the ultraviolet spectrum of HD 101065. G.Wegner (Dept. of Phys. & Astron., Dartmouth Coll., Hanover, NH, USA), D.J.Cummins, P.B.Byrne, D.J.Stickland.
Astrophys. J. (USA), vol.272, no.2, pt.1, p.646-59 (15 Sept. 1983).
Ultraviolet spectroscopic observations with the IUE satellite of the controversial peculiar star HD 101065 are presented and discussed. Low-resolution spectra combined with published visual and infrared broad-band photometry show that the star's spectral energy distribution is greatly distorted, presumably by the severe line blanketing. However, the presence of observable ultraviolet flux below 1900 Å suggests that HD 101065 is considerably hotter than 6000K. A detailed examination of the high-resolution spectrum of HD 101065 in the region 1900-3200 Å found that the lines of the iron-peak elements Fe II, Cr II, Mn II, and Ti II are strongly represented in the ultraviolet spectrum. The implications of the presence of these elements for the temperature estimate and nature of HD 101065 are discussed. (35 refs.)

111068 Spectrographic observations of the suspected delta Scuti variable beta Ari. A.Barbiano Di Belgioso, M.Fracassini, L.E.Pasinetti, P.Stroppa (Dipartimento de Fisica, Univ. de Milano, Milano, Italy).
Astrophys. & Space Sci. (Netherlands), vol.94, no.1, p.97-113 (July 1983).
Three sets of spectra (in all 85 spectra) of the well-known standard and high eccentricity spectroscopic binary star beta Ari were taken. These sets were taken during the periastron passage of 14-15 November 1976, after the periastron passage of 2-3 October 1977 and before the apastron passage of 23 November 1977. The analysis of the radial velocities RV and equivalent widths W_λ of hydrogen and metal lines show periodic variations similar to those of some classical delta scuti stars. The variations of the asymmetries of the profiles of H and Ca II K lines, linked to the variations of the RV seem to recall the Schuster effect observed in classical Cepheids. A periastron effect appears. A faint 'bump' in RV and W_λ curves of Ca II K line is singled out. (35 refs.)

111069 The magnetic field variation of the Ap star HR 465. G.Scholz (Zentralinst. fur Astrophys., Astrophys. Obs., Potsdam, Germany).
Astrophys. & Space Sci. (Netherlands), vol.94, no.1, p.159-63 (July 1983).
The magnetic field of HR 465 varies with a period of 23.3 yr. The number and intensity of the absorption lines show their extrema at the times of the cross-over points of the magnetic field in contrast to the phase relation of these quantities known for most short-time magnetic Ap stars. Apart from the variations produced by the binary motion no further general velocity changes were found. The radial velocity determined by lines of the neutral elements differ somewhat significantly from those of the ionized elements. The interpretation causes difficulties in all discussed models; a precession model seems to be a little more favourable than a rigid-rotator or alternating dynamo model. (9 refs.)

111070 Period-luminosities relation of classical Cepheids. G.R.Ivanov, N.S.Nikolov (Dept. of Astron., Univ. of Sofia, Sofia, Bulgaria).
Astrophys. & Space Sci. (Netherlands), vol.94, no.1, p.191-200 (July 1983).
A PL-relation for the Cepheids in the Galaxy, the Magellanic Clouds and M31 is constructed. On deriving this relation both the period-radius and period-colour relations are used. The distance moduli of the three galaxies under discussion are obtained. The colour-coefficient of period-colour-luminosity-relation is briefly discussed. (54 refs.)

111071 AB Aurigae and its variable hydrogen lines. U.Finkenzeller (Landessternwarte, Konigstuhl, Heidelberg, Germany).
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.157-62 (Aug. 1983).
Coude spectrograms of dispersion 8 and 16 Å/mm of the variable Herbig Ae/Be star AB Aur are discussed. From this material and a 5.3 Å/mm echelle spectrogram of H_α and NaD a stellar wind, possibly decelerated, and a relatively compact emitting region close to the star are suggested. The latter region is variable on time scales of less than a day. The heliocentric radial velocity of AB Aur of $+21 \pm 10$ km s^{-1} is in agreement with $+15.3 \pm 0.6$ km s^{-1} observed for the associated molecular cloud. The possibility that AB Aur is a member in a close binary system is not supported. (5 refs.)

111072 The intrinsic properties of 29 Cepheids in the Magellanic Clouds. A.M.van Genderen (Leiden Obs., Leiden, Netherlands).
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.223-35 (Aug. 1983).
The intrinsic properties of 29 long-period Cepheids in the Magellanic Clouds are derived applying individual reddening corrections. The temperature/colour relation is calibrated using the temperatures of the theoretical $V-B/B-U$ diagram. In order to match observations with the theoretical ML relations of Becker et al. (1977), distance moduli of 19.12 and 18.65 for the SMC and LMC, respectively, had to be adopted. The theoretical indication that at constant period Cepheids in their first crossing through the instability strip are brighter than in the other crossings, seems to be confirmed by the observations. PLT$_{eff}$ relations are determined. (37 refs.)

111073 Spectroscopic observations of the cataclysmic variable HL CMa during outburst. W.Wargau, A.Bruch, H.Drechsel, J.Rahe (Astron. Inst., Univ. Erlangen-Nurnberg, Bamberg, Germany).
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.L1-4 (Aug. 1983).
Presents optical spectrophotometric observations of the cataclysmic system HL CMa during rise, maximum, and decline phase of an outburst. The spectral evolution is discussed. At maximum light, broad absorption troughs of the Balmer lines are visible. In addition, strong H, He I, He II, and CIII-NIII (4650 Å) emission is present. Radial velocity measurements reveal an orbital period of $0.2145^d \pm 0.0006^d$. The overall spectral behavior makes HL CMa an unusual cataclysmic variable. (6 refs.)

111074 Infrared colors of the chemically peculiar stars of the upper main sequence. W.K.Bonsack, H.M.Dyck (Inst. for Astron., Univ. of Hawaii, Honolulu, HI, USA).
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.29-33 (Aug. 1983).
A program of *J, H, K, L′, M* photometry of CP stars and normal comparison stars has been carried out at the Mauna Kea Observatory. The infrared colors of the CP and normal stars are found to be similar to each other, and to the predictions of normal model atmospheres, to within at worst 20%. These results do not support the conclusion of Groote et al. (1980, 1981) that infrared excesses at 5 μm are found in CP stars wtih magnetic fields. (16 refs.)

111075 Non-LTE analysis of massive O stars. III. The O3 stars HD93128, HD93129 A, and HDE303308. K.P.Simon (Inst. fur Astron. und Astrophys., Univ. Munchen, Munchen, Germany), G.Jonas, R.P.Kudritzki, J.Rahe.
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.34-44 (Aug. 1983).
For pt.II see ibid., vol.118, no.2, p.245-54 (1983). The three stars HD 93128: O3V ((f)), HD 93129 A are analyzed by means of high-resolution, low-noise

coude spectra. The measurements of the equivalent width of He I λ4471 and of the Balmer and He II line profiles yield the helium abundance and effective temperatures and gravities. From the position in the log *g*-log T_{eff} diagram and from theoretical evolutionary tracks the authors deduce some results. From the distance of the ocean clusters Tr 14 and Tr 16 the authors evaluate radii and luminosities. (53 refs.)

111076 The old-nova GK Per (1901). III. Accretion disc models. A.Bianchini, F.Sabadin (Asiago Astrophys. Obs., Asiago, Italy).
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.112-16 (Aug. 1983).
For pt.II see ibid., vol.106, no.1, p.176-8 (1982). The UV spectrum of the old-nova GK Per (1901) at quiescence greatly differs from those of the other observed old-novae. In spite of the presence of high excitation emission lines the UV to visual continuum energy distribution is peaked at ~3600 Å, whereas for most old-novae it steeply rises towards shorter wavelengths. The authors construct a grid of models of accretion discs around a magnetic white dwarf for two physically different cases. A modification of the standard disc model in which the inner edge of the disc does not reach the star fails to reproduce the observed X-ray to infrared energy distribution. A better fit is achieved with a disc model whose radial temperature distribution has been changed by the presence of magnetic field lines. (37 refs.)

111077 Stimulated emission and the flat Balmer decrements of cataclysmic variable stars. M.Elitzur, G.J.Ferland (Dept. of Phys. & Astron., Univ. of Kentucky, Lexington, KY, USA), W.G.Mathews, G.A.Shields.
Astrophys. J. Lett. Ed. (USA), vol.272, no.2, pt.1, p.L55-9 (15 Sept. 1983).
Balmer emission lines from cataclysmic variables often have nearly equal intensities rather than the rapid decrement predicted by simple nebular theory. Traditionally, this has been interpreted in terms of local thermodynamic equilibrium emission from a dense gas with small volume located just above the accretion disk. The authors show that the intense radiation field within a close binary system can affect excited-state populations and optical emission in ways which allow a relatively low density gas to closely mimic the high-density situation. In at least one case, the old nova V603 Aql, the emitting gas has a low density and nearly fills the orbital plane of the system. If this is characteristic of other systems, then the determination of orbital parameters and masses of cataclysmic variables from emission-line radial velocities, as well as the prediction of soft X-ray emission from accreting binaries, will be affected. (17 refs.)

111078 The orbital periods for six cataclysmic binaries. A.W.Shafter (Dept. of Astron., Univ. of California, Los Angeles, CA, USA).
Inf. Bull. Variable Stars (Hungary), no.2377, p.1-2 (1 Aug. 1983).
The orbital periods of VW Vulpeculae, V380 Ophiuchi, CM Delphini, TW Virginis, V794 Aquilae and SY Cancri have been determined from the radial velocity variations of their Hα emission lines. (5 refs.)

111079 The spectrum of VY Aquarii at minimum. E.M.Hendry (Corralitos Obs., Las Cruces, NM, USA).
Inf. Bull. Variable Stars (Hungary), no.2381, p.1-3 (10 Aug. 1983).
The author reports spectroscopic observations of the recurrent nova VY Aquarii on 17 and 18 July 1983. The star was at minimum at this time, with m≤16. The spectrum is that of a Be star with all the hydrogen lines visible in emission from Hβ to H11. He I emission lines and Ca IIK emission were also present. All the lines took the form of double emission-central absorption profiles, in which the violet emission was always the wider feature. Radial velocities are presented for all measurable features. There is considerable scatter in the velocities of the central absorptions, both on a single spectrum and from night to night; however, there is no consistent Balmer progression. (4 refs.)

111080 R CrB. G.M.Hurst.
Br. Astron. Assoc. Circ. (GB), no.637, 1 pp. (12 Sept. 1983).
It is reported that R Coronae Borealis has started to fade. A visual magnitude estimate of 6.8 is reported for 1983 August 26. (no refs.)

111081 GK Persei. G.M.Hurst.
Br. Astron. Assoc. Circ. (GB), no.637, 1 pp. (12 Sept. 1983).
A visual magnitude estimate of 10.6 is reported for 1983 August 15. It appears that GK Persei has reached a similar magnitude to that observed during the last mini-outburst in 1981. (no refs.)

111082 AG Draconis. R.Viotti, C.Eiroa, A.Cassatella, A.Altamore.
I.A.U. Circ. (USA), no.3855, 1 pp. (29 Aug. 1983).
It is reported that the Population II symbiotic star AG Draconis has now reached a minimum state following the active phase which began in 1980. Coordinated ultraviolet and infrared observations during June 1983 indicate that the ultraviolet continuum and line fluxes have decreased and are now close to the pre-outburst values. The equivalent width of He II 164 nm is much larger than at maximum, suggesting a higher temperature for the hot source. Small, probably irregular, light variations in JHKL were observed during 1981-1983, but these are not correlated with the UV variations. These observations confirm that the hot radiation source undergoes large-amplitude variations, whereas the cool star is more stable. (1 ref.)

111083 Novalike object in Libra. J.Maza.
I.A.U. Circ. (USA), no.3856, 1 pp. (29 Aug. 1983).
It is reported that this novalike object is present at m_{pg}=18.5 on the ESO B Survey and on essentially monthly exposures since 1980. A further observation on 1983 August 18 showed the object at m_{pg}~10. (1 ref.)

111084 GK Persei. M.Verdenet, I.Dalmeri, J.Bortle, E.Mayer, M.Cavagna, C.E.Spratt, C.Scovil.
I.A.U. Circ. (USA), no.3856, 1 pp. (29 Aug. 1983).
Visual and photographic magnitude estimates are reported for the period 1983 August 6 to 24. (no refs.)

111085 SU Tauri. J.Mattei.
I.A.U. Circ. (USA), no.3856, 1 pp. (29 Aug. 1983).
Reports visual magnitude estimates of this R Coronae Borealis variable for the period 1983 April 10 to August 21; the star is recovering from the minimum of October 1982. (2 refs.)

111086 KR Aurigae. J.Bortle.
I.A.U. Circ. (USA), no.3857, 1 pp. (29 Aug. 1983).
Reports visual magnitude estimates for the period 1983 August 10 to 16. (1 ref.)

111087 R Coronae Borealis. J.Mattei.
I.A.U. Circ. (USA), no.3857, 1 pp. (29 Aug. 1983).
It is reported that R Coronae Borealis has started to fade. Visual magnitude estimates are presented for the period 1983 August 10 to 25. (2 refs.)

111088 U Aquarii. J.Bortle.
I.A.U. Circ. (USA), no.3857, 1 pp. (29 Aug. 1983).
Reports visual magnitude estimates of this R Coronae Borealis star for the period 1983 July 21 to August 16. (no refs.)

111089 Observations of red variable stars in globular clusters. T.L.Evans (South African Astron. Obs., Cape Town, S Africa).
Mon. Not. R. Astron. Soc. (GB), vol.204, no.3, p.961-73 (Sept. 1983).
Extensive observations of line strengths in the spectra of variable and constant stars in globular clusters show that while variable stars often have H emission lines, the H lines in variables of small amplitude often show stronger absorption than typical non-variable stars. Strong H emission is found in stars of smaller amplitude as well as in Mira variables, especially in the more metal-deficient clusters, and is often accompanied by a weakening of strong lines of neutral metals which is well known in Mira variables. The subdivision of red variables into Mira, semi-regular and supragiant branch stars, as well as small amplitude variables on the giant branch, is apparent in 47 Tuc: the extension of this subdivision to very metal-poor clusters, where generally small amplitudes and a prevalence of strong H emission complicate the situation, is discussed. (65 refs.)

111090 M and S stars in the Magellanic Clouds. T.L.Evans (South African Astron. Obs., Cape Town, S Africa).
Mon. Not. R. Astron. Soc. (GB), vol.204, no.3, p.985-96 (Sept. 1983).
Digital spectra of 46 red stars in the field of the SMC and in globular clusters in both Magellanic Clouds reveal that 8 are K stars, 18 are M stars, 19 are early S stars and 1 is a foreground dwarf. Stars with B-V ~2 in the field of the SMC may be of type K, M or S, though a common explanation for the abnormal colours in terms of an enhanced C/O ratio seems likely. Most of the non-carbon stars brighter than $M_{bol}=-4.3$ in the clusters are S stars, which evidently represent an intermediate stage in the modification of atmospheric composition. Systematic trends with cluster age are tentatively outlined, indicating that the M→S and S→C transitions occur at higher luminosity and lower surface temperature in the younger (more massive) stars. (38 refs.)

111091 Symbiotic stars: spectrophotometry at 3-4 and 8-13 μm. P.F.Roche (Dept. of Phys. & Astron., Univ. Coll. London, London, England), D.A.Allen, D.K.Aitken.
Mon. Not. R. Astron. Soc. (GB), vol.204, no.3, p.1009-15 (Sept. 1983).
Presents infrared spectrophotometry of 20 symbiotic stars, mostly of the dust-rich variety. HDE 330036 is unique in showing an emission feature at 11.3 μm. The remainder combine a hot grey component and/or optically thin silicate emission. A model in which the grey component is due to optically thick silicate dust is not consistent with the spectra. The authors propose instead that iron-based grains, expected to form in the ejecta of cool stars, are heated by the ultraviolet radiation field of the hot companion. (19 refs.)

111092 Outburst period-energy relations in cataclysmic novae. G.T.Bath (Dept. of Astrophys., Univ. of Oxford, Oxford, England), J.van Paradijs.
Nature (GB), vol.305, no.5929, p.33-6 (1 Sept. 1983).
Shows that the behaviour of SS Cygni is in close agreement with theoretical predictions of dynamically unstable states of the red star when it fills the Roche-lobe, and is in conflict with the assumptions of early disk instability models. (18 refs.)

111093 γ-ray line emission from SS 433. R.C.Lamb, J.C.Ling, W.A.Mahoney, G.R.Riegler, W.A.Wheaton, A.S.Jacobson (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Nature (GB), vol.305, no.5929, p.37-9 (1 Sept. 1983).
Reports preliminary evidence for γ-ray line emission from the region of SS 433. The observations were accomplished with the high-resolution γ-ray spectrometer aboard the HEAO 3 satellite. One of the line features reported, located at an energy of 1.5 MeV, has a statistical significance of ~6 σ during a particular 18-day interval. Another feature appears near 1.2 MeV. The observed energies may be explained in terms of a kinematic model as blue- and red-shifted components of the 1.369-MeV line from a nuclear transition of ^{24}Mg from its first excited state to its ground state. (12 refs.)

111094 Spectrophotometry of Nova Muscae 1983. B.S.Shylaja (Indian Inst. of Astrophys., Bangalore, India).
Observatory (GB), vol.103, no.1055, p.203-4 (Aug. 1983).
Reports a spectral scan on 1983 February 4 when the nova appeared to be $\sim 11^m$. The observations were confined to the region from *Hβ* to *Hα*. Line identifications and comparisons with other nova spectra suggest that the nova was in the 'Orion' phase at the time. (6 refs.)

111095 Sk−71°34: a new Wolf-Rayet star in the Large Magellanic Cloud. P.S.Conti, C.D.Garmany (Dept. of Astrophys., Univ. of Colorado, Boulder, CO, USA).
Publ. Astron. Soc. Pac. (USA), vol.95, no.569, p.411-12 (July 1983).
Reports the serendipitous discovery of a relatively weak-lined Wolf-Rayet star of the nitrogen sequence in the Large Magellanic Cloud. (13 refs.)

111096 HR 4912: a variable of the old-disk population. R.E.Luck (Dept. of Phys. & Astron., Louisiana State Univ., Baton Rouge, LA, USA), D.L.Lambert, H.E.Bond.
Publ. Astron. Soc. Pac. (USA), vol.95, no.569, p.413-21 (July 1983).
HR 4912 is a luminous F-type star lying at a galactic latitude of +36°; it is also a low-amplitude variable with a 44-to 68-day period. It is shown that HR 4912 has a moderately low iron content: [Fe/H]=−1.2, implying that it derives from the old-disk population. The N/C ratio is large, indicating mixing of CNO-cycled material to the surface. The derived gravity implies an absolute magnitude $M_v \sim -4$. HR 4912 is probably evolving to the left off the asymptotic giant branch in the H-R diagram; it is suggested that it is an SRd-type variable. (47 refs.)

111097 The behavior of Hα in the 16-day Cepheid X Cygni. G.Wallerstein (Astron. Dept., Univ. of Washington, Seattle, WA, USA).
Publ. Astron. Soc. Pac. (USA), vol.95, no.569, p.422-6 (July 1983).
Presents radial velocities of X Cyg from 19 spectra of 10 Å mm^{-1} obtained at the Dominion Astrophysical Observatory. All the spectra were taken between phases 0.6 and 0.2 so as to cover rising light very thoroughly. As with other long-period cepheids a redward displaced component of Hα appears near phase 0.80 and gradually descends to the center-of-mass velocity of the star where it remains from near phase 0.3 to the next maximum. A violet-shifted component appears near maximum and may be related to Ca II emission seen before maximum. The velocity curves of Hα are discussed in terms of velocity gradients in the outer envelope of X Cyg combined with the excitation of the metastable 2s state of hydrogen by trapped *Lα* and collisions. (15 refs.)

111098 New observations of six RV Tauri and SRd variable stars. D.L.Dupuy, J.W.B.Allwright (Dept. of Astron., Saint Mary's Univ., Halifax, Canada), D.W.Dawson, J.L.Africano.
Publ. Astron. Soc. Pac. (USA), vol.95, no.569, p.427-32 (July 1983).
Differential photoelectric observations in the *b* and *y* filters of the four-color system have been obtained of five known or questionable RV Tau variable stars and one SRd variable, using the 1.2-meter telescope at Cloudcroft Observatory. These observations spanned roughly 180 days for TT Oph and V564 Oph, with 40 to 50 observations each (every fourth night on the average). The other four stars, (TX Aql, DW Peg, EI Peg, and Z Sex) were all

observed an average of 13 nights, spanning roughly 100 nights. One to three cycles were covered for each star. V564 Oph displayed an unusual asymmetric deep minimum in its light curve. TT Oph has adhered closely to its light elements (61.08^d) over the past 43 years. (8 refs.)

111099 A photometric and spectrographic study of YZ Bootis. M.D.Joner, D.H.McNamara (Dept. of Phys. & Astron., Brigham Young Univ., Provo, UT, USA).
Publ. Astron. Soc. Pac. (USA), vol.95, no.569, p.433-9 (July 1983).
Photometry of YZ Boo has been secured in the $uvby\beta$ photometric system. A reddening value, $E(b-y)=-0.018^m$, is derived from the photometry. Intrinsic $(b-y)$ and c_1 values used in conjunction with a model-atmosphere grid yields a mean effective temperature, $\langle T_{eff}\rangle=7590$K, and a mean surface gravity, $\langle \log\ g\rangle=3.95$. The metal abundance determined from δm_1 is $[Fe/H]=-0.25$. A mean absolute bolometric magnitude, $\langle M_{bol}\rangle=+1.7$ is inferred from the data. A radius determination by the Wesselink method failed. The radial-velocity data indicate a mean radial velocity of -20 km s^{-1} and a total velocity range of 35 km s^{-1}. YZ Boo is apparently a normal Population I dwarf Cepheid. (15 refs.)

111100 Spectroscopy of six Wolf-Rayet stars: the latest and faintest. P.Massey (Dominion Astrophys. Obs., Herzberg Inst. for Astrophys., Victoria, Canada), P.S.Conti.
Publ. Astron. Soc. Pac. (USA), vol.95, no.569, p.440-6 (July 1983).
Presents absolute spectrophotometry and classification of six relatively faint galactic Wolf-Rayet (WR) stars for which previous photometry was poor. One of these objects, the heavily reddened infrared source CRL 2179, is the faintest known galactic WR star, with a visual magnitude ~22. Its spectral type is WC10, later than that of any other known Population I WC star. Another faint star, WR 122, has a strong N II emission-line spectrum which is unprecedented: its type is defined by the authors as WN10. The other four stars have typical WR spectra. (25 refs.)

111101 BD+43°1894, a mono-periodic delta Scuti star. A.Yamasaki (Dept. of Earth Sci. & Astron., Univ. of Tokyo, Tokyo, Japan), S.F.Gonzalez, R.Peniche, J.H.Pena.
Publ. Astron. Soc. Pac. (USA), vol.95, no.569, p.447-50 (July 1983).
New photoelectric observations have been carried out in two different observatories to increase the observing time span of the δ Scuti variable star BD+43°1894. Analysis of these data gives 0.098286^d as the only period of pulsation, making its period one of the shortest among the mono-periodic δ Scuti stars. (5 refs.)

111102 The photometric behavior of FK Comae Berenicis. S.L.Morris, E.F.Milone (Rothney Astrophys. Obs., Univ. of Calgary, Calgary, Canada).
Publ. Astron. Soc. Pac. (USA), vol.95, no.568, p.376-85 (June 1983).
UBVRI light curves are given of FK Com obtained in February 1981. The light curves and two large flares on this star are examined, and all published light curves of this object are Fourier analyzed and discussed in terms of the current models of this star. An improved period of 2.39960 ± 0.00015 days is also obtained. (20 refs.)

111103 Spectrophotometric observations of CH Cygni in 1980-1982. A.P.Ipatov, B.F.Yudin.
Pis'ma v Astron. Zh. (USSR), vol.9, no.7, p.421-3 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
Spectrophotometric observations of CH Cyg in the spectral range 3300-7500 Å with the resolution of 50 Å were carried out in 1980-2. Maximum *UV* radiation was observed in the spring 1982, the bolometric luminosity of the *UV* source not exceeding 10% from the bolometric luminosity of CH Cyg at its quiet period stage. A possibility of explaining the CH Cyg phenomenon in the frame of a single-giant-star model with a hot bright spot in the atmosphere is not rejected by the energetic estimates. (11 refs.)

111104 The intermediate and narrow band photoelectric studies of some delta Scuti stars. C.Ibanoglu, A.Y.Ertan, Z.Tunca, O.Tumer, S.Evren (Ege Univ. Obs., Bornova, Izmir, Turkey).
Rev. Mex. Astron. & Astrofis. (Mexico), vol.5, no.4, p.261-9 (March 1983).
Intermediate and narrow band photoelectric photometry of the delta Scuti type variables 28 And, 28 Aql, κ Boo and 44 Tau was performed and the physical parameters, average periods were redetermined. The light curves are presented and their variations are discussed. (28 refs.)

111105 Spectral variations in HD 190002: evidence of a companion. G.F.Bisiacchi, C.Firmani, E.de Lara (Inst. de Astron., Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
Rev. Mex. Astron. & Astrofis. (Mexico), vol.5, no.4, p.285-8 (March 1983).
Eight medium dispersion (1.1 Å $channel^{-1}$) spectra of HD 190002 are analyzed in the spectral range 4440-4800 Å. The equivalent width and the profile of the C III 4650 Å He II 4686 Å blend shows periodic variability with a period of 8.16 days. The variation of the equivalent width of the line is interpreted as being due to the periodic contribution to the continuum of the WC7 star by a secondary object. (10 refs.)

111106 A photometric study of dwarf novae. J.Echevarria (Univ. of Sussex, Brighton, England), D.Jones.
Rev. Mex. Astron. & Astrofis. (Mexico), vol.5, no.4, p.301-8 (March 1983).
A catalogue of *UBVRI* photoelectric photometry of dwarf novae available in the literature is presented. A comparison with theoretical colour-colour diagrams from steady state discs is made. A correlation of *V*-magnitude with the depth of the Balmer discontinuity is discussed. (46 refs.)

111107 The radial pulsation modes of the δ Scuti stars, and their nonuniform period distribution. Ts.G.Tsvetkov (Phys. Dept., Sofia Univ., Sofia, Bulgaria).
Sov. Astron. (USA), vol.26, no.6, p.666-72 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1103-14 (Nov.-Dec. 1982).
From Breger's 1979 survey of the observational data for the δ Sct variables, radial pulsation modes are assigned to 83 of these stars. They can pulsate in the four lowest modes; F, $1H$, $2H$, $3H$, and perhaps also in $4H$ and even $5H$. Confirming the author's earlier suggestion, the apparent nonuniformity in the distribution of δ Sct stars both with respect to period and in the period-luminosity diagram may naturally be attributed to pulsation in differing modes. Semiempirical (P,L) relations are derived for the four lowest modes, and the semiempirical and theoretical period ratios are compared. Several statistical relationships are obtained, and in certain cases criteria are proposed for determining the radial-pulsation mode. (32 refs.)

111108 Mapping of chemical elements on the surfaces of Ap stars. I. Solution of the inverse problem of finding local profiles of spectral lines. A.V.Goncharskii, V.V.Stepanov, V.L.Khokhlova, A.G.Yagola (Phys. Dept., Moscow State Univ., Moscow, USSR).
Sov. Astron. (USA), vol.26, no.6, p.690-6 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1146-56 (Nov.-Dec. 1982).
An algorithm is developed for solving the incorrectly stated inverse problem of finding local profiles of spectral lines for a rotating, chemically inhomogeneous star by Tikhonov's regularization method. The program is written in the FORTRAN language and investigated through the solution of model problems. (21 refs.)

111109 WBVR photometry of SS 433: spectra of the 'normal' star and the accretion disk. A.M.Cherepashchuk, A.A.Aslanov, V.G.Kornilov (P.K. Shternberg State Astron. Inst., Moscow, USSR).
Sov. Astron. (USA), vol.26, no.6, p.697-702 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1157-66 (Nov.-Dec. 1982).
WBVR photoelectric photometry of SS 433 is carried out at different phases of the 13-day period (phase $\psi\simeq0.5$ for the 164-day period). The light curves in the WBVR filters are qualitatively similar and the depths of the primary minimum (eclipse of the accretion disk by the 'normal' star) are $O.8^m$, 0.7^m, 0.55^m, and 0.4^m in the W, B, V, and R filters, respectively. The authors bring out the 13-day periodic variability in the J, H, and K filters (using published data). The interstellar absorption is determined for SS 433:$A_v=7.4^m$-8.3^m. Drawing on infrared observations, the authors construct unreddened spectra of the 'normal' star and the accretion disk at phases $\psi=0.5$ and 0 of the 164-day precession period. For $A_v=7.4^m$-8.3^m the spectrum of the 'normal' star has a color temperature $T_c=13000$-43000K. The mass of the 'normal' star is $m_v>10\ M_\odot$. The 'normal' star fills its Roche lobe and outflow takes place in the thermal time scale of relaxation. The spectrum of the projection of the accretion disk in the optical range is bluer than that of the 'normal' star and for $A_v=7.85^m$ it can be approximated satisfactorily by a Planck function at $T\geq50000$K. The bolometric luminosity of the disk exceeds 10^{40} erg/sec. The appearance of collimated relativistic ejections perpendicular to the disk plane is evidently connected with supercritical accretion of matter onto the relativistic object in the massive close binary system. The analogy between the processes taking place in the accretion disk in the SS 433 system and the processes observed in the galactic nuclei and quasars is pointed out. (28 refs.)

A catalogue of late-type supergiant stars in the Small Magellanic Cloud .... See Entry 110929

Long-period variables in the Magellanic Clouds: supergiants, AGB stars, supernova precursors, planetary nebula precursors, and enrichment of the interstellar medium .... See Entry 111022

On the excitation of oscillations of stars at their encounters .... See Entry 111033

Outer atmospheres of late stars .... See Entry 111035

X-rays and rotation among post-T Tauri G stars in Orion Ic .... See Entry 111037

Outer atmospheres of cool stars. XIII. Capella at critical phases .... See Entry 111039

A search for rapid spectroscopic variability in the early type supergiants γ and θ Ara .... See Entry 111048

Spectroscopy and infrared photometry of southern T Tauri stars .... See Entry 111049

An investigation of short timescale variability in 6 early B stars .... See Entry 111050

UBV observations and a photometric sequence for the highly active T Tauri star VY Tau .... See Entry 111051

Null results from a survey for pulsating DB white dwarfs .... See Entry 111054

Preliminary 1983 photometry of HD 174429 (PZ tel.) .... See Entry 111138

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Identification of the soft X-ray source H 1011−47 (=E 1013−477): a new magnetic variable? .... See Entry 111149

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S stars in ω Centauri .... See Entry 111158

The spectroscopic parallax of Stock 14 .... See Entry 111161

X-ray emission from pre-main-sequence stars, molecular clouds, and star formation .... See Entry 111185

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Probable association of UX Piscium with a galaxy .... See Entry 111232

97.60 LATE STAGES OF STELLAR EVOLUTION
(inc. black holes)

97.60B Supernovae

111110 On the frequency of supernova flares in Sc galaxies. R.G.Mnatsakanyan (Byurakan Astrophys. Obs., USSR).
Astrophysics (USA), vol.18, no.4, p.321-8 (Oct.-Dec. 1982). Translation of: *Astrofizika (USSR)*, vol.18, no.4, p.563-73 (Oct.-Dec. 1982).
The mean frequency of supernova explosions in Sc galaxies is determined by a method used to calculate the mean frequency of flares of flare stars in star aggregates (Ambartsumyan 1969). The mean time interval between two successive supernova explosions in one Sc galaxy brighter than 12.0^m is 48 years. It has not been possible to find clear dependence of the frequency of supernova explosions on the luminosity of the parent galaxy for the considered group of galaxies. (15 refs.)

111111 Anomalous reddening of supernovae. M.Joeveer (Inst. of Astrophys. & Phys. of Atmosphere, Acad. of Sci., Estonian SSR).
Astrophysics (USA), vol.18, no.4, p.328-31 (Oct.-Dec. 1982). Translation of: *Astrofizika (USSR)*, vol.18, no.4, p.574-9 (Oct.-Dec. 1982).
A study is made of the correlation between the color excesses E_{B-V} and the distorted (by absorption) absolute magnitudes M_{pg} of supernovae in the complex around the Virgo cluster of galaxies. It is shown that type I supernovae with different reddenings have equal $M0_{pg}$ only when allowance is made for the absorption of light in accordance with the anomalous relation $A_{pg}=1.8E_{B-V}$. After allowance for absorption in accordance with this relation moderately reddened ($E_{B-V}<0.5$) type I supernovae in spiral galaxies are almost as good standard candles as type I supernovae in elliptical galaxies. (17 refs.)

111112 Cosmological estimate of the age of stars exploding as Type I supernovae. I.S.Shklovskii (Space Res. Inst., Acad. of Sci., Moscow, USSR).
Nature (GB), vol.304, no.5926, p.513 (11 Aug. 1983).
There is evidence to suggest that quasars are active nuclei of galaxies most of which formed at $z\sim2.5$ when the age of the Universe was 1000-2000 Myr. During the same period of time the intergalactic gas should have formed in clusters, with a Fe abundance lower by a factor of 3 than that of oxygen. It is argued that the evolution time of the stars responsible for the synthesis of

Fe nuclei (apparently Type 1 supernovae) should be ~1500 Myr and their masses small, ~1.7-1.5 $M_{\odot}$. (7 refs.)

111113 Discovery of an IR echo from a supernova dust cloud. J.R.Graham, W.P.S.Meikle, M.J.Selby (Dept. of Phys., Imperial Coll. of Sci. & Technol., London, England), D.A.Allen, A.Evans, G.Pearce, M.F.Bode, A.J.Longmore, P.M.Williams.
Nature (GB), vol.304, no.5928, p.709-10 (25 Aug. 1983).
The authors have obtained IR light curves for SN 1982e in NGC 1332 covering 100-250 days after its discovery. It is shown that the IR radiation is due to heated dust. No evidence has been found for grain condensation in the SN ejecta. In fact, the light curves reveal that the IR emission originates from a pre-existing circumstellar dust cloud and is produced by an 'echo' of the UV and visible pulse of the SN. (18 refs.)

111114 The Local Group supernova rate. S.Van Den Bergh (Dominion Astrophys. Obs., Herzberg Inst. of Astrophys., Victoria, Canada).
Publ. Astron. Soc. Pac. (USA), vol.95, no.568, p.388-90 (June 1983).
Observations of distant spirals would lead one to expect a total of ~6 $(H/50)^2$ supernovae per century in Local Group galaxies other than the Milky Way. In fact only one such subject (S And) has been discovered during the last 100 years. Available evidence on historical galactic supernovae is roughly consistent with the supernovae rate derived from distant spirals. It is therefore tentatively concluded that the number of Local Group Supernovae may have been unusually low during the last century or that some of them have unexpectedly remained undiscovered. (13 refs.)

111115 Supernova outburst in a circumstellar dusty envelope. V.A.Okorokov.
Pis'ma v Astron. Zh. (USSR), vol.9, no.6, p.353-7 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
The appearence of a supernova outburst in a circumstellar dusty envelope is studied. Spectra of emergent radiation at various stages of the supernova flash are constructed. The influence of the envelope on the probability of supernova detection is estimated. For a mass-loss rate at the supergiant stage of $M=10^{-3}$ $M_{\odot}$/yr the probability to detect the flash decreases by more than an order of magnitude. (14 refs.)

111116 Line profiles and a model of the envelope of the type II supernova SN 1970g. N.N.Chugai (Astron. Council, Acad. of Sci., USSR).
Sov. Astron. (USA), vol.26, no.6, p.683-90 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1134-45 (Nov.-Dec. 1982).
Profiles of the Hα and Na Iλ 5892 lines, which are observed in the spectrum of SN 1970g, are calculated. The expansion velocity V_c at the photosphere level, which proved to be considerably lower than the radial velocity of the absorption minima, is found from a comparison of calculations and observations. The velocity V_c decreases with time. The kinematic radius $V_c t$ of the photosphere reaches a maximum almost simultaneously with the photometric radius on about the 10th day after the end of the 'plateau' phase. The value of n_e, which does not depend on the adopted distance to the supernova, is determined from the Hα profile. The mass of ionized hydrogen in the envelope (0.1-0.2 $M_{\odot}$), the oxygen mass (0.03-0.2 $M_{\odot}$), and the sodium mass (10^{-4} $M_{\odot}$) are estimated. The distribution of ionized hydrogen in the envelope of Sn 1970g based on the velocities has a concentration maximum in the vicinity of $V=1400$ km/sec for the time of 92 days after maximum light. The density of matter in the envelope declines with an increase in velocity, at least in the velocity range $V>1500$ km/sec. (17 refs.)

Blast waves with cosmic-ray pressure .... See Entry 110882

Long-period variables in the Magellanic Clouds: supergiants, AGB stars, supernova precursors, planetary nebula precursors, and enrichment of the interstellar medium .... See Entry 111022

On the evolution of massive zero-metal stars .... See Entry 111152

Phenomena in the center of the Galaxy as a consequence of a recent supernova outburst .... See Entry 111235

97.60G Pulsars

111117 On the radio pulse emission mechanism of PSR 1133+16: simultaneous dual-frequency high time resolution observations. V.Boriakoff (Nat. Astron. & Ionosphere Center, Cornell Univ., Ithaca, NY, USA).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.687-701 (15 Sept. 1983).
The microstructure of PSR 1133+16 (a pulsar which has two peaks in the average pulse profile) has been studied simultaneously at 318 and 196.3 MHz with the 305 m Arecibo radio telescope. A cross-correlation study shows that the microstructure is broad band in this frequency range, and that it follows the interstellar plasma dispersion relation. That is, the emission of a micropulse is simultaneous at 318 and 196.3 MHz at the source. However, the subpulses do not follow the dispersion line but instead follow the $\nu^{-0.26}$ dependence of the average profile peak separation with frequency. Implications of these observations for current theories are discussed. (33 refs.)

111118 Implications of the millisecond pulsar for neutron star models. S.L.Shapiro, S.A.Teukolsky, I.Wasserman (Center for Radiophys. & Space Res., Cornell Univ., Ithaca, NY, USA).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.702-7 (15 Sept. 1983).
Examines the constraints imposed by the high spin rate of PSR 1937+214 on the masses and radii of nonrotating neutron stars that can be spun up to such a short period. Assuming uniform rotation, it is found that none of the currently viable nuclear equations of state can be ruled out. However, the discovery of a single pulsar with period $\lesssim 0.5$ ms would rule out all current equations of state. Assuming that PSR 1937+214 was spun up uniformly from a nonrotating progenitor requires that the maximum mass of a nonrotating star in general relativity cannot exceed 12.5 $M_{\odot}$, independent of any knowledge of the equation of state. This limit decreases linearly with the shortest known period of a pulsar. (38 refs.)

111119 On the decay of gamma-quanta of curvature radiation near a pulsar surface. V.V.Usov, A.E.Shabad.
Pis'ma v Astron. Zh. (USSR), vol.9, no.7, p.401-4 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
It is shown that when the magnetic field strength on the surface of a pulsar exceeds 0.2 B_{cr} ($B_{cr}=m^2c^3/e\hbar$) a considerable number of curvature photons with the electric field vector orthogonal to the plane in which the external magnetic field and the photon wave vector lie decay before reaching the threshold of pair creation. Polarization observations of the pulsar curvature γ-radiation may present a possibility of judging the value of the magnetic field near the pulsar surface. (22 refs.)

97.60J Neutron stars

111120 Structure of neutron star envelopes. E.H.Gudmundsson, C.J.Pethick, R.I.Epstein (Nordita, Copenhagen, Denmark).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.286-300 (1 Sept. 1983).
Investigates the envelopes of nonmagnetic neutron stars using the best available opacities and equation of state. The temperature at the inner boundary of the envelope, T_b, is found to be very nearly a universal function of the parameter T_s^4/g_s, where T_s is the effective surface temperature, and g_s is the surface gravity of the neutron star. This result is used to derive a number of other scaling relations, to investigate the effects of general relativity on the thermal structure of the envelope, and to compare envelope calculations by different workers. (61 refs.)

111121 Analytic neutron stars in general relativity: exact solutions for the non-homogeneous charged model. J.M.Ibanez Cabanell (Dept. de Mecanica y Astron., Facultad de Matematicas, Burjasot, Valencia, Spain).
Astrophys. & Space Sci. (Netherlands), vol.94, no.1, p.133-43 (July 1983).
Extends the so-called Adams' (1974) method to the non-homogeneous charged model of neutron stars. Numerical applications are compared with results obtained for a given equation of state. (22 refs.)

111122 Normal and pion-condensed states in neutron star matter in a relativistic field theory constrained by bulk nuclear properties. I. N.K.Glendenning, B.Banerjee, M.Gyulassy (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Ann. Phys. (USA), vol.149, no.1, p.1-21 (Aug. 1983).
A theory of isospin asymmetric matter and of neutron star matter in particular, which is compatible with bulk nuclear properties, is formulated in the framework of a relativistic field theory and solved in the mean field approximation. The self-consistent conditions defining the σ-, ω-, π-, and ρ-fields are derived for the normal and the pion-condensed states in explicit form for asymmetric matter, which is in chemical equilibrium, and with prescribed total charge. (12 refs.)

111123 Normal and pion-condensed states in neutron star matter in a relativistic field theory constrained by nuclear bulk properties. II. N.K.Glendenning, P.Hecking, V.Ruck (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Ann. Phys. (USA), vol.149, no.1, p.22-43 (Aug. 1983).
For pt.I see ibid., vol.149, no.1, p.1-21 (1983). A relativistic field theory of isospin asymmetric matter and of neutron star matter in particular, which is compatible with nuclear matter bulk properties, was formulated in Part I of this series and treated in mean-field approximation. The self-consistent solutions include the σ, ω, and ρ-fields for both the normal and pion-condensed states. The bulk properties of nuclear matter such as saturation density and energy, compressibility and asymmetry energy impose rather stringent restrictions on meson-nucleon coupling constants and the parameters of the nonlinear interactions in the σ-model. The numerical results include the equation of state, particle densities as functions of charge and baryon density and the composition of a neutron star. Based on these results, the authors discuss neutron star cooling for various equations of state. (18 refs.)

111124 Thermal origin of neutron star magnetic fields. R.D.Blandford, J.H.Applegate, L.Hernquist.
Mon. Not. R. Astron. Soc. (GB), vol.204, no.3, p.1025-48 (Sept. 1983).
It is proposed that magnetic field arises naturally in neutron stars as a consequence of thermal effects occurring in their outer crusts. The heat flux through the crust can give rise to a possible thermoelectric instability in the solid crust which causes horizontal magnetic field components to grow exponentially with time. However, in order for the thermally driven growth to exceed ohmic decay, either the electron collision time must exceed existing estimates by a factor ~3 or the surface layers comprise helium. A second instability is possible if the liquid phase that lies above the solid crust also contains a horizontal magnetic field. If either of these two instabilities develops the field will quickly grow to a strength of $\sim 10^{12}$G, where the instabilities become non-linear. Further growth will saturate when either the magnetic stress exceeds the lattice yield stress or the temperature perturbations become non-linear, both of which occur at a subsurface field strength of $\sim 10^{14}$G; the corresponding surface field strength is $\sim 10^{12}$G. Further evolution of the magnetic field should lead to long-range order and yield neutron star magnetic dipole moments $\sim 10^{30}$G cm^3, comparable with those observed. (75 refs.)

Gravitational radiation and the motion of compact bodies ..... See Entry 105184

Relativistic hydrodynamics of a superfluid .... See Entry 108096

Implications of the millisecond pulsar for neutron star models .... See Entry 111118

A 0538−66 .... See Entry 111143

97.60L Black holes

111125 The dynamics of dissipatively heated spherical accretion. E.T.Scharlemann (Dept. of Astron., Columbia Univ., New York, NY, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.279-85 (1 Sept. 1983).
The dynamical equations that describe dissipatively heated spherical accretion onto a black hole are developed, without the customary assumption of equipartition between the magnetic energy density and the gravitational potential energy density. Instead, the (somewhat arbitrary) assumption is made that, after averaging over a spherical surface, the local electric field associated with the magnetic field dissipation is a fixed fraction of the Alfven velocity times the radial field strength. A dynamically significant radial stress term appears in the momentum equation; the stress is shown also to be required by energy conservation, irrespective of the electric field assumption. The radial stress gives rise to an instability of the flow, characterized by density and temperature fluctuations of opposite sign. The instability has implications for the variability and Comptonization of the luminosity of quasars and active galactic nuclei. (10 refs.)

111126 Neutrino emission from black holes. F.Giovannelli (Inst. of Space Astrophys., CNR, Frascati, Italy), S.Karakula, W.Tkaczyk.
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.126-9 (Aug. 1983).
Spherically accretion of matter onto massive objects (Schwarzschild black holes) is one of the processes responsible for the heating of a proton plasma up to ultra-relativistic temperatures. Using the neutrino and antineutrino energy production spectra in a relativistic plasma (Giovannelli et al., 1983) in the temperature range 10^{11}-10^{13}K, the authors derive the expected neutrino and antineutrino energy spectra from matter accreting spherically onto massive objects. From the computed spectra, the luminosity of a black hole of 10 $M_{\odot}$ and with mass accretion rate $M=10^{-8}$ $M_{\odot}$/yr and the emissivity of the same object for the same Mach's numbers are found. (14 refs.)

General relativistic axisymmetric rotating systems: coordinates and equations .... See Entry 105181

Gravitational radiation and the motion of compact bodies ..... See Entry 105184

Viscous drag on an accretion disk due to an embedded stellar system .... See Entry 110884

Discovery of a massive unseen star in LMC X-3 .... See Entry 111127

Super-Eddington luminosity characteristics of active galactic nuclei .... See Entry 111222

Dissipative capture of stars by the active objects in galactic nuclei .... See Entry 111238

The distinction between Seyfert 1 and Seyfert 2 galaxies ...... See Entry 111244

On the possibility of a test of the cosmology of asymptotically free SU(5) theory .... See Entry 111289

97.80 BINARY AND MULTIPLE STARS

(inc. extrasolar planetary systems)

111127 Discovery of a massive unseen star in LMC X-3. A.P.Cowley (Univ. of Michigan, Ann Arbor, MI, USA), D.Crampton, J.B.Hutchings, R.Remillard, J.E.Penfold.
Astrophys. J. (USA), vol.272, no.1, pt.1, p.118-22 (1 Sept. 1983).
Spectroscopic observations of the optical counterpart of LMC X-3 show it to be a spectroscopic binary in the Large Magellanic Cloud with an orbital period of 1.70 days. The B3 main-sequence primary has a large radial velocity amplitude ($K=235\pm11$ km s^{-1}) indicating a mass function of 2.3 $M_\odot$. LMC X-3 is an extremely luminous and variable X-ray source, but no 1.7 day X-ray periodicity has been detected. The lack of optical and X-ray eclipses limits the inclination to $i=<70°$ and implies a mass for the unseen star of $M_x>9.0$ $M_\odot$, if the B star has a normal mass. The system now appears to be the strongest evidence for the existence of a stellar mass black hole and is the first extragalactic example. (18 refs.)

111128 A new look at BE Ursae Majoris. D.Crampton, A.P.Cowley, J.B.Hutchings (Dominion Astrophys. Obs., Herzberg Inst. of Astrophys., Victoria, BC, Canada).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.202-5 (1 Sept. 1983).
The radial velocity and light curve of BE UMa have been studied to determine the physical parameters of the stellar components. The authors find that the primary is a very hot subdwarf which has a large heating effect on a cool secondary, whose magnitude and radius both indicate that it is an evolved subgiant. (10 refs.)

111129 RW Tauri as a weak W Serpentis star. M.J.Plavec, J.J.Dobias (Dept. of Astron., Univ. of California, Los Angeles, CA, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.206-13 (1 Sept. 1983).
The short-period classical Algol system RW Tauri was observed with the *IUE* satellite in 1982 August and with the ITS scanner of Lick Observatory between 1982 August and October. *IUE* observations in the total eclipse showed weak excess continuous radiation in the LWR camera, while the SWP camera revealed several emission lines typical for the W Serpentis stars and of about the same strength as in U Cephei. Combined *IUE* and optical scans gave for the primary star: $T_{\rm eff}=11750$K, log $g=4.2$, spectral type of the cool component as K0 III, color excess $E(B-V)=0.14$ mag, and distance to the system 270 pc. (25 refs.)

111130 HEAO 1 high-energy X-ray observations of Centaurus X-3. S.K.Howe, F.A.Primini, M.W.Bautz, F.L.Lang, A.M.Levine, W.H.G.Lewin (Dept. of Phys., MIT, Cambridge, MA, USA).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.678-86 (15 Sept. 1983).
The results of observations of Cen X-3 made with the UCSD/MIT High-Energy X-Ray and Low-Energy Gamma-Ray Experiment aboard the HEAO 1 satellite are presented. The observations covered two $\sim50^d$ time intervals spanning ~1 yr. The results include the detection of both high- and low-intensity states, measurement of the pulsation period and its rate of change over the entire second 50^d interval, detection of X-ray pulsations above ~38 keV, and measurement of the X-ray spectrum above ~12 keV as a function of pulse phase. (37 refs.)

111131 Spectrophotometric studies of star HD 157978. M.A.Hamdy (Helwan Obs., Cairo, Egypt), S.Abou Elazm.
Astrophys. & Space Sci. (Netherlands), vol.94, no.1, p.1-3 (July 1983).
Examination of the stellar spectrum of this star reveals that it has a composite spectrum. It could be classified as (A7V+G5V). It contains three forbidden (Fe II) lines which are of the essential features of η Carinae stars. The spectrum also contains H, He I, Fe II, Mn I, Ti II, and other different lines. The K-line seems to be sharp double line while other lines appear single ones which suggest early component may be double. This also seems to be true according to radial velocity measurements. (4 refs.)

111132 Apsidal motion in the eclipsing binary AS Cam. Kh.F.Khaliullin, V.S.Kozyreva (Sternberg Astron. Inst., Moscow Univ., Moscow, USSR).
Astrophys. & Space Sci. (Netherlands), vol.94, no.1, p.115-22 (July 1983).
Multi-colour WBVR photoelectric observations of the eclipsing binary AS Cam have been carried out and the photometric elements, absolute dimensions, and the angular velocity of a periastron motion (ω_0Rdb$_s$) are determined. The obtained value of $\omega_{\rm obs}$ is almost three times smaller than that theoretically predicted. (18 refs.)

111133 The angular momentum of eclipsing binaries. R.F.Sistero, S.Marton (Obs. Astron., Univ. Nacional, Cordoba, Argentina).
Astrophys. & Space Sci. (Netherlands), vol.94, no.1, p.165-70 (July 1983).
The angular momentum-mass relationship for 1048 eclipsing binaries is presented. (13 refs.)

111134 Detection of a stellar prominence of the K supergiant 32 Cyg. K.-P.Schroder (Hamburger Sternwarte, Univ. Hamburg, Hamburg, Germany).
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.L16-18 (Aug. 1983).
A sequence of high-resolution IUE spectra taken around the 1981 eclipse of 32 Cyg B has been used for determining light curves at various UV wavelengths. The first detection of a stellar prominence of the K supergiant, seen as transient absorption of the B star continuum flux, is reported. The absorption mechanism is most probably Rayleigh scattering which follows from the wavelength dependence of optical depths $\tau_\nu\sim\nu^{5.5}$. The prominence has a typical column density of $N_H=2.8\times10^{24}$ cm^{-2}, α linear extension perpendicular to the line of sight of about 30 $R_\odot$ and an apparent height of 15 $R_\odot$ above the limb. (19 refs.)

111135 A study of UV spectra of ζ Aur/VV Cep stars. IV. System parameters and mass-loss of δ Sge. D.Reimers, K.-P.Schroder (Hamburger Sternwarte, Univ. Hamburg, Hamburg, Germany).
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.241-6 (Aug. 1983).
The orbital elements of the δ Sge system are improved using new radial velocity measurements. A distance of 170 pc is determined with the assumption that the companion is a main-sequence star with $T_e=10500$K (ca. B9) as found from IUE fluxes. Using circumstellar Fe II absorption lines in the UV spectrum of the B star companion, a mass-loss rate of 2×10^{-8} $M_\odot$yr^{-1} has been found for the M2 II primary. Evidence for an accretion disk around the B star fed by the M giant wind and a shock front moving with the B star is briefly discussed. (26 refs.)

111136 HD 134518: a main-sequence detached or a semi-detached eclipsing binary?. G.Russo (Capodimonte Astron. Obs., Naples, Italy).
Astron. Nachr. (Germany), vol.304, no.3, p.133-6 (1983).
Analyzes Przybylsky's (1981) photometric observations of HD 134518, an eclipsing binary with a period of 1.15 days and a β Lyrae type light curve. Performing a grid of solutions with different assumed values of the mass ratio by means of the Wilson-Devinney method the author has determined the photometric elements of this variable, which shows an extremely low mass ratio ($q=m_c/m_h=0.06$) and appears to be a semi-detached system. The discrepancies between the Wilson-Devinney solution and the Wood solution are pointed out. (12 refs.)

111137 A redetermination of the orbit of HD 123299. E.W.Elst (Koninklijke Sterrenwacht van Belgie, Brussel, Belgium), B.Nelles.
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.2, p.215-17 (Aug. 1983).
Radial velocity measurements of HD 123299 are presented. All available data are analysed and lead to improved orbital elements. (7 refs.)

111138 Preliminary 1983 photometry of HD 174429 (PZ tel.). J.L.Innis, D.W.Coates, T.T.Moon, K.Thompson (Dept. of Phys., Monash Univ., Clayton, Victoria, Australia).
Inf. Bull. Variable Stars (Hungary), no.2378, p.1-4 (4 Aug. 1983).
Reports photoelectric BV photometry during May and June 1983 of the RS Canum Venaticorum star HD 174429 (KO Vp). (8 refs.)

111139 Some observations of the central star of the bipolar planetary nebula NGC 2346. A.Purgathofer, A.Schnell (Inst. for Astron., Univ. of Vienna, Vienna, Austria).
Inf. Bull. Variable Stars (Hungary), no.2379, p.1-3 (8 Aug. 1983).
The authors report UBV photometry of the central star of NGC 2346 between April 1982 and January 1983. Between March and October 1982 the light curve was nearly sinusoidal, with maxima and minima in V-light of about 11.5 and 14.0 mag. However, since November 1982 the brightness of the star has decreased throughout the light curve, and a very deep and wide minimum has developed; in January 1983 the star varied between about magnitude 12.5 and magnitude 15.0, and the central phase of the eclipse extended from $\phi=0.7$ to $\phi=0.3$. (5 refs.)

111140 Local regularization of the magnetic-binary problem. A.G.Mavraganis (Nat. Tech. Univ., Athens, Greece).
Celestial Mech. (Netherlands), vol.30, no.3, p.219-24 (July 1983).
The singularities in a magnetic-binary system are regularized separately by changing both the coordinates and the time. It is shown why, in this problem, it is more efficient to relate the geometric transformation to the rescaling of time. (5 refs.)

111141 ϵ Aurigae. M.Parthasarathy, D.L.Lambert.
I.A.U. Circ. (USA), no.3857, 1 pp. (29 Aug. 1983).
Observations of ϵ Aurigae during totality show variations in the strength of the K I 770 nm resonance line: W(λ) was 0.055 nm between December 1982 and March 1983, and 0.043 nm between April and July 1983. The Hα line is broad and the emission in the wings has disappeared. (1 ref.)

111142 4U 1543−45. R.J.Blissett, H.Pedersen, M.Veron, P.Veron, H.-E.Schuster.
I.A.U. Circ. (USA), no.3858, 1 pp. (6 Sept. 1983).
It is reported that an EXOSAT observation on 1983 August 28 located the transient X-ray source 4U 1543−45 at $\alpha=15^h43^m34^s$, $\delta=-47°31.1'$ (equinox 1950.0). The 2 to 10 keV spectrum is unusually soft, with a characteristic temperature of about 1.7 keV. A possible optical counterpart of this X-ray source has been identified, namely a 15th-magnitude star at $\alpha=15^h43^m33.9^s$, $\delta=-47°30'54''$ (equinox 1950.0); this star has recently brightened by about 1 magnitude. Low dispersion spectra obtained on September 2 and 3 show emission lines of He I, He II and N III. (2 refs.)

111143 A 0538−66. J.Menzies, I.Howarth.
I.A.U. Circ. (USA), no.3858, 1 pp. (6 Sept. 1983).
It is reported that the LMC recurrent X-ray transient A 0538−66 appears to have become active again. Spectrograms obtained on 1983 August 9 show weak emission lines at Hβ and Hγ, and a strong, double-peaked emission line at He II 469 nm. An IUE observation on August 26 shows emission lines at N V 1224 nm, C IV 155 nm and He II 164 nm. (1 ref.)

111144 A study of the binary system 58 Persei. D.L.Harmer, D.J.Stickland, C.Lloyd, C.F.W.Harmer, C.D.Pike (Royal Greenwich Obs., Hailsham, England), D.Croft.
Mon. Not. R. Astron. Soc. (GB), vol.204, no.3, p.927-34 (Sept. 1983).
The spectroscopic (and astrometric) binary 58 Persei has been observed at optical wavelengths and with IUE. The system is shown to consist of a mid-B-type main-sequence star and a late-G-type supergiant at a distance of 320 pc. (27 refs.)

111145 CPD −62° 1837: a K0 III+Mira binary system?. J.W.Menzies, R.M.Catchpole, P.A.Whitelock (South Africa Astron. Obs., Cape Town, S Africa).
Observatory (GB), vol.103, no.1055, p.195-8 (Aug. 1983).
From new optical and infrared observations of the Trapezium-like system CPD −62° 1837, it is shown that the faintest star (C), of spectral type M3 III, is not physically associated with the other two. Stars A and B are at the same distance and have the same radial velocities to within the errors of measurement. One of these stars (B) is a Mira variable with a period of 320 days. (7 refs.)

111146 Spectroscopic binary orbits from photoelectric radial velocities. LI. 30 Vulpeculae. R.F.Griffin (Cambridge Obs., Cambridge, England).
Observatory (GB), vol.103, no.1055, p.199-203 (Aug. 1983).
Presents an orbital analysis of this bright late-type giant star derived from four Lick observations (1918-21) and 61 observations from the period 1969-83. (30 refs.)

111147 A photometric orbit for the eclipsing binary AG Phoenicis. M.A.Cerruti (Inst. de Astron., Fisica del Espacio, Buenos Aires, Argentina).
Publ. Astron. Soc. Pac. (USA), vol.95, no.568, p.347-53 (June 1983).
In each of the UBV bandpasses about 1760 observations define for the first time the photoelectric light variation of the binary system AG Phe. A consis-

tent set of elements is derived in the framework of the classical model. The system would be a well-detached binary consisting of two normal A9 and K0 main-sequence components. (15 refs.)

111148 Narrow- and intermediate-band Hα and O I λ7774 photometry and Reticon spectroscopy of SX Cassiopeiae. E.F.Guinan (Dept. of Astron., Villanova Univ., Villanova, PA, USA), S.Tomczyk, D.J.Turnshek.
Publ. Astron. Soc. Pac. (USA), vol.95, no.568, p.364-7 (June 1983).
The complicated 36.57-day eclipsing binary SX Cas was observed on eight nights during February and March 1979 with pairs of intermediate- and narrow-band filters centered on the wavelengths of the Balmer Hα line and the O I λ7774 triplet. In addition, a Reticon spectrum, covering a wavelength range of 4750 Å to 7700 Å, was obtained during September 1979; this shows strong Hβ and Hα emission lines as well as showing absorption features of the K-giant component of the system. Strong Hα emission is found at all the orbital phases sampled. The emission is consistent with the presence of significant amounts of circumstellar and circumbinary gas. (8 refs.)

111149 Identification of the soft X-ray source H 1011$-$47 (=E 1013$-$477): a new magnetic variable?. K.O.Mason (Mullard Space Sci. Lab., Dorking, England), F.A.Cordova, J.Middleditch, G.A.Reichert, S.Bowyer, P.Murdin, D.Clark.
Publ. Astron. Soc. Pac. (USA), vol.95, no.568, p.370-5 (June 1983).
A variable, blue, emission-line star is identified as the probable counterpart of the HEAO-1 soft X-ray source H 1011$-$47 on the basis of an improved position derived with the Einstein satellite. The star varies between magnitudes 16.7 and 17.7 on a time scale of ~100 minutes and by as much as 0.6 magnitude on a time scale of a few minutes. The spectrum exhibits strong, broad optical emission lines of hydrogen, He I, He II, and Ca II, and strong ultraviolet emission lines of C IV and Si IV. These characteristics suggest that the star most probably belongs to the AM Her class of magnetic cataclysmic binary. (6 refs.)

111150 Ultraviolet observations of the transient X-ray sources A 0535+26 and A 0620$-$00. Chi-Chao Wu, R.J.Panek, A.V.Holm, M.Schmitz (Computer Sci. Corp., Silver Spring, MD, USA), J.H.Swank.
Publ. Astron. Soc. Pac. (USA), vol.95, no.568, p.391-7 (June 1983).
A 0535+26 (HDE 245770) was observed by the ANS in September 1975 and March 1976 when it was at the X-ray low state. Fifty-eight early-type stars which lie within 10° of HDE 245770 were also observed by the ANS, and these stars were used to derive a localized extinction curve. An $E(B-V)=0.72$ is derived for HDE 245770. A 0620$-$00 was observed by the ANS in March 1976. Twenty-five early-type stars were used to establish a localized extinction curve and an $E(B-V)=0.35$ was derived. The dereddened continuum can be described by a combination of 60% $T=18000$K black body and 40% F_ν=constant spectra. (30 refs.)

111151 Orbits of 15 visual binaries. G.A.Starikova.
Pis'ma v Astron. Zh. (USSR), vol.9, no.6, p.353-9 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
From available published data and from new observations the revised orbits of 15 visual binary stars are obtained. The new orbits are in better agreement with the observations. (1 ref.)

Outer atmospheres of late stars ....See Entry 111035

A search for X-rays from runaway stars ....See Entry 111038

Confirmation among visual multiples of an increase of Ap stars with age ....See Entry 111061

The massive WC6+O6-8 spectroscopic binary HD 94305 ....See Entry 111062

A search for light-time effects in binary Cepheids: AW Persei ....See Entry 111064

On the nature of dwarf novae ....See Entry 111065

Photoionization models for the winds from cataclysmic variables ....See Entry 111066

Spectrographic observations of the suspected delta Scuti variable beta Ari ....See Entry 111068

The magnetic field variation of the Ap star HR 465 ....See Entry 111069

Spectroscopic observations of the cataclysmic variable HL CMa during outburst ....See Entry 111073

The old-nova GK Per (1901). III. Accretion disc models ....See Entry 111076

Stimulated emission and the flat Balmer decrements of cataclysmic variable stars ....See Entry 111077

The orbital periods for six cataclysmic binaries ....See Entry 111078

The spectrum of VY Aquarii at minimum ....See Entry 111079

GK Persei ....See Entry 111081

GK Persei ....See Entry 111084

KR Aurigae ....See Entry 111086

Outburst period-energy relations in cataclysmic novae ....See Entry 111092

γ-ray line emission from SS 433 ....See Entry 111093

Sk$-$71°34: a new Wolf-Rayet star in the Large Magellanic Cloud ....See Entry 111095

Spectral variations in HD 190002: evidence of a companion ..See Entry 111105

A photometric study of dwarf novae ....See Entry 111106

WBVR photometry of SS 433: spectra of the 'normal' star and the accretion disk ....See Entry 111109

R136: supermassive star or dense core of a star cluster? ....See Entry 111223

97.90 OTHER TOPICS IN STELLAR ASTRONOMY

111152 On the evolution of massive zero-metal stars. V.Castellani, A.Chieffi, A.Tornambe (Inst. for Space Astrophys., CNR, Frascati, Italy).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.249-55 (1 Sept. 1983).
The evolution of zero-metal stars of 10, 15, and 25 $M_\odot$ has been followed through the core H burning and the core He burning phases to the phase of C ignition. It is found that such stars fail to reach the red giant region, burning both H and He at large effective temperature (log $T_e=4.5$). Variations in the original amount of He in the range $0.20<Y<0.30$ only marginally affect the structures of the stars. Zero-metal stars develop peculiarly small H exhausted regions, with larger electron degeneracy in comparison with Population II stars. The impact of supernovae from those stars is briefly discussed in terms of chemical pollution by Population III. (19 refs.)

111153 An investigation of faint stars in a region of the Magellanic Stream. M.T.Bruck, M.R.S.Hawkins (Dept. of Astron., Univ. of Edinburgh, Edinburgh, Scotland).
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.216-22 (Aug. 1983).
Star counts to 20.5^m in B have been performed on UKST plates using the COSMOS automatic measuring machine of an extended area in the Magellanic Stream. No surplus of stars has been found in the region of maximum HI density. Excess stars to 20.5^m are expected to consist of intermediate age objects. Their evident scarcity in the Magellanic Stream can be explained if the supposed encounter of the Magellanic Clouds with the Galaxy occurred before or at the time of the birth of the intermediate age stars ($\sim 3\times10^9$ yr ago). (17 refs.)

111154 Can Population III stars generate primordial helium?. J.R.Bond, B.J.Carr (Inst. of Astron., Cambridge Univ., Cambridge, England), W.D.Arnett.
Nature (GB), vol.304, no.5926, p.514-15 (11 Aug. 1983).
Only stars with masses in excess of ~200 $M_\odot$ can generate a cosmologically significant amount of helium without overproducing either metals or radiation. Such very massive objects (VMOs) would also leave a large number of black hole remnants. Stellar evolution calculations show that the helium-rich envelope of VMOs could undergo explosive ejection. A viable model of primordial helium synthesis is described which can be constructed after recombination, providing heavy elements are not dredged up and ejected at the same time. (12 refs.)

On the determination of absolute right ascensions and declinations of groups of stars using minor planets ....See Entry 110864

UBV observations and a photometric sequence for the highly active T Tauri star VY Tau ....See Entry 111051

The structure of the Carina dwarf elliptical galaxy ....See Entry 111231

98.00 STELLAR SYSTEMS; GALACTIC AND EXTRAGALACTIC OBJECTS AND SYSTEMS; THE UNIVERSE

98.10 STELLAR DYNAMICS

Periodic orbits in elliptical galaxies ....See Entry 111224

The stability of a differentially rotating disk of stars ....See Entry 111243

98.20 STELLAR CLUSTERS AND ASSOCIATIONS

111155 The ellipticities of globular clusters and the second parameter problem. J.Norris (Mount Stromlo & Siding Spring Obs., Res. School of Phys. Sci., Australian Nat. Univ., Canberra, Australia).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.245-8 (1 Sept. 1983).
For globular clusters with abundances in the range $-1.9\leq[\mathrm{Fe/H}]\leq-1.4$, which brackets those of the classic 'second parameter' trio M13-M3-NGC 7006, a correlation appears to exist between the Mironov horizontal branch parameter $B/(B+R)$ and the apparent cluster ellipticities, in the sense that there are no clusters with red horizontal branches and higher than average ellipticities. The correlation is significant at the 4.0% level, and offers support for the hypothesis that angular momentum is a parameter affecting horizontal-branch morphology. (22 refs.)

111156 The kinematics of globular clusters in the large Magellanic cloud. K.C.Freeman (Mount Stromlo & Siding Spring Obs., Private Bag, Woden, Australia), G.Illingworth, A.Oemler,Jr..
Astrophys. J. (USA), vol.272, no.2, pt.1, p.488-508 (15 Sept. 1983).
Velocities are determined for 35 globular clusters in the LMC. These data are combined with data from other sources to give velocities for 59 clusters ranging in age from $\sim10^8$ to $\sim10^{10}$ yr. A study of the kinematics-age relation for the LMC globular cluster system is performed. The young clusters form a flattened system having a low line-of-sight velocity dispersion, an amplitude of their rotation of 37 ± 5 km s^{-1}, a galactocentric systemic velocity of 40 ± 3 km s^{-1}, and a line of nodes in position angle 1°±5°, consistent with that found from previous kinematical and photometric studies. The older clusters are also flattened to a disklike system with an intrinsic line-of-signt dispersion of only 17 km s^{-1}, and a rotation amplitude of 41 ± 4 km s^{-1}. Surprisingly, however, both the systemic velocity at 26 ± 2 km s^{-1}, and the position angle of the line of nodes at 41°±5 are very significantly different for the older clusters. This enigmatic situation resisted all attempts at a solution. While the number of clusters is small, it was striking to note that even the oldest clusters in the LMC appeared to lie in a highly flattened disklike system with a z scale height $z_0\sim0.5$ kpc at $r\approx3°\approx3$ kpc. There is no evidence for a kinematic halo population among the globular clusters in the LMC. (51 refs.)

111157 Magnitudes and colours of stars of central part of globular cluster M15. N.M.Spassova (Dept. of Astron., Bulgarian Acad. of Sci., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.36, no.5, p.553-6 (1983).
The BV magnitudes of 206 stars in the central part of cluster M 15 are listed. Four V-plates (103 aD+6611) and three B short-exposure plates (ORWO ZU21+GG13, 103aO+GG13), taken in the Cassegrain focus of the Schemaha 2 m (7″/m) and Bulgaria 2 m (12.8″/m) telescopes, were measured on an iris photometer at Pulkovo Observatory (USSR). Photoelectric and photographic standards were used. A comparison of the author's magnitudes with the standard ones is shown. The author's standard observations involved a mean error of ±0.062(V), ±0.055(B), ±0.061(B-V). All stars brighter than 14.90 (V) and well-resolved on the short-exposure V-plates were measured. At $R<12''$ the star clustering makes iris measurements impossible. In the area of $12''<R<2'.5$, 223 stars were measured. A comparison of the magnitudes obtained on different plates revealed a mean error of ±0.044 (V) and ±0.026 (B) respectively. (10 refs.)

111158 S stars in ω Centauri. T.L.Evans (South African Astron. Obs., Cape Town, S Africa).
Mon. Not. R. Astron. Soc. (GB), vol.204, no.3, p.975-84 (Sept. 1983).
The ZrO band at 6473 Å has been found in 10 of the 12 stars previously found to have TiO bands, indicating that these are MS or early S stars. The stars also show strong metal lines and in particular strong Ba II λ4554, in common with hotter fainter stars which are also found to lie to the red (cool) side of the giant branch of ω Cen in the I, V-I diagram. These stars are much fainter than MS stars in the Magellanic Clouds and are not associated with carbon stars as the latter are. It is likely that they represent the top of the range of metal abundance in ω Cen and that the strong Ba II and ZrO features result from a primordial excess of s-process elements. (48 refs.)

111159 Globular clusters and the early chemical history of galactic halos. D.S.De Young, K.Lind, S.E.Strom (Kitt Peak Nat. Obs., Tucson, AZ, USA).
Publ. Astron. Soc. Pac. (USA), vol.95, no.569, p.401-5 (July 1983).
Calculations presented suggest that ejecta from evolved massive stars in globular clusters could play a significant role in the early chemical evolution of the spheroidal component of galaxies. In the case of the M87 globular cluster system, the yield from massive cluster members, assumed drawn from a Salpeter initial mass function, can supply protogalactic gas of mass 2×10^{11} $\mathfrak{M}_\odot$ with heavy elements sufficient to produce the observed mean metal-to-hydrogen ratio of $Z=10^{-2}$ $Z_\odot$ for the outer halo stars of M87. For initial mass functions with a greater proportion of massive stars, the yield is even larger. (20 refs.)

111160 Detectability of globular cluster systems in distant galaxies. W.E.Harris (Phys. Dept., McMaster Univ., Hamilton, ON, Canada).
Publ. Astron. Soc. Pac. (USA), vol.95, no.569, p.406-10 (July 1983).
A simple modeling procedure is used to describe the appearance of distance globular cluster systems viewed against background fields at various limiting magnitudes. The 'detectability' of such cluster systems, as a function of magnitude and distance, is described numerically under conditions where the background consists of (a) only field stars, or else (b) all types of images (stellar and nonstellar) together. If faint star/galaxy image classification can be successfully carried out to $B_J(\text{lim})\sim26$ (either from space or from ground-based telescopes with modern CCD detectors), the cluster systems around giant elliptical galaxies should be plainly detectable to distances approaching 100 Mpc. (15 refs.)

111161 The spectroscopic parallax of Stock 14. M.P.FitzGerald, M.L.Miller (Astron. Program, Univ. of Waterloo, Waterloo, Canada).
Publ. Astron. Soc. Pac. (USA), vol.95, no.568, p.361-3 (June 1983).
The spectroscopic parallax of Stock 14 is determined from MK classification of the 14 brightest stars. Of these, two are spectroscopic nonmembers and one is the supergiant V810 Cen. The authors find a mean colour excess of $E_{B-V}=0.26^m$, and a mean distance modulus of $V_0-M_v=12.29^m\pm0.12^m$ (s.e. mean for 11 stars), fully consistent with Turner (1982), whose results are based mainly on UBV photometry and fitting to the slightly evolved main sequences of NGC 3293. This independent determination confirms Turner's result, especially with respect to the absolute magnitude and probable membership of the pseudo-Cepheid V810 Cen. (14 refs.)

111162 Photoelectric photometry of globular clusters in the Andromeda Nebula. IX. A.S.Sharov, V.M.Lyuty, V.F.Esipov.
Pis'ma v Astron. Zh. (USSR), vol.9, no.7, p.393-4 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
For pt.VIII see ibid., vol.8, no.8, p.451-3 (1982). Results of photoelectric UBV photometry of 14 globular clusters in the Andromeda Nebula obtained in 1982 at the 2.6-m telescope are presented. (16 refs.)

Positions of stars in regions of 14 southern galactic clusters ....See Entry 110865

X-rays and rotation among post-T Tauri G stars in Orion Ic ....See Entry 111037

The Al I-cyanogen correlation in the spectra of globular cluster red giants and the origin of intracluster heavy element variations ....See Entry 111041

Abundance sensitive parameters for red giants in globular clusters ....See Entry 111052

Polarization of stars in R-associations: observational data ....See Entry 111056

The evolutionary state and pulsation characteristics of red variables in globular clusters ....See Entry 111059

Confirmation among visual multiples of an increase of Ap stars with age ....See Entry 111061

Observations of red variable stars in globular clusters ....See Entry 111089

M and S stars in the Magellanic Clouds ....See Entry 111090

Globular cluster systems in the Hydra I elliptical galaxies. II ....See Entry 111203

R136: supermassive star or dense core of a star cluster? ....See Entry 111223

98.40 INTERSTELLAR MATTER; AND NEBULAE

111163 The extraordinary extragalactic supernova remnant in NGC 4449. II. X-ray and optical investigations. W.P.Blair, R.P.Kirshner (Dept. of Astron., Univ. of Michigan, Ann Arbor, MI, USA), P.F.Winkler,Jr..
Astrophys. J. (USA), vol.272, no.1, pt.1, p.84-91 (1 Sept. 1983).
For pt.I see ibid., vol.236, no.1, p.135-42 (1980). X-ray observations with the Einstein Observatory show that the supernova remnant (SNR) in the galaxy NGC 4449 is the most luminous known X-ray SNR—a distinction it already holds at optical and radio wavelengths. New optical spectroscopy and the X-ray data indicate that the extraordinary luminosity is due to chemically enriched material at unusually high densities. A model in which the NGC 4449 remnant resulted from the explosion of a massive star in a medium of density near 25 cm^{-3} about 100 years ago is consistent with all of the data. Models in which chemically processed material makes up less of the X-ray emitting plasma are also possible. The detection of optical emission lines from [O II], [S II], and [Ne III] provides a refined picture of the physical conditions where the optical emission takes place and permits comparison of this remnant with others. The chemistry supports the picture that the remnant in NGC 4449 resulted from the explosion of a star of mass greater than 25 $M_\odot$. (44 refs.)

111164 Magnetic field structure in the Gum Nebula area. J.P.Vallee (Section d'Astron., Inst. Herzberg d'Astrophys., Nat. Res. Council of Canada, Ottawa, Ontario, Canada), R.C.Bignell.
Astrophys. J. (USA), vol.272, no.1, pt.1, p.131-6 (1 Sept. 1983).
New rotation measure data are calculated from recent linear polarization observations for extragalactic radio sources in the direction of the Gum Nebula area. An analysis of these rotation measures, in conjunction with a model of the Gum Nebula or with a tangential view to an arm, sheds more light on the magnetic field distribution in the region. The observations are consistent with a shell model of the Gum Nebula whose magnetic field in the shell is about 2×10^{-6} gauss. This 'magnetic bubble' is the third to be found near the Sun. (13 refs.)

111165 Near-infrared spectrophotometry of planetary nebulae. P.D.LeVan (Air Force Geophys. Lab., Univ. of California, San Diego, CA, USA), R.J.Rudy.
Astrophys. J. (USA), vol.272, no.1, pt.1, p.137-48 (1 Sept. 1983).
The results of an infrared spectrophotometric study of 10 planetary nebulae in the wavelength region from 0.85 to 1.4 μm are reported. Line strengths were measured for the Paschen lines Paβ and Paγ, the [S III] lines λ9069 and λ9532, and He I λ10830. Excess continuum flux found at 1.28 μm for five planetary nebulae is shown to be of central star origin. A discrepancy is found between the measured ratio of the λ10830 and λ5876 helium triplet line fluxes and previously predicted values. (43 refs.)

111166 The detection of vinyl cyanide in TMC-1. H.E.Matthews, T.J.Sears (Herzberg Inst. of Astrophys., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.149-53 (1 Sept. 1983).
Observations of four rotational transitions of vinyl cyanide (CH_2CHCN) at λ3 cm and λ1.5 cm are reported. The molecule has been detected in the dense dark cloud TMC-1 for the first time and the observed relative intensities of the hyperfine components are consistent with those expected under LTE conditions. The CH_2CHCN column density in TMC-1 is 3×10^{12} cm^{-2}. Upper limits are reported for a number of other sources. (17 refs.)

111167 Radio images of the bipolar H II region S106. J.Bally (Bell Labs., Holmdel, NJ, USA), R.L.Snell, R.Predmore.
Astrophys. J. (USA), vol.272, no.1, pt.1, p.154-62 (1 Sept. 1983).
Reports evidence for the presence of a circumstellar disk surrounding the exciting star of the bipolar H II region S106. Gas lying in the geometric shadow of this disk is shielded from direct ultraviolet illumination by the exciting star of the H II region. The high density of gas and dust within the disk may be responsible for the longevity of the disk against photoionization and ablation by the diffuse radiation from the H II region. The optically obscured exciting star of the He II region, S106 IR, lies at the center of the shadowed area. The radio and IR properties of this object indicate that it is probably a BO star possessing a massive stellar wind. The ionized gas distribution in the H II region is discussed. (36 refs.)

111168 Neutral interstellar gas in the lower galactic halo. C.E.Albert (Yerkes Obs., Univ. of Chicago, Chicago, IL, USA).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.509-39 (15 Sept. 1983).
Optical interstellar absorption lines of Ti II, Ca II, and Na I, and the 21 cm emission line of H I have been observed at high resolution and high detection sensitivity toward nine pairs of nearly aligned distant halo stars and foreground disk stars with well-determined distances. Analysis of the column densities, velocities, and the directly determined variation of the titanium abundances with *z*-distance leads to a general picture of the neutral interstellar material in the lower galactic halo. Two types of gas with distant distribution, kinematics, and abundances are found: a thick, low-velocity disk (type A) extending from the plane to well beyond the thin disk of OB stars, and a high-velocity, much less strongly depleted gas (type B) observed only at *z*-distances, which constitutes at least 24% of the mass of the halo gas. The possible origins of the observed gas and its connection with QSO absorption lines are discussed. (104 refs.)

111169 Interpretation of neutral hydrogen spin temperature measurements. H.E.Payne (Nat. Radio Astron. Obs., Greenbank, WV, USA), E.E.Salpeter, Y.Terzian.
Astrophys. J. (USA), vol.272, no.2, pt.1, p.540-50 (15 Sept. 1983).
Sensitive neutral hydrogen emission-absorption observations, which had used the 3′ Arecibo beam, are analyzed. Spin temperature results in the direction of 'small' and 'large' extragalactic sources are found to be statistically similar, showing that variations in derived spin temperature from case to case are real and not an artifact of the 'subcloudlet model'. The mean emission temperature as a function of velocity is found for widely dispersed warm material (INSA), which is independent of a cloud and is not strongly absorbing. Correcting the emission-absorption data for the contribution of the INSA emission gives cloud spin temperatures which vary roughly as the minus one-third power of the cloud optical depth. The data can be fitted by a composite model with cloud cores at gas kinetic temperatures of about 55K, but varying optical depths, surrounded by a warm (nonabsorbing) halo which contributes about 4.5K emission brightness. The analysis of cloud statistics by Crovisier (1981) is repeated, using more sensitive data. (35 refs.)

111170 Interstellar polarization, grain growth, and alignment. P.A.Aannestad (Dept. of Phys., Arizona State Univ., Tempe, AZ, USA), J.M.Greenberg.
Astrophys. J. (USA), vol.272, no.2, pt.1, p.551-62 (15 Sept. 1983).
Shows that the observed correlation of the width of the normalized linear polarization curve with the wavelength of maximum polarization is most likely caused by the accretion of mantles on grains with an initial power-law size distribution. Calculations assuming Purcell's (1979) suprathermal alignment mechanism with the 'rocket' lifetime determined by a monolayer accretion time scale are discussed. The Davis-Greenstein (1951) thermal alignment mechanism cannot account for the observed correlation at large values of λ_{max}. The authors investigate the effect of subsonic turbulent coagulation on a power-law size distribution of grains. The predicted correlation between width and λ_{max} is at variance with the observed data. (45 refs.)

111171 A far-ultraviolet extinction law: what does it mean?. J.M.Greenberg, G.Chlewicki (Lab. Astrophys., Univ. of Leiden, Leiden, Netherlands).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.563-78 (15 Sept. 1983).
The dust grains in the diffuse cloud medium are characterized by a far-ultraviolet (FUV) extinction 'law' so that all curves have the same functional form for inverse wavelengths $\lambda^{-1}\gtrsim6$ μm^{-1}. A direction theoretical consequence of this fact that there is very little scattering by either the particles responsible for the FUV extinction or the 220 Å hump. A strong correlation between the strength of the 2200 Å hump and the visual extinction is confirmed. Poor correlation is found between the FUV extinction and either the 2200 Å hump or the visual extinction. All indications are that the dust grains responsible for the visual, the 2200 Å hump, and the FUV extinction are a trimodal distribution of independent groups of particles of which the latter two are rather strictly limited in radii (if treated as spheres) to $a\lesssim0.01$ μm. It is also that no Mie theory calculations using currently accepted graphite or silicate optical properties can provide the observed shapes of the ultraviolet and FUV extinction. (46 refs.)

111172 Synthesis of chain molecules in regions with partially ionised carbon. H.Suzuki (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.579-90 (15 Sept. 1983).
A chemical mechanism for the formation of carbon chain molecules is proposed, and its efficiency under interstellar conditions is investigated. In this chemical scheme, C^+ reactions have the essential role of chain growing. As high C^+ abundance and low photodissociation rates of hydrocarbons and chains are preferable, this mechanism is most effective in regions with partially ionized carbon. Since the reaction rates of radiative association generally become greater as the number of atoms in the reaction increases, the chain growing from C_3 chain to C_4 chain is the rate-determining reaction. Higher density, lower temperature, and lower intensity of the external radiation field provide favorable conditions for chain growing. Rapid condensation of cloud matter also favors chain growing because more carbon remains without changing to CO molecules. (56 refs.)

111173 The kinetic temperature and CH_3CCH column density profiles in Sgr B2, Orion, and DR 21. E.Churchwell (Univ. of Wisconsin-Madison, Madison, WI, USA), J.M.Hollis.
Astrophys. J. (USA), vol.272, no.2, pt.1, p.591-608 (15 Sept. 1983).
Describes a simple technique for estimating kinetic temperatures from intensities of adjacent rotational transitions of symmetric top molecules. The method relies on two assumptions: (1) that the metastable levels (lowest energy level in each K ladder) are thermalized; and (2) that the excitation temperature connecting the upper level of the observed transition to the lowest level in the K ladder is the same for both adjacent transitions. The method is applied to observations of the $J=5$-4 and $J=6$-5 transitions of CH_3CCH obtained at 1′ intervals along a NS-EW cross centered on Orion KL, Sgr B2, and DR 21. (55 refs.)

111174 A large molecular cloud toward the SNR W50 and SS 433. Y.-L.Huang, T.M.Dame, P.Thaddeus (Columbia Univ., New York, NY, USA).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.609-14 (15 Sept. 1983).
The CO $1 \rightarrow 0$ transition at 115 GHz has been mapped over an area of more than 6 deg^2 toward W50, the extended SNR surrounding the peculiar object SS 433. W50 is found to lie at the end of a filamentary molecular cloud 4° long and 1° wide that closely matches a conspicuous dust lane on the Palomar Sky Survey; the cloud's kinematic distance is 2.2 ± 0.7 kpc, in agreement with the distance 2-3.3 kpc estimated for the SNR, and its mass is about $1.2 \times 10^5\ M_\odot$. (31 refs.)

111175 Herbig-Haro objects in the dust globule ESO 210-6A. J.A.Graham, J.H.Elias (Cerro Tololo Inter-American Obs., La Serena, Chile).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.615-26 (15 Sept. 1983).
New narrow-band Hα and [S II] images of the dark globule ESO 210-6A and its associated Herbig-Haro objects HH 46 and HH 47 show additional emission knots. The HH objects are tightly collimated about an axis at PA 57°. New radial velocity measurements are presented. The HH objects appear to be a manifestation of bipolar outflow from an isolated star embedded in the globule. (27 refs.)

111176 Stability of the equilibrium distributions of interstellar gas, cosmic rays, and magnetic field in an external gravitational field. V.D.Kuznetsov, V.S.Ptuskin (Inst. of Earth Magnetism, Ionosphere & Propagation of Radio Waves, Acad. of Sci., Moscow, USSR).
Astrophys. & Space Sci. (Netherlands), vol.94, no.1, p.5-21 (July 1983).
An interstellar medium consisting of regular and turbulent magnetic fields, thermal gas and cosmic rays is tested for stability in a stellar gravitational field. Cosmic rays are described by the diffusion-convection equation and the stability region of the system is determined. It is shown that the presence of cosmic rays is a stabilizing factor if the cosmic-ray diffusion coefficient is sufficiently small. The dependence of the maximum growth rate of instability on the cosmic-ray diffusion coefficient is qualitatively determined. (22 refs.)

111177 The heterogeneous condensation of interstellar ice grains. J.Seki, H.Hasegawa (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
Astrophys. & Space Sci. (Netherlands), vol.94, no.1, p.177-89 (July 1983).
Processes of heterogeneous condensation are investigated. The authors consider the situation that vapor and solid grains of which material is other than that of the vapor coexist and the saturation of the vapor increases with time. If the contact angle of the condensate to the solid is small ($\gtrsim 90°$), the condensate will be formed as mantles coating the solid grains but only a fraction of the solid grains will be coated by mantles. The ratio of core-mantle grains to bare solid grains in number will be smaller as the density of the vapor and the time scale of saturation increase are large. Actual calculations are made by adopting H_2O ice as the mantle material and magnesium silicate as the core material. (17 refs.)

111178 Interstellar proteins and the discovery of a new absorption feature at $\lambda=2800$ Å. L.M.Karim, F.Hoyle, N.C.Wickramasinghe (Dept. of Appl. Maths. & Astron., Univ. Coll., Cardiff, Wales).
Astrophys. & Space Sci. (Netherlands), vol.94, no.1, p.223-9 (July 1983).
The discovery of a broad interstellar absorption feature centred on 2800 Å in the extinction curve of starlight confirms the presence of proteinaceous material in grains. (9 refs.)

111179 Planck mean radiation-pressure cross sections for nonspherical grains. I. N.V.Voshchinnikov, V.B.Il'in (Leningrad State Univ., Leningrad, USSR).
Astrophysics (USA), vol.18, no.4, p.353-60 (Oct.-Dec. 1982). Translation of: *Astrofizika (USSR)*, vol.18, no.4, p.616-28 (Oct.-Dec. 1982).
Expressions are obtained for the efficiency factors for radiation pressure for infinite circular cylinders. The Planck mean radiation-pressure cross sections are calculated for statically oriented cylindrical grains composed of graphite, pure and contaminated iron, lead, silicates (obsidian and basalt), and silicon carbide. Particles with radii from 0.001 to 1 μm and the four effective temperatures 3300, 5770, 15500, and 40000K are considered. The dependence of the Planck mean cross sections on the temperature, grain diameter, and the direction of the incident radiation is discussed. (32 refs.)

111180 Interstellar C_2 in the Ophiuchus clouds. A.C.Danks (European Southern Obs., Santiago, Chile), D.L.Lambert.
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.188-96 (Aug. 1983).
Interstellar lines of the C_2 molecule are reported from high resolution high signal to noise spectra of ζOph, χOph and ρOph A. Rotational level populations for the C_2 toward ζOph are not described by a single rotational temperature. The populations are quite consistent with a competition between collisional and radiative excitation under conditions expected for the ζOph cloud. The excitation of the C_2 molecules toward χOph and ρOph A is similar to the results found for ζOph. The C_2 column density is $N(C_2)=2.2 \times 10^{13}$, 3.5×10^{13} and 2.6×10^{13} cm^{-2} toward ζOph, χOph and ρOph A respectively. (46 refs.)

111181 Spectrophotometry of low excitation Herbig-Haro objects. K.H.Bohm (Astron. Dept., Univ. of Washington, Seattle, WA, USA), E.W.Brugel, E.Olmsted.
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.23-8 (Aug. 1983).
New spectrophotometric observations of the low excitation Herbig-Haro object H-H7, H-H11, and H-H43 have been obtained with the Palomar 5.08 m telescope and the multichannel spectrometer. The results confirm that these objects show an unusually low degree of ionization indicating shock velocities of ~40 km s^{-1} or less. In spite of considerable differences between the line spectra of these low excitation and normal 'high excitation' H-H objects the low excitation objects show about the same continuum energy distribution as high excitation objects. The rapid rise of F_λ towards shorter wavelengths can (as far as we can see now) be attributed only to either a very hot black body or, more probably, to a two-photon continuum. (31 refs.)

111182 3-D simulations of the collapse of nonspherical interstellar clouds. M.Rozyczka (Inst. fur Astrophys., Max-Planck-Inst. fur Phys. und Astrophys., Garching, Munchen, Germany).
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.45-51 (Aug. 1983).
A few numerical examples of the collapse of nonspherical interstellar clouds with initial density perturbations are presented. The calculations reach far into the non-linear regime and show that the growth rate of the perturbation as well as the probability of fragmentation are complicated functions of the initial conditions. It is found, in accordance with previously published results, that only high-amplitude or long-wavelength perturbations can evolve into well-defined fragments, which can survive the overall collapse of the cloud. The formation of spinning blobs is observed in the case of very strong initial density contrasts. (20 refs.)

111183 H_2 densities and masses of the molecular clouds close to the galactic center. R.Gusten, C.Henkel (Max-Planck-Inst. fur Radioastron., Bonn, Germany).
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.136-45 (Aug. 1983).
Reports a high resolution study of the $H_2CO(2_{11}\text{-}2_{12})$ absorption line toward molecular clouds near the galactic center. A large-velocity gradient model of the 14.5 and 4.8 GHz H_2CO line excitation yields H_2 densities, abundances, and H_2 column densities. The high-density cores have masses of $10^6\text{-}10^7\ M_\odot$, and are stable against tidal disruption in the gravitational field of the central bulge. Comparison of the H_2CO (140 GHz) and NH_3 emission, and the H_2CO (14.5 GHz) absorption maps confirms earlier conclusions that the '20 km s^{-1} cloud' (M $0.13-0.08$) is in front of the Sgr A continuum, while the '40 km s^{-1}' (M $0.02-0.07$) lies on the far side of the galactic center and is sandwiched between Sgr A West and the non-thermal Sgr A East ridge. Carbon isotope ratios are inferred. (32 refs.)

111184 A note on compressibility and energy cascade in turbulent molecular clouds. R.C.Fleck,Jr. (Embry-Riddle Aeronautical Univ., Daytona Beach, FL, USA).
Astrophys. J. Lett. Ed. (USA), vol.272, no.2, pt.1, p.L45-8 (15 Sept. 1983).
A phenomenological theory of energy cascade in a compressible, turbulent fluid is outlined. For stationary flow, the turbulent velocity v, associated region size l, and fluid density ρ scale as $v \sim (l/\rho)^{1/3}$. Thus, in the interstellar medium where typically $\rho l \sim$ constant, the effect of compressibility is to steepen the velocity-size correlation as compared with the Kolmogorov result $v \sim l^{1/3}$ for incompressible turbulence. A comparison is made with the observed v-l-ρ power-law correlations for molecular clouds. (15 refs.)

111185 X-ray emission from pre-main-sequence stars, molecular clouds, and star formation. J.Silk (Inst. d'Astrophys., Paris, France), C.Norman.
Astrophys. J. Lett. Ed. (USA), vol.272, no.2, pt.1, p.L49-53 (15 Sept. 1983).
The pre-main-sequence X-ray emitting stars observed in molecular clouds appear to provide the bulk of the ionization. Newly forming stars therefore control the coupling of the magnetic field to the cloud. Since this coupling itself is believed to be responsible for the rate of cloud collapse, the authors argue that there is a natural feedback mechanism, involving observed X-rays, which is capable of regulating molecular cloud evolution and the rate of star formation. (27 refs.)

111186 Masses of interstellar gas clouds. V.B.Bhatia (Dept. of Phys. & Astrophys., Univ. of Delhi, Delhi, India).
Can. J. Phys. (Canada), vol.61, no.9, p.1305-7 (Sept. 1983).
The equilibrium masses of the interstellar gas clouds have been calculated when the clouds are imbedded with magnetic fields. It is found that the masses of these clouds may be of the order of several thousand solar masses. These masses appear to be consistent with the generally accepted level of efficiency for the processes of star formation. (9 refs.)

111187 On the calculation of ion-molecule reaction rates in interstellar space and planetary atmospheres. D.Mathur (Tata Inst. of Fundamental Res., Bombay, India).
Indian J. Radio & Space Phys., vol.12, no.2, p.59-61 (April 1983).
Ghosh and Ghosh (1982) have suggested the use of a simple equation to calculate the rate constant for ion-molecule reactions. This study points out inadequacies in the suggested approach and draws attention to experimental rate constants which are orders of magnitude different from the values deduced from the proposed equation. (19 refs.)

111188 High-resolution study of the supernova remnant G330.2+1.0. J.L.Caswell, R.F.Haynes, D.K.Milne, K.J.Wellington (Div. of Radiophys., CSIRO, Epping, NSW, Australia).
Mon. Not. R. Astron. Soc. (GB), vol.204, no.3, p.915-20 (Sept. 1983).
Observes the radio supernova remnant G330.2+1.0 with resolution better than 1 arcmin using both the Fleurs synthesis telescope and the Molonglo Observatory synthesis telescope. The overall appearance is suggestive of a shell structure delineated by eight blobs of high brightness approximately equi-spaced round the periphery. A similar number of high-brightness blobs are seen well within the outer boundary. The irregular brightness variations are strikingly different from those seen in other supernova remnants and seem likely to be the result of a thin shell interacting with the interstellar medium, there is an underlying gradient of surface brightness, with the side towards the galactic plane being more intense. (17 refs.)

111189 A new radio map of the AD 1006 supernova remnant, G327.6+14.6. J.L.Caswell, R.F.Haynes, D.K.Milne, K.J.Wellington (Div. of Radiophys., CSIRO, Epping, NSW, Australia).
Mon. Not. R. Astron. Soc. (GB), vol.204, no.3, p.921-6 (Sept. 1983).
The radio remnant of the AD 1006 supernova has been mapped with resolution of ~1 arcmin using the Fleurs synthesis telescope at 1.4 GHz. The radio map and a recent X-ray map of similar resolution both show a bright ring of emission indicative of a shell structure. While the general appearance is remarkably similar, with both radio and X-ray emission strong in the same general portions of the ring, detailed comparisons show no precise correspondence of the brightest features. A major difference is that the X-ray emission is quite intense at the centre of the ring, where there is essentially no detectable radio emission. Optical observations conflict with the X-ray interpretation of a large ejected mass, high energy and no deceleration to date. (15 refs.)

111190 8-13 μm spectral observations of eight moderately extended planetary nebulae. P.F.Roche, D.K.Aitken, B.Whitmore (Dept. of Phys. & Astron., Univ. Coll. London, London, England).
Mon. Not. R. Astron. Soc. (GB), vol.204, no.3, p.1017-24 (Sept. 1983).
Obtains 8-13 μm spectra of eight moderately extended planetary nebulae at a resolution of 0.24 μm using a 20-arcsec circular aperture. More compact planetaries which have been studied in this way generally show a strong continuum due to emission from dust, together with fine structure line emission. In contrast, these more extended objects have very weak continuum emission, and are dominated by fine structure line emission, especially by [S IV] which in several cases accounts for most of the broad-band 10 μm flux. There appears to be very little warm ($\gtrsim$150K) dust in some of these objects. (19 refs.)

111191 He 2-442—two emission objects under the same name. V.P.Arkhipova, V.F.Esipov, B.F.Yudin, A.M.Mechetin.
Pis'ma v Astron. Zh. (USSR), vol.9, no.6, p.349-52 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
By means of an IR image tube two stellar sources (He 2-442A and He 2-442B) have been found at the place of the diffuse visual image of the peculiar object He 2-442 (PK 61+2°1). They are NE-SW directed with an angular separation of ~6″. The spectra of both sources in the 4000-6800 Å region are similar to those of planetary nebulae of the 3-4 excitation class. The spectrum of He 2-442B differs from that of He 2-442A mainly in the presence of the He II λ4686 line. The intensity of this line corresponds to a source temperature of $\sim 10^5$K. (9 refs.)

111192 Quasi-resonance collisional pumping of H_2O masers. D.A.Varshalovich, W.K.Kegel, S.Chandra.
Pis'ma v Astron. Zh. (USSR), vol.9, no.7, p.395-400 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
A new pumping mechanism is proposed for the strong H_2O masers associated with star-forming regions. This mechanism is based on the two following phenomena: (i) superthermal excitation of H_2 molecules as a result of the relaxation time difference in the post-shock cooling, and (ii) the quasi-resonance transfer of the superthermal excitation from H_2 to H_2O in their collisions. The necessary conditions and efficiency of this pumping mechanism are estimated. (12 refs.)

111193 On the evolution of Hα/N II in supernova remnants. J.Bohigas (Inst. de Astron., Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
Rev. Mex. Astron. & Astrofis. (Mexico), vol.5, no.4, p.271-84 (March 1983).
The line ratio Hα/N II in supernova remnants has been observed to evolve as a function of the expansion velocity. This is explained by assuming that the abundance of nitrogen with respect to hydrogen in the mass ejected by the supernova explosion or, prior to it, by the presupernova star, is higher than the average ambient value. The line ratio will increase as the relative abundance of nitrogen evolves towards the normal cosmic value as a result of accretion of interstellar material by the shock wave. The behavior of Hα/N II as a function of the radius of the supernova remnant and as a function of the [S II] line ratio 6717/6731 Å can also be explained with this model. (75 refs.)

111194 Faint early-type stars in the neighbourhood of the H II region RCW 99. M.Rabolli (Observatorio Astron., Univ. Nacional de La Plata, La Plata, Argentina).
Rev. Mex. Astron. & Astrofis. (Mexico), vol.5, no.4, p.309-11 (March 1983).
Uses *UBV* photographic photometry to search for faint early-type stars in an area of about 600 square minutes of arc around the H II region RCW 99. The magnitude limits of the search are: $V=15.59$ mag, $B=16.70$ mag, and $U=17.49$ mag. Twenty seven new early-type stars were found. (46 refs.)

111195 High dispersion *IUE* observations of the planetary nebula NGC 3918. M.Pena, S.Torres-Peimbert (Inst. de Astron., Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
Rev. Mex. Astron. & Astrofis. (Mexico), vol.5, no.4, p.313-17 (March 1983).
Measures absolute fluxes of the lines present in a high dispersion short wavelength exposure of NGC 3918. Amongst the measured lines are several density dependent multiplets and the C IV and N V resonance doublets. The mean electron density derived is in agreement with previous determination. The authors find an anomalous value for the ratio of the 1239/1243 Å lines of NV and discuss its implications. (20 refs.)

111196 Bipolar nebulae and type I planetary nebulae. N.Calvet (Centro de Investigacion de Astron., Merida, Venezuela), M.Peimbert.
Rev. Mex. Astron. & Astrofis. (Mexico), vol.5, no.4, p.319-28 (March 1983).
It is suggested that the bipolar nature of PN of Type I can be explained in terms of their relatively massive progenitors ($M_i \geq 2.4\ M_\odot$), that had to lose an appreciable fraction of their mass and angular momentum during their planetary nebula stage. The following objects are discussed in relation to this suggestion: NGC 6302, NGC 2346, NGC 2440, CRL 618, Mz 3 and M2-9. It is found that CRL 618 is overabundant in N/O by a factor of 5-10 relative to the orion Nebula. (58 refs.)

111197 Bipolar gas jets in star-forming regions. J.Bally (Bell Labs., Holmdel, NJ, USA).
Sky & Telesc. (USA), vol.66, no.2, p.94-7 (Aug. 1983).
Discusses the structure of bipolar nebulae. Gas velocities and distributions are considered in relation to the forming star. The relation between bipolar jets and nebulae is discussed. (no refs.)

Planetary Nebulae. International Astronomical Union Symposium No.103 .... See Entry 105027

Internal Kinematics and Dynamics of Galaxies. International Astronomical Union Symposium No.100 .... See Entry 105029

Association reactions of Na^+ and some implications for interstellar chemistry .... See Entry 109712

Release of protons with energy $>10^{18}$eV from intergalactic magnetic field into interstellar magnetic field .... See Entry 110816

Collisional-induced dissociation of the molecular hydrogen in rarefied gas .... See Entry 110902

Turbulence in a self-gravitating gaseous disk. II. Turbulence spectra .... See Entry 110904

A new method of determining nebular radial velocities from Fabry-Perot interferograms .... See Entry 110921

Isotopic composition of carbonaceous-chondrite kerogen: evidence for an interstellar origin of organic matter in meteorites .... See Entry 110999

Analysis of the polarization measurements during the occultations of the Crab Nebula by the plasma surrounding the Sun in 1977-1982 ...... See Entry 111018

Long-period variables in the Magellanic Clouds: supergiants, AGB stars, supernova precursors, planetary nebula precursors, and enrichment of the interstellar medium .... See Entry 111022

Studies of the Carina Nebula. V. The near infrared excess of O-type stars and the anomalous extinction law in their environment .... See Entry 111028

Infrared observations of R136, the central object of the 30 Doradus Nebula .... See Entry 111036

Late stages of stellar evolution. II. Mass loss and the transition of asymptotic giant branch stars into hot remnants .... See Entry 111044

Polarization of stars in R-associations: observational data .... See Entry 111056

The circumstellar dust of mu Cephei .... See Entry 111060

Anomalous reddening of supernovae .... See Entry 111111

Some observations of the central star of the bipolar planetary nebula NGC 2346 .... See Entry 111139

Ultraviolet observations of the transient X-ray sources A 0535+26 and A 0620−00 .... See Entry 111150

The rate of star formation in normal disk galaxies .... See Entry 111199

VLA observations of extragalactic NH_3 in IC 342 .... See Entry 111205

Numerical investigation of the generation of global spiral structure in interacting galaxies .... See Entry 111219

Velocity field in the central region of Mark 617 galaxy .... See Entry 111237

Dissipative capture of stars by the active objects in galactic nuclei .... See Entry 111238

The [N II]/[S II] galactic gradient derived from SNRs .... See Entry 111239

Spiral structure and gas motion in M81 .... See Entry 111240

Theoretical quasar emission-line profiles. II. Effects of source function variation and total thickness .... See Entry 111261

On the dynamical structure of QSOs and the origin of emission clouds .... See Entry 111265

Reverse stellar evolution, stellar ablation, and the origin of gas in quasars .... See Entry 111273

98.50 THE GALAXY, EXTRAGALACTIC OBJECTS AND SYSTEMS

111198 The optical variability and spectrum of PKS 2155−304. H.R.Miller, H.A.McAlister (Dept. of Phys. & Astron., Georgia State Univ., Atlanta, GA, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.26-8 (1 Sept. 1983).
Photometry of the BL Lacertae object PKS 2155−304 has demonstrated that small-amplitude color variations accompany long-term trends in the optical variations of this object. These variations are similar to those found for the optically violent variable quasar 3C 446. These variations have been compared and found to agree well with a model suggested by Marscher (1980). Spectroscopy of PKS 2155−304 has failed to confirm the identification of the [O III] features and the redshift reported by Charles, Thorstensen, and Bowyer (1979). (15 refs.)

111199 The rate of star formation in normal disk galaxies. R.C.Kennicutt,Jr. (Dept. of Astron., Univ. of Minnesota, Minneapolis, MN, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.54-67 (1 Sept. 1983).
Photometry of the integrated Hα emission in a large sample of field spiral and irregular galaxies is used to obtain quantitative estimates of the total star formation rate (SFR) in the galaxies. The photoionization properties of a stellar population are modeled for a variety of choices for the initial mass function (IMF). The observed *UBV* colors and Hα emission equivalent widths place tight constraints on the slope of the IMF between 1 $M_\odot$ and 50 $M_\odot$ in the galaxies. The properties of late-type galaxies are not well reproduced by the Miller-Scalo solar neighborhood IMF. The extinction-corrected star formation rates are large, as high as 20 $M_\odot\ yr^{-1}$ in giant Sc galaxies ($H_0=50\ km\ s^{-1}\ Mpc^{-1}$). The current rates in late-type galaxies are comparable to the past rates averaged over the age of the disk; late-type disk galaxies have evolved at a nearly constant rate, confirming earlier models by Searle, Sargent, and Bagnuolo (1973). Little evidence is found for a strong correlation between the SFR and average gas density. Comparison of the present SFRs with the remaining supply of interstellar gas yields consumption time scales. These are discussed. Infall of intergalactic gas may extend these time scales. It is possible that the present epoch is characterized by rapid changes in the integrated properties and morphologies of disk galaxies. (58 refs.)

111200 The space density and spectroscopic properties of a new sample of emission-line galaxies. A.J.Wasilewski (Warner & Swasey Obs., Case Western Reserve Univ., Cleveland, OH, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.68-83 (1 Sept. 1983).
A moderate-dispersion objective prism survey for low-redshift emission-line galaxies has been carried out in an 825 sq. deg. region of sky. A 4° prism (400 Å mm^{-1} at Hβ) was used with the IIIa-J emulsion to show that a new sample of emission-line galaxies is available even in areas already well searched with the 'excess UV-continuum' technique. Spectroscopic observations with a fiber-controlled SIT spectrometer and the objective prism spectra yielded redshifts for two-thirds of the new emission-line galaxies. These galaxies occur quite commonly in systems with peculiar morphology indicating gravitational interaction with a close companion or other disturbance. About 10%-15% of the sample are Seyfert galaxies. An additional 20% exhibit the characteristics of starburst galaxies. It is suggested that tidal interaction involving matter infall may play a significant role in the generation of an emission-line spectrum. The space density of the new galaxies is investigated. (68 refs.)

111201 An infrared and optical investigation of galactic nuclei with compact radio sources. T.M.Heckman (Astron. Program, Univ. of Maryland, College Park, MD, USA), M.J.Lebofsky, G.H.Rieke, W.van Breugel.
Astrophys. J. (USA), vol.272, no.2, pt.1, p.400-10 (15 Sept. 1983).
Presents infrared multicolor (JHKLN) photometry and optical spectrophotometry of a sample of bright ($m_v \leq 18$) galaxies with powerful compact nuclear radio sources ($S \geq 200$ mJy at 5 GHz). Nearly all of the objects (≥85%) have a nonstellar optical-infrared nuclear continuum whose strength is roughly proportional to that of the compact radio source. Except for their lower luminosities, the nuclei in these galaxies probably resemble radio-loud quasars. Compact nuclear radio sources with associated large-scale double radio lobes probably have enhanced nonstellar optical-infrared continua compared to the objects without such extended radio emission. The sample is diverse in its emission-line properties. Generally, the radio-loud objects have much stronger emission lines than do the nuclei of normal (radio-quiet) early-type galaxies. (45 refs.)

111202 X-ray, optical, and radio observations of the blue galaxy Butcher-Oemler 6 in the 3C 295 cluster. J.P.Henry (Inst. for Astron., Univ. of Hawaii, Honolulu, HI, USA), J.T.Clarke, S.Bowyer, R.J.Lavery.
Astrophys. J. (USA), vol.272, no.2, pt.1, p.434-8 (15 Sept. 1983).
Investigates the nature of the blue members of distant, condensed clusters of galaxies through X-ray, optical, and radio observations of the brightest such object in the 3C 295 cluster. The X-ray luminosity and the optical emission line spectrum show that this galaxy is a Seyfert, in contrast to the original suggestion that the blue galaxies are rapidly evolving spirals. The observations yield an X-ray luminosity, strong optical emission lines of Mg II and [O II] at a redshift of 0.473, and an upper limit to the radio luminosity at 20 cm. Compared to other Seyfert galaxies, this object appears relatively X-ray luminous, shows an average Mg II/X-ray flux ratio, and is relatively weak in Hβ emission. (17 refs.)

111203 Globular cluster systems in the Hydra I elliptical galaxies. II. W.E.Harris (Dept. of Phys., McMaster Univ., Hamilton, Ontario, Canada), M.G.Smith, E.S.Myra.
Astrophys. J. (USA), vol.272, no.2, pt.1, p.456-72 (15 Sept. 1983).
For pt.I see ibid., vol.205, p.709-15 (1976). Presents a deep ($B_{\rm lim}\approx 24.5$) photometric survey around NGC 3311, the giant central galaxy of the Hydra I (A1060) Cluster, to investigate the characteristics of its globular cluster system. Measurements of the images in a 7.4′ square field centered on NGC 3309/3311, compared with a 'background' field ~15′ away, used to derive various results. NGC 3311 is surrounded by an extensive and extremely populous cluster system. The NGC 3311 globular clusters appear in detectable numbers for $B_J>22$, increasing steadily to the survey limit. Their distribution in apparent magnitude is satisfactorily matched by the standard Virgo/Local Group luminosity function for globular clusters if Hydra is placed (2.0 ± 1.0) mag farther away than Virgo, NGC 311 represents the first additional example of a 'supergiant' or anomalously populous, globular cluster system, similar to the system in the Virgo giant elliptical galaxy M87. The authors discuss the possible connections between the M87 and NGC 3311 situations, with the tentative suggestion that their exceptional cluster populations may have been acquired at birth rather than in subsequent evolution. (32 refs.)

111204 Multicolor surface photometry of Markarian Seyfert galaxies. H.K.C.Yee (Steward Obs., Univ. of Arizona, Tuscon, AZ, USA).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.473-83 (15 Sept. 1983).
Surface photometry of 20 Markarian Seyfert galaxies in three colors: r (6500 Å); g (4950 Å) and ν (3980 Å), obtained by using a SIT-vidicon camera, is used to study the host galaxies and nuclear components of Seyfert galaxies. From the profiles, it is found that the parameters of the disk components are similar to normal spiral galaxies, but with somewhat brighter central surface brightness. However, the discrepancies in the disk parameters can be attributed to selection effects and the problems in separating the nucleus from the galaxy. The color of the underlying galaxies are found to be comparable to those of normal spirals in the range from Sa to Sbc. Luminosities of the nuclear and galaxy components are estimated. (26 refs.)

111205 VLA observations of extragalactic NH_3 in IC 342. P.T.P.Ho (Radio Astron. Lab., Univ. of California, Berkeley, CA, USA), R.N.Martin.
Astrophys. J. (USA), vol.272, no.2, pt.1, p.484-7 (15 Sept. 1983).
Aperture synthesis maps of the nuclear region in the nearby spiral IC 342 were made in the $(J,K)=(1,1)$ and (2,2) inversion lines of NH_3. NH_3 emission was not detected with an upper limit to the apparent brightness temperature of 0.5K (referred to 6″ resolution). Comparison with single-dish measurements indicates that the NH_3 emission in the nucleus of IC 342 must be distributed on a size scale greater than 130 pc. The authors interpret these results as favoring a model where the NH_3 emission is moderately optically thick, thermalized to a gas temperature of ~50K, and clumpy. This is consistent with a high OB star-formation rate in the nucleus accompanied by heated dust and gas. (10 refs.)

111206 The X-ray spectra of the BL Lacertae objects PKS 0548−322 and 3C 66A. D.Maccagni (CNR, Istituto di Fisica Cosmica, Milano, Italy), T.Maccacaro, M.Tarenghi.
Astrophys. J. (USA), vol.273, no.1, pt.1, p.70-4 (1 Oct. 1983).
Observes two BL Lac objects, PKS 0548−322 and 3C 66A with the Einstein Observatory. The authors combine the simultaneous imaging proportional counter and monitor proportional counter data to derive the energy spectra of the two sources between 0.2 and 10 keV. 3C 66A is found to be variable, both in intensity and spectra shape, within the data set. PKS 0548−322, which shows a constant behavior in the data, is inferred to have experienced a variation in its spectrum by comparison with results from other experiments. The authors discuss the implications of flux and spectral variability in BL Lac objects for models of X-ray emission mechanisms. (22 refs.)

111207 X-ray and UV observations of the BL Lacertae object 3C 66A. D.Maccagni, L.Maraschi, E.G.Tanzi (Istituto di Fisica Cosmica, CNR, Milano, Italy), M.Tarenghi, L.Chiappetti.
Astrophys. J. (USA), vol.273, no.1, pt.1, p.75-80 (1 Oct. 1983).
The energy distribution of the BL Lac object 3C 66A is investigated in the soft X-ray range by means of repeated observations with the Einstein Observatory and in the UV range by means of the IUE satellite. The available optical photometry from 1979 to 1981 is reported. 3C 66A is characterized by violet X-ray activity over a time scale of 6 months, probably uncorrelated with optical variations. The featureless UV continuum is steeper than that deduced from infrared broadband photometry, thus indicating a spectral break in the region 10^{14}-10^{15}Hz. The overall energy distribution is discussed in the framework of theoretical models proposed for BL Lac objects. (31 refs.)

111208 Spectrophotometry of 12 metal-poor galaxies: implications for the primordial helium abundance. D.Kunth (Inst. d'Astrophys., Paris, France), W.L.W.Sargent.
Astrophys. J. (USA), vol.273, no.1, pt.1, p.81-98 (1 Oct. 1983).
High-precision spectrophotometry is obtained for 12 emission-line galaxies, most of them dwarf systems. All except II Zw 40 have not been analyzed previously. Abundances were derived for He, N, O, and Ne relative to H. Particular attention was paid to the error analysis which takes into account errors in the raw fluxes, in the reddening correction, and in the electron temperature and electron density determinations. No correlation was found between the mass fraction of helium Y and the heavy-element abundances as represented by the O/H ratio. The authors therefore take the mean value of $Y_p=0.245\pm 0.003$ to be the best estimate of the primordial or pregalactic helium abundance and show that other estimates which lead to a lower value of Y_p do not stand up to critical study, usually because of lack of attention to errors. (44 refs.)

111209 Spectral evolution of galaxies. I. Early-type systems. G.Bruzuala (Centro de Investigaciones de Astron., Merida, Venezuela).
Astrophys. J. (USA), vol.273, no.1, pt.1, p.105-27 (1 Oct. 1983).
Develops models for the spectral evolution of early-type galaxies using population synthesis techniques. Different choices of the initial mass function and the star formation rate allow the construction of models which at the present epoch cover the range of observed galaxy spectra. Special emphasis is given to the ultraviolet region of the spectrum. Ultraviolet spectra of late-type stars and early-type galaxies obtained with the International Ultraviolet Explorer satellite are used. The evolving spectral energy distributions are used to compute galaxy colors, magnitudes, K-corrections, and evolutionary corrections as functions of redshift for different photometric systems. (80 refs.)

111210 The inner radio structure of Centaurus A: clues to the origin of the jet X-ray emission. J.O.Burns (Dept. of Phys. & Astron., Univ. of New Mexico, Albuquerque, NM, USA), E.D.Feigelson, E.J.Schreier.
Astrophys. J. (USA), vol.273, no.1, pt.1, p.128-53 (1 Oct. 1983).
Multifrequency (1.4 and 4.9 GHz) observations of the jet and inner lobes of the nearby radio galaxy Centaurus A (=NGC 5128) were made with all four configurations of the VLA. These data were used to construct maps of the total intensity and polarization at resolutions of 31″×10″ and 3.6″×1.1″. The results argue in favor of a common synchrotron radiation origin for the full spectrum jet emission. The implications of X-ray synchrotron radiation from $\gamma=8\times 10^7$ electrons on models of in situ particle acceleration are briefly considered. (68 refs.)

111211 The discovery of optical emission knots in the inner jet of Centaurus A. J.Brodie, A.Konigl, S.Bowyer (Astron. Dept., Univ. of California, Berkeley, CA, USA).
Astrophys. J. (USA), vol.273, no.1, pt.1, p.154-66 (1 Oct. 1983).
The authors have discovered three regions of intense optical emission in the inner ~2 kpc of the Cen A jet. Two of the regions coincide with X-ray and radio knots and emit strong optical continuum radiation with superposed emission lines. The third region, situated between the other two and coincident with a low surface brightness inter-knot zone in the radio and X-ray maps, has little continuum flux but still displays intense line emission which brightens up significantly at its downstream boundary. Spectra were obtained for each of the regions in the range 3700-7500 Å. The observed line emission is probably produced by shock heating or photoionization by a power-law continuum. The densities estimated in the continuum emission regions and in the inter-knot region are discussed. The authors attribute the line emission to dense clumps immersed in the flow and interpret the apparent flare-up at the edge of the inter-knot region in terms of a large-scale shock wave in the jet. The authors discuss the possible origins of the clumps and the shock. (47 refs.)

111212 MCG 5-29-86: a galaxy with a prolate central bulge?. K.-I.Wakamatsu (Junior Tech. Coll., Gifu Univ., Gifu, Japan), H.C.Arp.
Astrophys. J. (USA), vol.273, no.1, pt.1, p.167-76 (1 Oct. 1983).
MCG 5-29-86 is a 16th mag galaxy with a very peculiar appearance. Its main body looks like an inclined S0 galaxy with a pair of faint straight filaments along its minor axis. Optical spectra reveal no gaseous emission in the filaments of the galaxy. Radio observations with VLA reveal no radio material or central radio source. It is difficult therefore to interpret the filaments as jets due to internal activity. The authors discuss two other possible interpretations: (1) an edge-on galaxy with a polar ring; (2) an edge-on galaxy with a prolate bulge and a ring seen edge-on. No alternative is entirely satisfactory. Isophotometry of the object is discussed as it applies to these alternatives. (44 refs.)

111213 Photometric classification of normal galaxies and their redshift determination. V.Straizys, Z.Sviderskiene (Astron. Obs., Inst. of Phys., Lithuanian Acad. of Sci., Vilnius, Lithuanian SSR).
Astrophys. & Space Sci. (Netherlands), vol.94, no.1, p.23-30 (July 1983).
Two-color diagrams including magnitudes from several photometric systems are investigated with respect to the possibility of determining from the integrated photometry the galaxy type and its redshift. The color indices of galaxies are calculated using the energy distribution curves of Coleman et al. (1980). It is shown that redshift determination at low values of z requires an ultraviolet magnitude with λ_0 shorter than 300 nm. Different sources of errors and uncertainties are discussed. (26 refs.)

111214 Radial velocities of galaxies in neighborhoods of groups of galaxies. I. J.Vennik, A.Kaazik (Inst. of Astrophys. & Phys. of Atmosphere, Acad. of Sci., Estonian SSR).
Astrophysics (USA), vol.18, no.4, p.297-302 (Oct.-Dec. 1982). Translation of: *Astrofizika (USSR)*, vol.18, no.4, p.523-32 (Oct.-Dec. 1982).
New determinations of the radial velocities for 62 galaxies in the neighborhoods of groups of galaxies are presented. The rms error of the velocities is about 80 km/sec with the dispersion of the spectra 200 Å/mm. The possible membership of the observed galaxies to various types of systems is considered. (15 refs.)

111215 Radial velocities of galaxies in neighborhoods of groups of galaxies. II. J.Vennik, A.Kaazik, A.Amirkhanyan (Inst. of Astrophys. & Phys. of Atmosphere, Acad. of Sci., Estonian SSR).
Astrophysics (USA), vol.18, no.4, p.303-7 (Oct.-Dec. 1982). Translation of: *Astrofizika (USSR)*, vol.18, no.4, p.533-40 (Oct.-Dec. 1982).
For pt.I see Astrofizika, vol.18, no.4, p.523-32 (1982) or Astrophysics, vol.18, no.4, p.297-302 (1983). New determinations of the radial velocities of 48 galaxies that are predominantly situated in the neighborhoods of groups of galaxies are presented. (13 refs.)

111216 On Markaryan 6 and the problem of the intermediate Sy 1.5 type. E.E.Khachikyan, V.N.Popov, A.A.Egiazaryan (Byurakan Astrophys. Obs., USSR).
Astrophysics (USA), vol.18, no.4, p.308-12 (Oct.-Dec. 1982). Translation of: *Astrofizika (USSR)*, vol.18, no.4, p.541-7 (Oct.-Dec. 1982).
The results of new spectroscopic observations of the variable type 2 Seyfert galaxy Markaryan 6 are considered. It is shown that the short wave components of the hydrogen emission lines discovered in 1969 by Khachikyan and Weedman (1970, 1971) can still be observed in the spectrum of this galaxy. A decrease in the equivalent widths of both H_β and the forbidden lines N_1 and N_2 is noted. It is suggested that the so-called type Sy 1.5 galaxies are a short phase in the evolution of Sy 2 galaxies. (16 refs.)

111217 On the connection between Seyfert galaxies and neighboring objects. A.R.Petrosyan (Byurakan Astrophys. Obs., USSR).
Astrophysics (USA), vol.18, no.4, p.312-21 (Oct.-Dec. 1982). Translation of: *Astrofizika (USSR)*, vol.18, no.4, p.548-62 (Oct.-Dec. 1982).
A sample of Seyfert galaxies containing 161 objects has been compiled. To consider the question of the connection between Seyfert galaxies and neighboring objects counts have been made of galaxies in circles of diameter 1.5 Mpc around fixed Seyfert galaxies. It is found that: the Seyfert galaxies participate in the clustering tendency of galaxies; the type 2 Seyfert galaxies reveal a stronger tendency to participate in clustering of galaxies than the type 1 objects; and the type 2 Seyfert galaxies occur more often in isolated pairs of galaxies than the type 1 objects. (30 refs.)

111218 The radio luminosity function of Seyfert galaxies. R.A.Kandalyan (Byurakan Astrophys. Obs., USSR).
Astrophysics (USA), vol.18, no.4, p.331-6 (Oct.-Dec. 1982). Translation of: *Astrofizika (USSR)*, vol.18, no.4, p.580-8 (Oct.-Dec. 1982).
The radio luminosity function ($F(\geq P)$) is constructed on the basis of the complete sample of Seyfert galaxies brighter than 14.2^m. Determination of the dependence of the mean radio luminosity ($\bar{P}_{1.4}$) and the radio luminosity function on the optical luminosity (L_p) of the galaxies leads to relations of the form $\bar{P}_{1.4}\sim L_p^{1.2\&0.3}$ and $F(\geq P)\sim L_p^{1.3\pm 0.5}$. It is assumed that the probability of a Sy 1 galaxy being a radio source with luminosity log $P_{1.4}\geq 23.0$ is greater than for a Sy 2 galaxy. (27 refs.)

111219 Numerical investigation of the generation of global spiral structure in interacting galaxies. V.I.Korchagin, Yu.G.Shevelev (Rostov-on-Don State Univ., Rostov, USSR).
Astrophysics (USA), vol.18, no.4, p.337-40 (Oct.-Dec. 1982). Translation of: *Astrofizika (USSR)*, vol.18, no.4, p.589-95 (Oct.-Dec. 1982).
A numerical investigation is made of the time-dependent nonlinear response generated in the flat gas subsystem by a satellite rotating in the plane of a galactic disk in the direction of its rotation. Besides the features typical of

interacting galaxies (bridge and satellite tail), there is excited in the disk an asymmetric spiral structure of 20-30% amplitude comparatively close to the center of the galaxy. This confirms the conclusion of Kormendy and Norman (1979) that satellites of interacting galaxies are one of the possible mechanisms of generation of global spiral patterns. (12 refs.)

111220 Collisions of massive gas clouds with primordial chemical composition. A.A.Suchkov, Yu.A.Shchekinov, M.A.Edel'man (Rostov State Univ., Rostov, USSR).
Astrophysics (USA), vol.18, no.4, p.360-7 (Oct.-Dec. 1982). Translation of: *Astrofizika (USSR)*, vol.18, no.4, p.629-40 (Oct.-Dec. 1982).
A study is made of the thermochemical evolution of matter with primordial chemical composition in collisions of gas clouds at velocities 40-200 km/sec; the masses of the clouds are $M=10^6\text{-}10^9 M_\odot$. The variations in time of the temperature, degree of ionization, and concentration of H_2 and HD molecules behind the shock front are found. It is shown that H_2 and HD molecules are formed in appreciable numbers; they ensure cooling of the gas to temperatures $T \sim 10\text{-}30$K. The results are discussed in connection with the problem of star formation in the early stages of galaxy formation. (16 refs.)

111221 The nature of the nebula around BL Lacertae. K.D.Rakos, N.Fiala (Inst. fur Astron., Univ. Wien, Wien, Austria).
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.L11-12 (Aug. 1983).
New deep, high resolution images of the nebula around BL Lac are presented. These images indicate a spiral structure of the nebula surrounding BL Lac. The brightness distribution along a section through the proposed spiral arms is given. (9 refs.)

111222 Super-Eddington luminosity characteristics of active galactic nuclei. L.Bassani, A.J.Dean, S.Sembay (Phys. Dept., Southampton Univ., Southampton, England).
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.52-8 (Aug. 1983).
Analysis of the variability timescale-bolometric luminosity relation for active galaxies, including Seyferts, quasars and BL Lac objects, shows that a number of sources violate the classical Eddington limit. A more realistic formulation of this limit which takes into account the effects of beaming and/or decreasing scattering cross section as evaluated from the Klein-Nishina relationship is discussed in the context of contemporary black hole accretion models. Most of the objects which satisfy this luminosity limit are therefore compatible with the existence of massive black holes at this nuclei. It is found, for the remaining objects, that the violation of this limit is removed if a closed Universe with a value of $H_0 \approx 100$ km s^{-1} Mpc^{-1} is assumed. (96 refs.)

111223 R136: supermassive star or dense core of a star cluster?. A.F.J.Moffat, W.Seggewiss (Obs. Hoher List, Univ.-Sternwarte Bonn, Daun, Germany).
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.83-92 (Aug. 1983).
High signal-to-noise optical spectroscopy exhibits the type WN6+03-4 for the central $2.5'' \times 5''$ of R 136=HD 38268, the diffuse, luminous core object of the very young cluster NGC 2070 in the giant 30 Doradus nebula in the Large Magellanic Cloud. The published UV spectrum in the central 3″ diameter (Ø) can also be synthesized by the superposition of the spectrum of one or more WN stars with several O3 stars. The light distribution within R 136 and the surrounding cluster NGC 2070 from $Ø \approx 1.5''$ (~ seeing disk) to $Ø \approx 2'$ (maximum extent of the obvious cluster) is comparable to that seen in spherical stellar systems. The central projected surface brightness within $Ø \approx 0.50$ pc(2″) is not unusually intense. Published speckle interferometry reveals either a single central star (Meaburn et al., 1982) which cannot be brighter than $V \approx 12$ ($M_v \approx$-8) at the centre of R 136, or several (thus fainter) components (Weigelt, 1981). The latter is supported by the old astrometric observations of Innes (1927). An assessment of new differential photoelectric photometry and already published photometry suggests that R 136 is probably not variable. Marginally real radial velocity variations of the broad He II λ 4686 emission line show a possible 4d periodicity with low amplitude. If real, the best explanation is that the WN 6 component may be part of an unresolved spectroscopic binary. The best overall interpretation of R 136 is that it represents the dense stellar core of a populous cluster. (70 refs.)

111224 Periodic orbits in elliptical galaxies. E.Davoust (Obs. de Besancon, CNRS, Besancon, France).
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.101-8 (Aug. 1983).
Using the analytical method of Lindstedt the author makes an inventory of the regular families of periodic orbits inside non rotating model elliptical galaxies of oblate and prolate shape, in particular at and near resonances. The author also obtains periodic solutions approximated by formal trigonometric series and a third integral of motion which, to first order, depends on the square of the total angular momentum. (33 refs.)

111225 Are galaxy properties specific for their parent clusters?. R.C.Kraan-Korteweg (Astron. Inst., Univ. Basel, Binningen, Switzerland).
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.109-11 (Aug. 1983).
It is pointed out that the distance-independent relation between the 21 cm line width and the infrared surface brightness of spiral galaxies is different in different clusters. If this effect is not due to observational errors, it constitutes additional evidence for varying galaxian properties from cluster to cluster. (16 refs.)

111226 Quasi-simultaneous ultraviolet and optical observations of PKS 2155−304=H 2155−304. L.Maraschi, E.G.Tanzi (Istituto di Fisica Cosmica, CNR, Milan, Italy), M.Tarenghi, A.Treves.
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.117-20 (Aug. 1983).
The BL Lac object PKS 2155−304 was repeatedly observed in the 1200-3000 Å band with the International Ultraviolet Explorer. The variability of the source in this band is studied in detail. The UV continua are well fitted by power laws with frequency spectral index α_ν varying between −0.7 and −0.9. An optical spectrum was taken within one day from a UV spectrum. Combining the observations in the two ranges, evidence is found of a spectral steepening by $\Delta\alpha_\nu=0.36$ around 10^{15}Hz. (15 refs.)

111227 Magnitude-redshift relation in clusters, groups and pairs of galaxies. T.Jaakkola (Obs. & Astrophys. Lab., Univ. of Helsinki, Helsinki, Finland).
Astron. Nachr. (Germany), vol.304, no.3, p.103-23 (1983).
The magnitude-redshift relation within systems of galaxies is detailed in several kinds of systems. The main data contains 17 clusters, 64 groups, 121 pairs and 14 systems with two measured members, altogether 1043 galaxies in 162 separate systems. In addition, another sample of nearby groups and pairs, data on six clusters with 121 measured members, as well as 65 compact galaxies in four groups and 23 pairs are studied. Some properties of the velocity (redshift) dispersion are discussed. (57 refs.)

111228 High-resolution optical observations of NGC 3379. I. An analysis of previous data. J.-L.Nieto (Obs. du Pic-du-Midi et de Toulouse, Bagneres-de-Bigorre, France).
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.2, p.247-53 (Aug. 1983).
Analyses the photometric data on the galaxy NGC 3379 previously published in the literature, as a first step toward photometric studies of the central regions of galaxies at high resolution (FWHM ~0.5″-1.0″). The author suggests some corrections to the EW luminosity profile derived by de Vaucouleurs and Capaccioli (1979). The revised EW profile has a central surface brightness 0.15 mag $arcsec^{-2}$ brighter. Other data are transformed to EW profiles. The comparison of all the EW profiles is discussed. (11 refs.)

111229 Neutral hydrogen observations of double spiral galaxies. II. NGC 3958/3963, NGC 5289/5290, NGC 5673/IC 1029, NGC 5107/5112. G.A.van Moorsel (Kapteyn Astron. Inst., Univ. of Groningen, Groningen, Netherlands).
Astron. & Astrophys. Suppl. Ser. (France), vol.53, no.2, p.271-86 (Aug. 1983).
For pt.I see ibid., vol. 107, no.1, p.66-74 (1982). Full synthesis H I observations of four fields containing a binary galaxy system are presented. Individual total masses derived from the rotation curves are compared with the mass of the system as deduced from the observed orbital motion. The pairs NGC 3958/3963 and NGC 5673/IC 1029 show minimum orbital masses which are larger than the sum of the individual masses. The discrepancy is largest for the pair NGC 5673/IC 1029, which is likely part of a quadruple system. The other two pairs have minimum orbital masses smaller than the sum of the individual masses. Six of the eight galaxies show asymmetries in the H I distributions which are probably due to interaction with the other pair member. (18 refs.)

111230 Very large spiral galaxies. W.Romanishin (Astron. Dept., Univ. of California, Los Angeles, CA, USA).
Mon. Not. R. Astron. Soc. (GB), vol.204, no.3, p.909-14 (Sept. 1983).
Observations of large spiral galaxies are potentially useful for cosmological tests and studies of galaxy evolution. As a first step in a systematic study of large spirals, a catalogue of the 107 largest known spiral galaxies is presented. These galaxies have isophotal diameters ($\mu_B=25.0$ mag $arcsec^{-2}$) greater than 90 kpc, assuming $H_0=50$ kms^{-1} Mpc^{-1}. New UBVR photoelectric photometry is presented for 20 of these galaxies. The absolute magnitudes of all galaxies in the catalogue are derived using Zwicky magnitudes transformed to the B_T system. (12 refs.)

111231 The structure of the Carina dwarf elliptical galaxy. S.Demers, S.Beland (Dept. of Phys. & Obs. Astron. du Mont Megantic, Univ. de Montreal, Montreal, Canada), W.E.Kunkel.
Publ. Astron. Soc. Pac. (USA), vol.95, no.568, p.354-7 (June 1983).
The structure of the Carina dwarf elliptical galaxy is determined from counts of over 8000 stars on prints made from a CT10 4-m prime-focus blue plate. Carina has an ellipticity of $E=0.4$ to $r=11'$. Its tidal radius is 33′. If its luminosity function is similar to M3, its mass is 5.3×10^5 $\mathfrak{M}_\odot$. (11 refs.)

111232 Probable association of UX Piscium with a galaxy. A.R.Klemola (Lick Obs., Univ. of California, Santa Cruz, CA, USA).
Publ. Astron. Soc. Pac. (USA), vol.95, no.568, p.368-9 (June 1983).
The poorly observed SRa-type variable star UX Psc appears to coincide with a sixteenth-magnitude galaxy. Although the limited observations given in this paper do not support the reported variability, further photometric observations are needed to clarify the nature of this object. (6 refs.)

111233 UV-continuum galaxies with double-nucleus structure: mass-to-luminosity ratio. A.R.Petrosyan.
Pis'ma v Astron. Zh. (USSR), vol.9, no.6, p.339-41 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
For 23 UV-continuum galaxies with double-nucleus structure, the radial velocity differences of their nuclei, their linear separations, luminosities and mass-to-luminosity ratios are presented. The mean mass-to-luminosity ratio for double-nucleus galaxies is equal to 3.8 ± 1.6, typical for galaxies with late-type morphology which have enhanced gas and young stellar contents. The result is in good agreement with $\mathfrak{M}/L$ for pairs of galaxies with Markarian components. (23 refs.)

111234 The dwarf irregular galaxy VV 574: a possible member of the M81 group. V.P.Arkhipova, R.I.Noskova.
Pis'ma v Astron. Zh. (USSR), vol.9, no.6, p.342-4 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
Radial velocities in the galaxy VV 574—a possible nest of interacting galaxies—have been measured. No large internal motions are found. The rotation velocity does not exceed 10-15 km/s, giving a mass of $\approx 10^7$ $M_\odot$. The electron density derived from [SII] lines is 10^3 cm^{-3} and the ionized hydrogen mass is $\sim 10^4$ $M_\odot$. VV 574 appears to be a dwarf irregular galaxy with an absolute magnitude of $M_B=-11^m$ belonging to the M81 group. (5 refs.)

111235 Phenomena in the center of the Galaxy as a consequence of a recent supernova outburst. I.S.Shklovskii.
Pis'ma v Astron. Zh. (USSR), vol.9, no.6, p.345-8 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
Argues that the whole complex of phenomena observed in the galactic center can be explained by a supernova outburst in a massive binary system which occurred ~100 years ago. The object should be similar to SS 433 except that it would be considerably younger and much more compact and active. The recently discovered anomalously-high helium abundance is explained by an expanding remnant of a massive helium star explosion. The 511 keV annihilation line emission is associated with the intense generation of electron-positron pairs in a neutron star magnetosphere. (13 refs.)

111236 Redshifts of blue galaxies in the direction of the Virgo cluster. I.D.Karachentsev, V.E.Karachentseva, F.Borngen.
Pis'ma v Astron. Zh. (USSR), vol.9, no.7, p.387-8 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
Redshifts for 35 faint ($m=16\text{-}20^m$) blue galaxies from the Borngen's (1980, 1983) lists are presented. (4 refs.)

111237 Velocity field in the central region of Mark 617 galaxy. W.L.Afanas'ev, S.S.Rassokhin.
Pis'ma v Astron. Zh. (USSR), vol.9, no.7, p.389-92 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
Using spectrograms obtained on the diffraction spectrograph with image tube in the primary focus of the 6-m telescope, the velocity field in the central region of Mark 617 galaxy is investigated. Noncircular motions of gas found in the narrow interval of position angles of 70°-90° are explained by gas ejection from the nucleus along the small axis of the galaxy. The possible existence of large-scale radial motions of gas is noted. (6 refs.)

111238 Dissipative capture of stars by the active objects in galactic nuclei. E.Ya.Vilkoviskii.
Pis'ma v Astron. Zh. (USSR), vol.9, no.7, p.405-8 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
It is shown that the gas mass in the environment of a massive object ($M \sim 10^8 M_\odot$) in an active galaxy nuclei leads to the intensive capture of stars by this object provided its radius $R \sim 100 Rg = 200\ GM/c^2$ and the mass of the gas $Mg_{as} \gtrsim 0.01\ M$. (13 refs.)

111239 The [N II]/[S II] galactic gradient derived from SNRs. J.Gonzalez (Inst. de Astron., Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
Rev. Mex. Astron. & Astrofis. (Mexico), vol.5, no.4, p.289-91 (March 1983).
From 17 SNRs that cover a galactocentric range $5 < R < 14$ kpc a gradient of -0.05 ± 0.01 dex kpc^{-1} is found in the [N II]/[S II] line intensity ratio. This value is very similar to that derived from H II regions and is probably related to a N/S abundance gradient. The possibility of contamination of the N/S ratio by SN as well as the variation of the [N II]/Hα ratio with galactocentric distance are also discussed. (32 refs.)

111240 Spiral structure and gas motion in M81. V.G.Berman, Yu.N.Mishurov (Rostov Univ., Rostov, USSR).
Sov. Astron. (USA), vol.26, no.6, p.639-42 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1055-61 (Nov.-Dec. 1982).
From the two-component spiral-structure model proposed by Marochnik, Mishurov, and Suchkov, the spiral-arm geometry in the galaxy M81 is calculated and the density-wave parameters are evaluated: the pattern speed $\Omega_p \approx 20$ km sec^{-1}kpc^{-1} and the effective rotating component has a surface density $\sigma_1 \approx 50\ M_\odot/\mathrm{pc}^2$. The nonlinear gas glow in the gravitational field of the arms is calculated for these parameters. Comparison with the observed radial distribution of H II regions, the radial-velocity profile of the gas along the minor axis, and the gas density profiles in the arms indicates that the spiral gravitational-force amplitude $F \approx 5\%$ at 8-kpc distance from the center of the system. (29 refs.)

111241 An evolutionary scheme for active-nucleus objects. B.V.Komberg (Inst. for Space Res., Acad. of Sci., Moscow, USSR).
Sov. Astron. (USA), vol.26, no.6, p.643-7 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1062-9 (Nov.-Dec. 1982).
The features typical of active nuclei in galaxies and the conditions necessary for activity are discussed. QSIs may represent nuclei of luminous galaxies in an early, particular violent evolutionary phase. The spectroscopic properties of the various species of quasar-like objects suggest a possible evolutionary sequence from those with Sy, O, I (Seyfert 1) spectra to Sy II, III spectra. An evolutionary scheme is outlined whereby the active nuclei in various types of galaxies would correspond to well-evolved QSOs belonging to either spheroidal [QSO(E)] or flat [QSO(S)] systems. These two kinds of QSOs may be either strong radio emitters [QSS(E), QSS(S)] or weak radio emitters [QSG(E), QSG(S)], a distinction which would manifest itself, in evolutionary terms, as the difference observed between the radio properties of radio galaxies and Seyferts, on the one hand, and normal E, S galaxies with low-activity nuclei, on the other. QSO(S)s should be scores of times as common in the Universe as QSO(E)s; there may be as many as 10^{-6} QSG(S) per Mpc^3. Such objects should contribute significantly to counts of blue 21^m-23^m starlike images. (54 refs.)

111242 Observations of galaxies of high surface brightness at 102 MHz. V.S.Artyukh, V.G.Malumyan, M.A.Ogannisyan (Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. Astron. (USA), vol.26, no.6, p.650-3 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1075-80 (Nov.-Dec. 1982).
Forty-four of the galaxies of high surface brightness listed by Arakelyan have been observed at 102-MHz frequency with the Pushchino cophased antenna array by the interplanetary-scintillation method. Ten of these objects have been detected at flux-density levels above 1-2 Jy. Seven of them have scintillating components $\leq 1''$ across. The galaxy Ark 448 shows 100% scintillation; Ark 451, nearly 100%. Spectra are established for the scintillating components. Almost all the scintillators either are E or SO galaxies or appear highly compact at photographic wavelengths. (28 refs.)

111243 The stability of a differentially rotating disk of stars. S.V.Chalov (Inst. for Space Res., Acad. of Sci., Moscow, USSR).
Sov. Astron. (USA), vol.26, no.6, p.654-8 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1081-8 (Nov.-Dec. 1982).
The problem of whether certain models of infinitely thin, differentially rotating disks of stars will be stable against double-arm spiral disturbances is solved. Both the differential rotation and the spherical component of the galaxy will serve to stabilize the bar mode. (11 refs.)

111244 The distinction between Seyfert 1 and Seyfert 2 galaxies. A.S.Zentsova (Ioffe Phys. & Technol. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Astron. (USA), vol.26, no.6, p.658-60 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1089-92 (Nov.-Dec. 1982).
The activity of the nuclei of Seyfert 1 galaxies could represent two-temperature disk-type accretion onto a supermassive black hole, while the activity in Seyfert 2 nuclei would correspond to the accretion regime of an optically thin disk. The parameters of such a disk are evaluated. Seyfert 2 nuclei should generate an X-ray luminosity $L_x = 10^{42}$-10^{43} erg/sec, the flux declining exponentially with energy for $h\nu \gtrsim 10$ keV. (16 refs.)

Internal Kinematics and Dynamics of Galaxies. International Astronomical Union Symposium No.100 .... See Entry 105029

Extragalactic sources of gravitational waves .... See Entry 105188

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New galaxies with ultraviolet excess. IV .... See Entry 110926

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Infrared observations of R136, the central object of the 30 Doradus Nebula .... See Entry 111036

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Hα observations of four novae in M31 .... See Entry 111057

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Period-luminosities relation of classical Cepheids .... See Entry 111070

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On the frequency of supernova flares in Sc galaxies .... See Entry 111110

Anomalous reddening of supernovae .... See Entry 111111

The Local Group supernova rate .... See Entry 111114

The dynamics of dissipatively heated spherical accretion .... See Entry 111125

Discovery of a massive unseen star in LMC X-3 .... See Entry 111127

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An investigation of faint stars in a region of the Magellanic Stream .... See Entry 111153

The kinematics of globular clusters in the large Magellanic cloud .... See Entry 111156

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Redshifts of groups and clusters in the rich superclusters 1451+22 and 1615+43 .... See Entry 111249

Virial mass and luminosity of the Virgo cluster of galaxies .. See Entry 111250

The cluster of galaxies SC 0316$-$44. Does it rotate? .... See Entry 111251

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The Cherenkov effect and plasma turbulent reactors .... See Entry 111256

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Observations of H 1414+089, QSO with extremely high velocity broad-absorption-line gas .... See Entry 111271

Dynamics of the radiating gas in the quasar PHL 5200 and in kindred objects .... See Entry 111272

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Quantization in the large .... See Entry 111280

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Three-dimensional simulation of large-scale structure in the Universe .... See Entry 111283

Cluster analysis of the nonlinear evolution of large-scale structure in an axion/gravitino/photino-dominated Universe .... See Entry 111287

98.50K Groups, clusters, superclusters

111245 Two-dimensional spectrophotometry of the cores of X-ray luminous clusters. L.L.Cowie (Dept. of Phys., MIT, Cambridge, MA, USA), E.M.Hu, E.B.Jenkins, D.G.York.
Astrophys. J. (USA), vol.272, no.1, pt.1, p.29-47 (1 Sept. 1983).
Describes the results of a two-dimensional spectrophotometric survey of the core regions of 11 rich clusters of galaxies. Fields of view of 4.5′ were observed with a CCD camera through 20 or 70 Å filters centered on wavelengths corresponding to redshifted Hα, [N II] 6583 Å, [S II] 6716, 6731 Å, [Fe X] 6374 Å, and various continuum bands. A number of these clusters have spectacular optical emission line systems in their cores. Both morphologically and kinematically the emission line regions divide into extended ~20-100 kpc systems of long linear filaments associated with the cluster core and more compact homogeneous elongated regions associated with the dominant central cluster galaxy. In some clusters both types of systems are seen, while in other clusters the extended filamentary structures or the emission from the central galaxy occur separately. The authors argue that the results are expected as hot X-ray emitting gas cools in the cluster center. The morphology of the systems can be understood if the filaments form initially in the cooling flow and, in some cases, are subsequently accreted by the central galaxy. (66 refs.)

111246 The X-ray emitting gas in poor clusters with central dominant galaxies. G.A.Kriss (Dept. of Phys., MIT, Cambridge, MA, USA), D.F.Cioffi, C.R.Canizares.
Astrophys. J. (USA), vol.272, no.2, pt.1, p.439-48 (15 Sept. 1983).
X-ray observations of 16 poor clusters containing central dominant galaxies have been performed with the Imaging Proportional Counter of the Einstein Observatory. Twelve clusters were detected, and in each case the X-ray emission is centered on the dominant galaxy. The X-ray surface brightness implies density profiles that are roughly inversely proportional to radius. The low

temperatures and high central densities observed for the brightest clusters give central cooling times implying that radiative accretion flows may be present. The authors find total binding masses within 0.5 Mpc. The mean mass-to-light ratio for the bright clusters is ~70-100 $M_\odot/L_\odot$. Comparison of the deduced distribution of binding mass with the light distribution of the central galaxies of four clusters shows that M/L rises to over 200 $M_\odot/L_\odot$ in the galaxy halos. Thus these halos, like the clusters themselves, must possess dark matter. The X-ray data show clearly that the dominant galaxies sit at the bottoms of the poor cluster gravitational potential wells. This suggests a similar origin for dominant galaxies in poor and rich clusters. (52 refs.)

111247 Radiative accretion of intracluster gas onto dominant galaxies in poor clusters. C.R.Canizares, G.C.Stewart, A.C.Fabian (Inst. of Astron, Univ. of Cambridge, Cambridge, England).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.449-55 (15 Sept. 1983).
Finds that the hot gas in poor clusters is cooling and accreting onto the central, dominant galaxies. The evidence comes from the analysis of X-ray images of MKW 4, MKW 3s, AWM 4, and AWM 7 obtained with the Einstein Observatory and reported by Kriss, Cioffi, and Canizares (1983). Qualitatively, the presence of cooling and accretion can be deduced in a model-independent fashion from the sharply peaked central surface brightness distributions. Quantitatively, the authors apply the deprojection technique of Fabian et al. (1980, 1981) to deduce detailed density and temperature profiles for a wide range of assumed parameters. The authors compute mass accretion rates. The authors conclude that the high gas densities that give rise to cooling flows are not primarily the result of dynamical evolution of the cluster, in particular the merger of galaxies to form the dominant galaxy. Rather the general initial condition of high material density—both galaxies and gas—favors both mergers and cooling flows. (40 refs.)

111248 Filamentary galaxy clustering: a mapping algorithm. J.E.Moody (Dept. of Phys., Princeton Univ., Princeton, NJ, USA), E.L.Turner, J.R.Gott,III.
Astrophys. J. (USA), vol.273, no.1, pt.1, p.16-23 (1 Oct. 1983).
The Shane-Wirtanen galaxy count catalog gives the strong visual impression of large-scale linear or filamentary features in the galaxy distribution. Computer simulations of hierarchical galaxy clustering constructed to have two-, three-, and four-point autocorrelation functions like those observed do not have such an appearance. A simple and well-defined algorithm which maps and quantifies filamentary structure is developed. It appears to be successful in identifying those (and only those) filaments which the eye picks out in the Shane-Wirtanen catalog and thus provides an objective tool for studying these structures. A catalog and map of the most prominent Shane-Wirtanen filaments is given. Application of the algorithm to a computer simulation of hierarchical galaxy clustering is discussed. (21 refs.)

111249 Redshifts of groups and clusters in the rich superclusters 1451+22 and 1615+43. R.Ciardullo (Univ. of California, Los Angeles, CA, USA), H.Ford, F.Bartko, R.Harms.
Astrophys. J. (USA), vol.273, no.1, pt.1, p.24-35 (1 Oct. 1983).
Redshift measurements and finding charts are presented for galaxy clusters in the field of two rich, distant superclusters. Both systems are shown to have morphological and dynamical properties similar to the nearby superclusters, including small internal velocity dispersions and high density contrasts in redshift space. These data are consistent with two interpretations: either both superclusters are highly flattened systems with major axes close to the plane of the sky or the observed velocity dispersions do not arise from unperturbed Hubble flow. If the latter explanation is correct, these radial velocity data are a powerful probe of the large scale matter density in the Universe. (37 refs.)

111250 Virial mass and luminosity of the Virgo cluster of galaxies. I.D.Karachentsev (Special Astrophys. Obs., Acad. of Sci., USSR).
Astrophysics (USA), vol.18, no.4, p.279-85 (Oct.-Dec. 1982). Translation of: *Astrofizika (USSR)*, vol.18, no.4, p.501-11 (Oct.-Dec. 1982).
New measurements of the radial velocities and apparent magnitudes of the galaxies in the Virgo cluster made by Karachentsev and Karachentseva (1982) are used to determine the main dynamical parameters of the system. The dispersion of the radial velocities is plotted as a function of the radius r and the apparent magnitude m_B of the galaxies out to $r<6°$ from the center of the cluster. The luminosity function of the cluster is determined in the range $-22^m<M<-13^m$. The ratio of the virial mass to the luminosity of the Virgo cluster is $f=396\,f_\odot$. (26 refs.)

111251 The cluster of galaxies SC 0316−44. Does it rotate?. J.Materne, U.Hopp (Inst. fur Astron. & Astrophys., Tech. Univ. Berlin, Berlin, Germany).
Astron. & Astrophys. (Germany), vol.124, no.2, pt.1, p.L13-15 (Aug. 1983).
15 new radial velocities are presented in the region of the galaxy cluster SC 0316−44. The velocity distribution of the galaxies in this cluster appears to be asymmetric. The NE part seems to approach, the SE part to recede with respect to the cluster centre. It is proposed that this might be an indication of rotation. (16 refs.)

111252 Effect of cut-off inference on the redshift anomaly of galaxies in the Perseus supercluster. E.Giraud (Inst. Henri-Poincare, Paris, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.21, p.1647-50 (13 June 1983). In French.
The magnitude cut-off inference on the redshift excess of the Sb, Sbc, Sc galaxies situated in the Perseus filament central cluster is studied. The excess does not vanish after a selective cut-off of the Sb, Sbc, Sc ($m_0\leq12.4$) and S0($m_0\leq13.4$) samples. (7 refs.)

111253 Where is the location of blue low-luminosity galaxies observed in the Virgo cluster?. A.V.Zasov.
Pis'ma v Astron. Zh. (USSR), vol.9, no.6, p.327-31 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
Blue galaxies of low luminosity in the region of the Virgo cluster have an unusual radial velocities distribution, which differs from that of the normal galaxies in this cluster. It is argued that these galaxies are located in an extended expanding envelope (supercorona) of the cluster. (21 refs.)

111254 The distribution of centers of double galaxies. I.D.Karachentsev, A.L.Shcherbanovskii.
Pis'ma v Astron. Zh. (USSR), vol.9, no.6, p.332-8 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
For a complete sample of northern sky double galaxies with measured radial velocities the spatial distribution of their centers is considered. At different spatial scales mutual grouping of pairs is caused by their membership of systems of galaxies. The spatial two-point correlation function for the pair centers is constructed. Favourable conditions for double system formation may exist in the outlying regions of superclusters of galaxies. (14 refs.)

Radio data on clusters of galaxies from the Culgoora circular array ..... See Entry 110932

Anomalous reddening of supernovae ..... See Entry 111111

The Local Group supernova rate ..... See Entry 111114

X-ray, optical, and radio observations of the blue galaxy Butcher-Oemler 6 in the 3C 295 cluster ..... See Entry 111202

Globular cluster systems in the Hydra I elliptical galaxies. II ..... See Entry 111203

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Radial velocities of galaxies in neighborhoods of groups of galaxies. II ..... See Entry 111215

On the connection between Seyfert galaxies and neighboring objects ..... See Entry 111217

Are galaxy properties specific for their parent clusters? ..... See Entry 111225

Magnitude-redshift relation in clusters, groups and pairs of galaxies ..... See Entry 111227

The dwarf irregular galaxy VV 574: a possible member of the M81 group ..... See Entry 111234

Redshifts of blue galaxies in the direction of the Virgo cluster ..... See Entry 111236

The cluster around 3C 130 ..... See Entry 111257

Pair correlations in an expanding Universe for a multicomponent system ..... See Entry 111276

Three-dimensional simulation of large-scale structure in the Universe ..... See Entry 111283

Cluster analysis of the nonlinear evolution of large-scale structure in an axion/gravitino/photino-dominated Universe ..... See Entry 111287

98.70 OTHER OBJECTS AND BACKGROUND RADIATIONS OF UNKNOWN ORIGIN AND DISTANCES

(for pulsars, see 97.60G)

98.70D Discrete radio sources

111255 Statistical investigations of the physical properties of radio sources. B.Krygier (N. Copernicus Univ., Radio Astron. Obs., Torun, Poland), J.Krempec-Krygier.
Astrophys. & Space Sci. (Netherlands), vol.94, no.1, p.145-57 (July 1983).
Six complete samples of radio sources are analysed by the Spearman rank and the Spearman partial-rank correlation coefficients. The relations between the radio luminosities and linear sizes as well as between linear sizes and redshift indicate that the observed angular diameter-redshift diagram may be explained by the changes of linear sizes with radio luminosity of radio sources. (36 refs.)

111256 The Cherenkov effect and plasma turbulent reactors. R.D.Lomadze (Abastumani Astrophys. Obs., USSR).
Astrophysics (USA), vol.18, no.4, p.367-73 (Oct.-Dec. 1982). Translation of: *Astrofizika (USSR)*, vol.18, no.4, p.641-50 (Oct.-Dec. 1982).
The restrictions on the energy interval of the power-law distribution function of the power-law distribution function of the relativistic electrons formed in a plasma turbulent reactor due to the Cherenkov effect and ionization losses are determined together with the signs of the curvature of the distortions of the distribution function at low energies. The possibility of interpreting features in the radiation spectra of cosmic radio sources in the decameter wavelength range is discussed. (14 refs.)

111257 The cluster around 3C 130. W.J.Jagers (Sterrewacht Leiden, Leiden, Netherlands).
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.172-4 (Aug. 1983).
Radio observations of the narrow edge-darkened double source 3C 130, with the 3 km Westerbork Telescope at 0.6 GHz are presented. Two additional narrow edge-darkened radio sources are visible in the same radio map. The author suggests that the three sources are members of the same large cluster with a diameter of at least 6 Mpc. (13 refs.)

Focusing of high-Mach number jets by an ambient medium ..... See Entry 110878

Alfven wave collapse and the stability of a relativistic electron beam in a magnetized astrophysical plasma ..... See Entry 110879

A catalogue of extragalactic radio source identifications ..... See Entry 110927

Radio data on clusters of galaxies from the Culgoora circular array ..... See Entry 110932

Analysis of the polarization measurements during the occultations of the Crab Nebula by the plasma surrounding the Sun in 1977-1982 ..... See Entry 111018

γ-ray line emission from SS 433 ..... See Entry 111093

WBVR photometry of SS 433: spectra of the 'normal' star and the accretion disk ..... See Entry 111109

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The kinetic temperature and CH_3CCH column density profiles in Sgr B2, Orion, and DR 21 ..... See Entry 111173

High-resolution study of the supernova remnant G330.2+1.0 ..... See Entry 111188

A new radio map of the AD 1006 supernova remnant, G327.6+14.6 ..... See Entry 111189

An infrared and optical investigation of galactic nuclei with compact radio sources ..... See Entry 111201

The inner radio structure of Centaurus A: clues to the origin of the jet X-ray emission ..... See Entry 111210

The discovery of optical emission knots in the inner jet of Centaurus A ..... See Entry 111211

The radio luminosity function of Seyfert galaxies ..... See Entry 111218

Quasi-simultaneous ultraviolet and optical observations of PKS 2155−304=H 2155−304 ..... See Entry 111226

An evolutionary scheme for active-nucleus objects ..... See Entry 111241

Observations of galaxies of high surface brightness at 102 MHz ..... See Entry 111242

A flare in the millimetre to IR spectrum of 3C 273 ..... See Entry 111270

98.70J Quasars

111258 Optical variability, absolute luminosity, and the Hubble diagram for QSOs. A.J.Pica, A.G.Smith (Rosemary Hill Obs., Univ. of Florida, Gainesville, FL, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.11-25 (1 Sept. 1983).
Photometric data for 130 quasars, BL Lac objects, and active galaxies have been obtained at the Rosemary Hill Observatory during a continuous 13 year monitoring program. These long-term optical records are employed in an effort to assess the physical and cosmological properties of quasi-stellar objects. Monochromatic flux densities at a standard emitted wavelength of 2500 Å are obtained from corrected *B* magnitudes, and long-term light curves are compiled for all objects. Three levels of activity are determined for each individual source. The Mean, Base, and Max flux densities are used to study QSOs in their average, quiescent, and active phases, respectively. Absolute intrinsic luminosities of all sources in the sample are computed from the monochromatic flux densities, using relativistic cosmological models. The amplitude of variability versus absolute luminosity relation is used to discriminate between two classes of QSO models. (54 refs.)

111259 VLBI maps of 3C 273 and 3C 345 at 2.3 GHz. M.H.Cohen, S.C.Unwin, K.R.Lind, A.T.Moffet, R.S.Simon (Owens Valley Radio Obs., California Inst. of Technol., Pasadena, CA, USA), P.N.Wilkinson, R.E.Spencer, R.S.Booth, G.D.Nicolson, A.E.Neill, L.E.Young.
Astrophys. J. (USA), vol.272, no.2, pt.1, p.383-9 (15 Sept. 1983).
Maps of the quasars 3C 273 and 3C 345 made at 2.3 GHz with an eight station VLBI array are presented. Five compact components spanning 45 milli-arcsec are seen in 3C 273, and four are seen in 3C 345. Comparisons with maps at higher and lower frequencies show that in both sources the core, which dominates the high-frequency 'core-jet' structure, is strongly self-absorbed at 2.3 GHz and below. The jet components have flat spectra, peaking between 2 and 5 GHz. In both sources the VLBI jet curves toward the direction of the arcsecond-scale outer jet. (15 refs.)

111260 Luminosity function of high-redshift quasars. B.Gaston (Dept. of Astron., Pennsylvania State Univ., Philadelphia, PA, USA).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.411-33 (15 Sept. 1983).
Data from 10 different emission-line surveys are included in a study of the luminosity function of high-redshift quasars ($1.8 \leq z < 2.5$). Five of the surveys are analyzed through microdensitometric techniques, and the data for 70 new quasars are given including finding charts. The uncertainties in magnitudes, redshifts, and line equivalent widths are assessed. Criteria for selecting the redshift range $1.8 \leq z < 2.5$ are discussed, and the apparent magnitude distribution for quasars in that range is compared with that of UVX-selected quasars. The completion limits of the new surveys are examined in detail to establish the best sample for the study of the luminosity function. Data from the new surveys indicate a possible turndown at the faint end of the distribution. Total volume densities of quasars in the interval $1.8 \leq z < 2.5$ are calculated for each of three extrapolations of the trend of the data to low luminosities. These densities are compared with those of active galaxies and field galaxies at the present epoch. (31 refs.)

111261 Theoretical quasar emission-line profiles. II. Effects of source function variation and total thickness. R.C.Puetter, E.N.Hubbard (Center for Astrophys. & Space Sci., Univ. of California, San Diego, CA, USA).
Astrophys. J. (USA), vol.273, no.1, pt.1, p.36-43 (1 Oct. 1983).
For pt.I see ibid., vol.265, no.1, p.35-42 (1983). Continues the investigation of the effects of radiative transfer and individual cloud shape on the broad-line profiles observed in Seyfert 1 galaxies and quasars. The authors relax the assumption of Hubbard and Puetter (1983) that all the emission in a given line arises from a single portion of the curve of growth. They explicitly calculate aspect angle emission functions and are thereby able to prdict small line-to-line profile variations in a single object and present explicit aspect angle emission functions for use in future line profile studies for a wide range of source function variation and total optical depth. The authors propose a differential line profile test for cloud ensemble dynamics. (13 refs.)

111262 A single exhaust model for backward emission in Doppler quasars. J.V.Narlikar, K.Subramanian (Tata Inst. of Fundamental Res., Bombay, India).
Astrophys. J. (USA), vol.273, no.1, pt.1, p.44-57 (1 Oct. 1983).
Provides an astrophysical scenario for Hoyle's (1980) conjecture that quasars ejected at high velocities from active galactic nuclei radiate predominantly in a narrow backward cone. Backward emission is essential in a local Doppler theory in order to explain why no blueshifted quasars are seen. The mechanism suggested is an adaptation of the twin exhaust model of Blandford and Rees (1974). It is argued that a fast moving quasar encounters a strong ram pressure from the intergalactic medium in the forward direction which suppresses the forward exhaust. By contrast, the only exhaust from the object is along the line of least resistance lying in the backward direction. The model has several constraints from hydrodynamics, gravitation theory, and radiation requirements as well as the primary motivation that no blueshifted quasars are seen. (30 refs.)

111263 Millimeter and submillimeter observations of 3C 273. P.E.Clegg, W.K.Gear, P.A.R.Ade (Dept. of Phys., Queen Mary Coll., Univ. of London, London, England), E.I.Robson, M.G.Smith, I.G.Nolt, J.V.Radostitz, W.Glaccum, D.A.Harper, F.J.Low.
Astrophys. J. (USA), vol.273, no.1, pt.1, p.58-63 (1 Oct. 1983).
Reports the first detection of 3C 273 (1226+023) at wavelengths of 107, 240, and 400 μm together with contemporary measurements at 800 μm, 1.1, 1.9, 3.3, and 8.9 mm. These observations show that the continuum spectrum of 3C 273 can be extrapolated smoothly from the submillimeter to the infrared with a constant spectral index. There is no evidence of thermal emission from dust. The authors show that the spectrum is consistent with optically thin synchrotron emission from a relativistic beam at a small angle to the line of sight. (31 refs.)

111264 The radio structure of 3C 279. I.de Pater (Lunar & Planetary Lab., Univ. of Arizona, Tucson, AZ, USA), R.A.Perley.
Astrophys. J. (USA), vol.273, no.1, pt.1, p.64-9 (1 Oct. 1983).
Radio maps of the quasar 3C 279 have been made with resolutions between 0.06″ and 3.5″ at wavelengths of 1.3, 2.0, and 6 cm. At arcsecond resolutions, the source is a simple double with a component separation of 11.2″ in PA −35°. At higher resolutions, the northern component resolves out while the compact component consists of an unresolved flat-spectrum core with a jet extending 4.7″ in PA 205°. The jet is clearly resolved into numerous separate knots. This is no measurable Faraday depolarization in the resolved regions of the source, but a small rotation of the plane of the polarized emission is found in the unresolved core between 2 and 6 cm. The projected magnetic field is generally aligned parallel to the jet, and the spectral index of the jet emission steepens with increasing distance from the core. (24 refs.)

111265 On the dynamical structure of QSOs and the origin of emission clouds. G.A.Gurzadyan, V.G.Gurzadyan (Yerevan Polytech. Inst., Yerevan, Armenian SSR).
Astrophys. & Space Sci. (Netherlands), vol.94, no.1, p.31-42 (July 1983).
It is shown that emission lines, first of all the ultraviolet resonance double 2800 Mg II, can be used to decipher the internal dynamic structure of QSOs and active galactic nuclei. The electron temperatures of the emission regions of these objects are determined. A hypothesis is proposed explaining the observed broad profiles of the 2800 Mg II line as a summary effect of emission clouds with a Maxwellian velocity distribution. The main physical parameters of emission clouds in QSOs are obtained. A mechanism of formation of emission clouds is suggested. (30 refs.)

111266 Search for large-scale extension of the quasars 3C 273, 3C 345 and 3C 380. P.P.Kronberg (Scarborough Coll., Univ. of Toronto, Toronto, Canada), W.Reich.
Astron. & Astrophys. (Germany), vol.125, no.1, pt.2, p.146-9 (Aug. 1983).
Results of a further deep search for outer 'fossils' of earlier radio outbursts in the bright QSOs 3C 273, 3C 345 and 3C 380 are described—the first two of which have apparent superluminal motion. Multi-frequency, high dynamic range observations were made of and around the faint neighbour sources originally detected by Reich et al. (1980), using both the Effelsberg 100-m telescope and the VLA. The high resolution structure of the faint neighbour radio sources is determined, and a search for optical counterparts revealed only one certain identification—for 3C 345 SE. There is no firm evidence for extended radio features on a scale of a few hundred kpc to $\gtrsim 1$ Mpc for these QSOs. (4 refs.)

111267 Expected number of multiple QSOs from galaxy and QSO surface density data. J.A.Tyson (Bell Labs., Murray Hill, NJ, USA).
Astrophys. J. Lett. Ed. (USA), vol.272, no.2, pt.1, p.L41-4 (15 Sept. 1983).
What fraction of QSOs are gravitationally lensed? Recent data on galaxy counts, QSO counts, and radio and optical multiple QSO image surveys are examined. It is shown that these data are not consistent with the hypothesis that all QSOs are gravitationally lensed. Under the assumption that QSOs are at their redshift distance, a straightforward calculation based on seeing data, galaxy counts, and QSO counts yields a surface number density of multiple QSOs consistent with that found in existing surveys for multiple QSOs. This calculation suggests that the fraction of multiple QSOs will increase with QSO magnitude and that massive elliptical galaxies and clusters probably dominate as lenses. (24 refs.)

111268 3C 446. C.Barbieri, S.Cristiani, G.Romano.
I.A.U. Circ. (USA), no.3856, 1 pp. (29 Aug. 1983).
It is reported that between 4 and 11 August 1983 the quasar 3C 446 was at magnitude $B=15.1$, the brightest ever recorded for this object. (no refs.)

111269 Diffuse ultraviolet radiation in the intergalactic medium. P.M.Gondhalekar (Rutherford Appleton Lab., Chilton, Didcot, England).
Mon. Not. R. Astron. Soc. (GB), vol.204, no.3, p.997-1007 (Sept. 1983).
The intensity of the diffuse ultraviolet radiation in the intergalactic medium (IGM) due to quasars is estimated. The diffuse radiation will be attenuated by hydrogen and helium in the galactic haloes in the IGM and the optical depth of cloudy IGM due to neutral hydrogen in galactic haloes is estimated. The stability and ionization balance of hydrogen clouds (Sargent et al. 1980) in this radiation field are considered and it is shown that with the reduced ionizing flux the clouds cannot be in ionization equilibrium. (46 refs.)

111270 A flare in the millimetre to IR spectrum of 3C 273. E.I.Robson (Div. of Phys. & Astron., Preston Polytech., Preston, England), W.K.Gear, P.E.Clegg, P.A.R.Ade, M.G.Smith, M.J.Griffin, I.G.Nolt, J.V.Radostitz, R.J.Howard.
Nature (GB), vol.305, no.5931, p.194-6 (15 Sept. 1983).
The authors report observations between February and May 1983 of a concurrent flare in the IR to near millimetre spectrum of 3C 273. These observations imply that the emission over this range of frequency originates in the same region of the source. The flare was seen to propagate to longer wavelengths while decaying at shorter wavelengths. The time scale of the flare is suggestive of an event within the central 0.1 pc of the source. (16 refs.)

111271 Observations of H 1414+089, QSO with extremely high velocity broad-absorption-line gas. C.Foltz, B.Wilkes, R.Weymann (Steward Obs., Univ. of Arizona, Tucson, AZ, USA), D.Turnshek.
Publ. Astron. Soc. Pac. (USA), vol.95, no.568, p.341-6 (June 1983).
The authors present spectroscopic observations of a faint optically-selected QSO with broad absorption features in its spectrum. The absorption troughs are extremely complex with both large- and small-scale structure. The low-velocity edge of the C IV trough is displaced blueward of the apparent emission line center by $\gtrsim 13000$ km s^{-1}. The data provide evidence that the gas responsible for the broad absorption trough is moving relative to the gas responsible for the broad emission lines by up to 66000 km s^{-1}. (10 refs.)

111272 Dynamics of the radiating gas in the quasar PHL 5200 and in kindred objects. V.P.Grinin (Crimean Astrophys. Obs., Acad. of Sci., USSR).
Sov. Astron. (USA), vol.26, no.6, p.647-50 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1070-4 (Nov.-Dec. 1982).
Recent interpretations of the peculiar resonance-line profiles in the spectrum of PHL 5200 have suggested that a radially symmetric, outward decelerating flow is issuing from the nucleus of this quasar. The braking mechanism is briefly discussed, and an explanation is offered for the unique emission spectrum. Qualitatively, however, the kinematic conditions in the PHL 5200 envelope resemble the velocity field in other quasar and Seyfert-nucleus envelopes. (12 refs.)

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98.70L IR sources

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Reverse stellar evolution, stellar ablation, and the origin of gas in quasars ....See Entry 111273

98.70Q X-ray and gamma-ray sources

111273 Reverse stellar evolution, stellar ablation, and the origin of gas in quasars. W.G.Mathews (Lick Obs., Univ. of California, Santa Cruz, CA, USA).
Astrophys. J. (USA), vol.272, no.2, pt.1, p.390-9 (15 Sept. 1983).
A stellar origin for the emission line gas and its confining medium in quasars and Seyfert galaxies is investigated. Radiative ablation of the photospheres by quasar radiation pressure seems preferable as an abundant and steady source of relatively low temperature gas. More radiant energy is incident on low-mass stars in the broad emission line region than they normally produce. These stars may absorb and mix the energy of hard quasar X-radiation deep within their fully convective interiors. As the total energy of the stars slowly increases by this process, they undergo reverse stellar evolution, expanding away from the lower main sequence toward regions of decreasing surface gravity in the H-R diagram. Eventually, radiative ablation of the inflated stars by hard quasar X-rays becomes possible. The hot ejecta from stellar collisions may provide gas for the intercloud medium, while radiative ablation is the source of cooler broad line gas. It is widely asserted that the near-infrared source IRS 16 is the stellar nucleus of our Galaxy. If correct, the unusual weakness of CO absorption, implying an abnormal deficiency of M-type dwarfs, suggests that reverse stellar evolution may have occurred in the Galaxy during a previous Seyfert-like episode. (39 refs.)

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98.70V Background radiations

111274 On the anisotropy of the cosmological background matter and radiation distribution. II. The radiation anisotropy in models with negative spatial curvature. M.L.Wilson (Lab. for Extraterrestrial Phys., Goddard Space Flight Center, Greenbelt, MD, USA).
Astrophys. J. (USA), vol.273, no.1, pt.1, p.2-15 (1 Oct. 1983).
For pt.I see ibid., vol.243, no.1, p.14-25 (1981). The expected microwave background anisotropy is calculated on both large and small angular scales for various models with $\Omega_0=0.1$, including all effects of spatial curvature. Both adiabatic and isothermal fluctuations are considered, with power spectrum $|\delta_m(\tilde{k})|^2 \propto \tilde{k}^n$ initially. The adiabatic models can probably be ruled out on the basis of their large correlation length, but if only the microwave anisotropy is considered, models with $n \gtrsim 3$ are acceptable. The microwave anisotropy is below current upper limits for all values of n considered with isothermal initial conditions. (28 refs.)

111275 The anisotropy of the diffuse cosmic X-ray background. M.R.Issa, C.X.Xu, A.W.Wolfendale (Dept. of Phys., Univ. of Durham, Durham, England).
J. Phys. G (GB), vol.9, no.9, p.1151-8 (Sept. 1983).
In a previous paper Protheroe et al. (1980) used the Uhuru X-ray data of Schwartz (1979) to show that the anisotropy in the diffuse background for the energy range 2-7 keV was not inconsistent with that observed in the 2.7K relict radiation. The authors take more recent and extended data by Iwan et al. (1982) for the range 2-60 keV to make a new determination of the X-ray anisotropy. After eliminating the possibility that galactic effects are responsible or that the anisotropy is due to discrete extragalactic sources it is again found that there is no inconsistency with the 2.7K results, although the X-ray data are still not sufficiently accurate to enable a statement of clear consistency to be made. (14 refs.)

Diffuse ultraviolet radiation in the intergalactic medium ....See Entry 111269

98.80 COSMOLOGY

(for observational cosmology, see 98.70V; for origin and evolution of galaxy, see 98.50)

111276 Pair correlations in an expanding Universe for a multicomponent system. H.E.Kandrup (Center for Relativity, Univ. of Texas, Austin, TX, USA).
Astrophys. J. (USA), vol.272, no.1, pt.1, p.1-10 (1 Sept. 1983).
Fall and Saslaw (1976) have derived an equation for the growth of pair correlations in an expanding Universe of identical self-gravitating point masses which is correlation-free at some initial time. Their equation is rigorously true for the earliest stages of growth, assuming only that the system is spatially homogeneous and isotropic, and that it is characterized in the 'comoving frame' by a Maxwellian distribution of velocities. The author generalizes their analysis to the case of a multicomponent system of particles with different masses, each species of which is characterized by a Maxwellian distribution at the same temperature. Here there are two types of pair correlations to consider, namely among members of the same species and among members of different species. The general behavior may be understood most readily by considering the covariance functions, which assume very simple forms. (7 refs.)

111277 A general solution of the Einstein equations with a time singularity. V.A.Belinskii, I.M.Khalatnikov, E.M.Lifshitz (L.D. Landau Inst. for Theoretical Phys., Acad. of Sci., Moscow, USSR).
Adv. Phys. (GB), vol.31, no.6, p.639-67 (Nov.-Dec. 1982). [received: Sept. 1983]
This paper is a concluding review exposition of the investigations aimed at the construction of a general cosmological solution of the Einstein equations with a singularity in time; thus it is a direct continuation of the previous (1970) paper by the authors. A detailed description is given of the analysis which leads to the construction of such a solution, and of its properties. (12 refs.)

111278 Equation of state and equation symmetries in cosmology. M.Szydlowski (Dept. of Philosophy, Pontifica Acad. of Cracow, Cracow, Poland), M.Heller.
Acta Phys. Pol. B (Poland), vol.B14, no.8, p.571-80 (Aug. 1983).
Symmetry groups of Friedman equations both without and with dissipation, and of Bianchi type I equations with dissipation are discussed. It is shown that the symmetry groups of these equations correctly single out corresponding equations of state. (11 refs.)

111279 Fluctuations in the inflationary Universe. S.W.Hawking (DAMTP, Cambridge, England), I.G.Moss.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B224, no.1, p.180-92 (29 Aug. 1983).
In the usual treatment of the inflationary Universe, it is assumed that the expectation value of some component of the Higgs field develops a non-zero symmetry breaking value Φ_0. However, in the models normally considered, the expectation value of Φ will be zero at all times because Φ and $-\Phi$ are equally probable. To overcome this difficulty, the authors calculate the effective action as a function of $\langle\Phi^2\rangle$ rather than $\langle\Phi\rangle$. This also solves the infrared problem associated with a Coleman-Weinberg condition in de Sitter space. The expectation value of Φ^2 grows linearly with time at first and then as $(t_2-t)^{-1}$. The irregularities in the resulting Universe are smaller than those predicted by previous authors, though in the case of the standard SU(5) GUT they are still bigger than the limit set by the microwave background. (24 refs.)

111280 Quantization in the large. D.M.Greenberger (City Coll., City Univ. of New York, New York, NY, USA).
Found. Phys. (USA), vol.13, no.9, p.903-51 (Sept. 1983).
A model theory is constructed that exhibits quantization on a cosmic scale. A holistic rationale for the theory is discussed. The theory incorporates a fundamental length, of cosmic size, and preserves the weak, geometrical equivalence principle. The momentum operator is an integral, nonlocal, naturally contravariant operator, in contrast to the usual quantum case. In the limit of high quantum numbers the theory reduces to classical physics, giving rise to a world which is quantized both on the microscopic and cosmic scale, each of which passes over to the usual macroscopic, continuous, classical, world in the high n limit. The theory is applied to two experimental situations, absorption lines in high-z quasars and elliptical rings around normal galaxies, with suggestive but not definitive results. (22 refs.)

111281 The anthropic principle and the actual size of the Universe. V.De Sabbata, M.Gasperini (Istituto de Fisica, Univ. di Ferrara, Italy).
Lett. Nuovo Cimento (Italy), vol.37, ser.2, no.17, p.605-8 (27 Aug. 1983).
It is suggested that the equality of the recession velocity and the escape velocity of matter in our Universe can be explained by using the spin-torsion interactions, without invoking the anthropic principle. (16 refs.)

111282 Three-dimensional numerical model of the formation of large-scale structure in the Universe. A.A.Klypin, S.F.Shandarin (Keldysh Inst. of Appl. Maths., Acad. of Sci., Moscow, USSR).
Mon. Not. R. Astron. Soc. (GB), vol.204, no.3, p.891-907 (Sept. 1983).
The first results of numerical fully three-dimensional simulations of formation and evolution of the large-scale structure of the Universe are presented. The simulations are carried out in the framework of the adiabatic scenario of galaxy formation. The model contains $32^3=32768$ collisionless particles interacting only gravitationally. Equal mass particles are moving in a collective gravitational field which is smoothed at small scales. Evolution of perturbations is followed in an expanding cosmological model. The numerical procedure starts at $z_{\mathrm{start}} \simeq 5.25$, when $(\delta\rho/\rho)_{\mathrm{ro}} \simeq 0.22$ and ${}_{\mathrm{ro}}=5h_{100}{}^{-1}$ Mpc is the cell length. The two-point correlation function is calculated. (31 refs.)

111283 Three-dimensional simulation of large-scale structure in the Universe. J.Centrella (Dept. of Astron., Univ. of Illinois, Urbana, IL, USA), A.L.Melott.
Nature (GB), vol.305, no.5931, p.196-8 (15 Sept. 1983).
Three-dimensional numerical simulations of the nonlinear growth of adiabatic perturbations in collisionless matter demonstrate that a cellular structure develops in the Universe. This dark matter collapses into interconnecting dense regions surrounding large voids, or low density regions. The simulations show that the interconnecting dense regions contain both filamentary and flat, pancake-shaped structures. The low-density voids are approximately spherically symmetric in shape. The covariance function has a power law form at small radii, with anticorrelation found just beyond the break and no sizeable features at larger radii. (40 refs.)

111284 Exact rotating and expanding radiation-filled universe. K.Rosquist (Dept. of Appl. Math., Queen Mary Coll., London, England).
Phys. Lett. A (Netherlands), vol.97A, no.4, p.145-6 (22 Aug. 1983).
An exact rotating and expanding solution of the Einstein field equations without cosmological constant is given. The solution represents a Bianchi type

VI_0 spatially homogeneous universe filled with radiation having the equation of state $p=\rho/3$. (7 refs.)

111285 **Where has the four dimensionality come from?.** H.Ishikawa (Dept. of Phys., Nagoya Univ., Nagoya, Japan).
Prog. Theor. Phys. (Japan), vol.69, no.6, p.1837-9 (June 1983).
A five dimensional gravitation model is examined and it is shown that the smallness of extra-dimension is a consequence of the Universe being small in the past. (2 refs.)

111286 **Entropy from extra dimensions.** E.Alvarez (Lyman Lab. of Phys., Harvard Univ., Cambridge, MA, USA), M.Belen Gavela.
Phys. Rev. Lett. (USA), vol.51, no.10, p.931-4 (5 Sept. 1983).
The phenomenon of 'dynamical compactification' in a universe with $4+n_c$ dimensions is studied, and it is found that if the whole process is adiabatic, entropy is pumped into the effective four-dimensional universe. Some cosmological consequences of this fact are discussed. (7 refs.)

111287 **Cluster analysis of the nonlinear evolution of large-scale structure in an axion/gravitino/photino-dominated Universe.** A.L.Melott (Dept. of Phys. & Astron., Univ. of Pittsburgh, Pittsburgh, PA, USA), J.Einasto, E.Saar, I.Suisalu, A.A.Klypin, S.F.Shandarin.
Phys. Rev. Lett. (USA), vol.51, no.10, p.935-8 (5 Sept. 1983).
The authors consider nonlinear evolution of the inflationary scale-free spectrum of adiabatic density perturbations in (1) a neutrino-dominated Universe (sharp short-wavelength cutoff), and (2) an axion-, gravitino-, or photino-dominated Universe (some small-scale power). In (2) galaxy formation begins long before the present (as defined by covariance function), resolving a possible problem in (1). Both models are found to be acceptable upon cluster analysis. The authors believe that a new picture, based on (2), merits consideration. (54 refs.)

111288 **Problems with the new inflationary Universe.** J.D.Breit, S.Gupta, A.Zaks (Inst. for Advanced Study, Princeton, NJ, USA).
Phys. Rev. Lett. (USA), vol.51, no.11, p.1007-9 (12 Sept. 1983).
It is demonstrated that in the new-inflationary-Universe scenario based on a Coleman-Weinberg-type potential all the bubbles evolve through the $SU(4)\otimes U(1)$ local minimum. The transition from this local minimum to the $SU(3)\otimes SU(2)\otimes U(1)$ global minimum is first order, and so the scenario does not solve all of the cosmological problems. (9 refs.)

111289 **On the possibility of a test of the cosmology of asymptotically free SU(5) theory.** O.K.Kalashnikov (P.N. Lebedev Phys. Inst., Moscow, USSR), M.Yu.Khlopov.
Phys. Lett. B (Netherlands), vol.127B, no.6, p.407-12 (11 Aug. 1983).
Asymptotically free models of grand unification predict the existence of metastable superheavy fermions determining the evolution of the very early Universe. The estimates of the influence of such fermions on the baryon asymmetry of the Universe, on primordial black hole formation, and on the abundance of light elements provide stringent restrictions both on the parameters of grand unified models and on possible scenarios of the evolution of the very early Universe. (13 refs.)

111290 **Scalar Green function in Nardone's cosmological model.** P.Spindel (Univ. de l'Etat a Mons, Mons, Belgium).
Phys. Lett. B (Netherlands), vol.127B, no.6, p.413-14 (11 Aug. 1983).
Closed expressions for the Green functions of a free scalar field in Nardone's cosmological model (1983) are obtained by summing modes corresponding to a vacuum state defined in the far past. (5 refs.)

111291 **Inflation in a shear- or curvature-dominated Universe.** G.Steigman, M.S.Turner (Astron. & Astrophys. Center, Enrico Fermi Inst., Univ. of Chicago, Chicago, IL, USA).
Phys. Lett. B (Netherlands), vol.128B, no.5, p.295-8 (1 Sept. 1983).
The authors show that new inflation occurs even if the Universe is shear- or (negative) curvature-dominated when the phase transition begins. In such situations the size of a causally coherent region, after inflation, is only slightly smaller (by powers, but not by exponential factors) than the usual result. The creation and evolution of density perturbations is unaffected. This result is in marked contrast to 'old' inflation, where shear-or curvature-domination could quench inflation. (19 refs.)

111292 **Alternative descriptions of the discrete mixmaster universe.** Y.Elskens (Faculte des Sci., Univ. Libre de Bruxelles, Bruxelles, Belgium).
Phys. Rev. D (USA), vol.28, no.4, p.1033-5 (15 Aug. 1983).
In the framework of Belinskii, Khalatnikov, and Lifshitz's (1970) discretization of the mixmaster universe, a new representation is proposed admitting a transparent dynamics. (9 refs.)

111293 **Parameters of a neutrino-dominated Universe and GUT cosmology.** A.G.Doroshkevich, M.Yu.Khlopov.
Pis'ma v Astron. Zh. (USSR), vol.9, no.6, p.323-6 (1983). In Russian. English translation in: *Sov. Astron. Lett. (USA)*
Investigates the agreement between GUT values of the neutrino mass and observed parameters of the Universe. The possibilities put severe restrictions on GUTs. (19 refs.)

111294 **The dynamical role of a primordial electromagnetic field in spatially homogeneous, diagonal Bianchi type I-IX cosmologies.** V.A.Ruban (Leningrad Inst. of Nuclear Phys., Leningrad, USSR).
Sov. Astron. (USA), vol.26, no.6, p.632-8 (Nov.-Dec. 1982). Translation of: *Astron. Zh. (USSR)*, vol.59, no.6, p.1044-54 (Nov.-Dec. 1982).
The possible structure of a sourceless primordial electromagnetic field (which is admissible only for class *A* diagonal Bianchi metrics), its dynamical behavior, its role near the initial singularity, and its influence on the isotropization process are examined in terms of homogeneous, anisotropic cosmologies. In Bianchi type VI_0, VII_0 models a pure magnetic primordial field will cause a new form of oscillatory asymptotic approach to the singularity $\tau=0$, but in types VIII, IX the coupled electromagnetic field will have little effect on the 'mixmaster' vacuum regime. The primordial magnetic field hypothesis is compatible only with parabolic, isotropizing, quasi-Euclidean models (primarily Bianchi types I, VII_0), provided the energy density is near-critical ($\Omega=\epsilon_0/\epsilon_c\approx 1$). (61 refs.)

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